Uses of robotics to improve the instrumental skills of students with Autism Spectrum Disorder through the development of new inclusive contexts (DivInTech)

NAO Class

1 NAO Class

File 1: __init__.py

```
1 from . import *
```

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File 2: nao_audio_player.py

```
#! /usr/bin/env python
# -*- encoding: UTF-8 -*-
"""
    ////////////////////////////////////////////////////////////////////////////

Name: nao_audio_player.py
Function: File with the class to run audio in NAO
          See ALAudioPlayer:
          https://developer.softbankrobotics.com/nao6/naoqi-
              developer-guide/naoqi-apis/naoqi-audio/
              alaudioplayer/alaudioplayer-api
Last modified: 21/08/2022
Created by: SCV
////////////////////////////////////////////////////////////////////////////
    """


"""++++++++++++++++++++++++++++++++++++++
Libraries
++++++++++++++++++++++++++++++++++++++"""
#General
import subprocess
import qi
import paramiko
import os
import json


"""++++++++++++++++++++++++++++++++++++++
Constants Classes
++++++++++++++++++++++++++++++++++++++"""
DESTINATION = "nao@192.168.1.40:20"
DEFAULT_PATH = "/home/nao/musicS/"
USERNAME = "nao"
PASSWORD = "nao"


class Nao_AudioPlayer():
    """_____________________________________
    Name: __init__
    Function: init of the class
    Parameters: session: nao session
                file: file with the paths of the audios to send
                    to the robot
                       ONLY WAV!
    Return: -
    _____________________________________"""
```

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```
42      def __init__(self, session, file = None):
43          self.session = session
44          #Get the ip of the robot
45          self.ip = self.session.url()
46          ip_init = self.ip.find("/") + 2
47          ip_end = self.ip.find(":9559")
48          self.ip = self.ip[ip_init:ip_end]
49
50          # Get the service ALAudioPlayer.
51          self.audio_player_service = self.session.service("
                ALAudioPlayer")
52
53          if file != None:
54              self.send_audio_to_robot(file)
55      """-------------------------------------
56      Name: send_audio_to_robot
57      Function: sends through scp the WAV files
58      Parameters: file_with_paths: file with the paths of the
            audios to send to the robot
59                                      (see /Examples/SendFilesSCP/
                                            files2send.json for format
                                            example)
60      Return: -
61      -------------------------------------"""
62      def send_audio_to_robot(self, file_with_paths):
63          with open(file_with_paths, 'r') as f:
64              data = json.load(f)
65              for file in data:
66                  f_name_nao = file["name_in_nao"]
67                  c_path = file["path"]
68
69                  ssh = paramiko.SSHClient()
70                  ssh.load_host_keys(os.path.expanduser(os.path.
                        join("~", ".ssh", "known_hosts")))
71                  ssh.connect(self.ip, username=USERNAME, password
                        =PASSWORD)
72                  sftp = ssh.open_sftp()
73                  sftp.put(c_path, DEFAULT_PATH + f_name_nao)
74                  sftp.close()
75                  ssh.close()
76
77      """-------------------------------------
78      Name: delete_all_audios_in_robot
79      Function: deletes all the audios inside the robot
80      Parameters: -
81      Return: -
82      -------------------------------------"""
83      def delete_all_audios_in_robot(self):
84          ssh = paramiko.SSHClient()
```

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```
85          ssh.load_host_keys(os.path.expanduser(os.path.join("~",
                ".ssh", "known_hosts")))
86          ssh.connect(self.ip, username=USERNAME, password=
                PASSWORD)
87          sftp = ssh.open_sftp()
88
89          # Updated code below:
90          filesInRemoteArtifacts = sftp.listdir(path=DEFAULT_PATH)
91          for file in filesInRemoteArtifacts:
92              sftp.remove(DEFAULT_PATH + file)
93
94          # Close to end
95          sftp.close()
96          ssh.close()
97
98      """----------------------------------------
99      Name: play_audio
100     Function: plays the specified audio
101     Parameters: audio_name: name of the audio inside nao
102                             (see /Examples/SendFilesSCP/
                                    files2send.json [name_in_nao])
103                 async: if the sound has to be played
                        asyncronously
104     Return: -
105     ----------------------------------------"""
106     def play_audio(self, audio_name, async=True):
107         #Path inside the robot
108         fileId = self.audio_player_service.loadFile(DEFAULT_PATH
                + audio_name)
109         self.audio_player_service.play(fileId, _async=async)
110
111     """----------------------------------------
112     Name: stop_audio
113     Function: stops all audios
114     Parameters: -
115     Return: -
116     ----------------------------------------"""
117     def stop_audio(self):
118         self.audio_player_service.stopAll()
119         self.audio_player_service.unloadAllFiles()
```

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File 3: nao_autonomous_life.py

```
#! /usr/bin/env python
# -*- encoding: UTF-8 -*-
"""
    ////////////////////////////////////////////////////////////////////////////

Name: nao_autonomous_life.py
Function: File that changes the autonomous life of the NAO robot
    .
          See ALAuntonomousLife:
          http://doc.aldebaran.com/2-1/naoqi/core/autonomouslife
              .html
Last modified: 13/03/2023
Created by: SCV
////////////////////////////////////////////////////////////////////////////
    """


"""+++++++++++++++++++++++++++++++++++++
Libraries
+++++++++++++++++++++++++++++++++++++"""
#General
import subprocess
import qi
import paramiko
import os
import json


"""+++++++++++++++++++++++++++++++++++++
Constants Classes
+++++++++++++++++++++++++++++++++++++"""

"""*************************************
Name: AUTONOMOUSLIFE_STATES
Function: contains the possible autonomous
          life states.
          See: http://doc.aldebaran.com/2-1/naoqi/core/
              autonomouslife_advanced.html#autonomouslife-states
          See: http://doc.aldebaran.com/2-8/ref/life/
              autonomous_abilities_management.html?highlight=
              autonomous

          Solitary state
          --------------

When this state is entered:

```

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```
    Basic Awareness and Breathing services are started and
        parameters reset.
    Autonomous Launchpad is started.
    Only plugins for "solitary" group are enabled by default.

During this state:

    Any activity can be started via ALAutonomousLifeProxy::
        switchFocus().
    Starting interactive Activity will switch to interactive
        state.
    The safeguard and disabled states may be entered.
    Autonomous Launchpad can not be stopped, and its suggested
        activities will be automatically focused, potentially
        interrupting running Activity.

Launchpad Activity prioritization:

    If a solitary and interactive both have true conditions at
        the same time, interactive will get priority.
    When multiple activities have true conditions at the same
        time, the one that was focused least recently will get
        priority.
    During a solitary Activity, an interactive Activity may
        interrupt it to take the focus.
    A solitary Activity will not be interrupted another solitary
         Activity (this behavior could change in the future)


      Interactive state
      -----------------

Interactive state is only entered:

    when an Interactive Activity is focused.

When this state is entered:

    Basic Awareness and Breathing services will be started and
        parameters reset.
    Autonomous Launchpad will be stopped.

During this state:

    Interactive activities can be started via
        ALAutonomousLifeProxy::switchFocus()
     Focusing a new interactive Activity will re-enter the
         interactive state.
     Solitary activities may not be started, this would cause
```

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```
            the solitary state to enforce its rules and create a
            bad life cycle with the user. (This could change in
            the future)
76      The safeguard and disabled state may be entered.
77      Autonomous Launchpad can be started, it will not enforce
            focusing its suggestions. It will not interrupt the
            running Activity.
78      When an entire stack of interactive activities has exited,
            solitary state will be entered.
79      When all humans have been lost, the interactive Activity
            will be forcibly exited. (This is not yet implemented)
80
81
82          Disabled state
83          --------------
84  When this state is entered:
85
86      Focused Activity will be stopped and stack cleared.
87      Basic Awareness and Breathing services will be stopped if
            they are running.
88      Autonomous Launchpad. will be stopped.
89
90  During this state:
91
92      No Activity can be started via ALAutonomousLifeProxy::
            switchFocus()
93      Autonomous Launchpad can not be started.
94      The safeguard or interactive state may not be entered.
95
96  To exit this state:
97
98      the developer may call ALAutonomousLifeProxy::setState()
99      This action will be provided in a default startup behavior
            where desired.
100
101
102         Safeguard state
103         ---------------
104 Safeguard state is entered when:
105
106     A critical reflex raised.
107     The developer should not enter this state. Entering this
            state is reserved for critical Aldebaran code.
108     A critical reflex is raised when ALBodyTemperature sees that
             a critical joint is too hot to function, or if
            ALDiagnosis sees that critical hardware is not
            functioning properly, as defined in Level of failure
            severity.
109
```

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```
When this state is entered:

    Focused Activity is stopped and stack cleared.
    Basic Awareness and Breathing services are stopped if they
        are running.
    Autonomous Launchpad is stopped.
    The reflex is then processed.
    Based on the outcome of the reflex, the solitary state may
        be re-entered.
        For damaged hardware, the robot does not exit safeguard
            state.
        For overheating, the robot exits the safeguard state
            after cooling down sufficiently.

During this state:

    No Activity can be started via ALAutonomousLifeProxy::
        switchFocus()
    Autonomous Launchpad can not be started.
    The safeguard state may be re-entered for a higher priority
        reflex.

************************************"""
class AUTONOMOUSLIFE_STATES ():
    SOLITARY     = "solitary"
    INTERACTIVE = "interactive"
    DISABLED     = "disabled"
    SAFEGUARD    = "safeguard"

"""++++++++++++++++++++++++++++++++++++++
Class
++++++++++++++++++++++++++++++++++++++"""
class Nao_AutonomousLife():
    """--------------------------------------
    Name: __init__
    Function: init of the class
    Parameters: session: nao session
                file: file with the paths of the audios to send
                    to the robot
                        ONLY WAV!
    Return: -
    --------------------------------------"""
    def __init__(self, session):
        self.session = session

        # Get the service ALAutonomousLife
        self.autonomous_life_service = self.session.service("
            ALAutonomousLife")

```

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```
151     """-------------------------------------
152     Name: set_autonomous_life
153     Function: sets the autonomous life to an specified state.
154     Parameters: state: see AUTONOMOUSLIFE_STATES class.
155     Return: -
156     -------------------------------------"""
157     def set_autonomous_life(self, state):
158         self.autonomous_life_service.setState(state)
```

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File 4: nao_leds.py

```
#! /usr/bin/env python
# -*- encoding: UTF-8 -*-
"""
    ////////////////////////////////////////////////////////////////////////////

Name: nao_leds.py
Function: File with the class to control the leds of robot nao
          LEDs specification in:
          https://developer.softbankrobotics.com/nao6/nao-
              documentation/nao-developer-guide/technical-
              overview/leds#naov6-led
          LEDs functions in:
          https://developer.softbankrobotics.com/nao6/naoqi-
              developer-guide/naoqi-apis/naoqi-sensors-leds/
              alleds/alleds-api#ALLedsProxy::createGroup__ssCR.
              std::vector:ss:CR
Creation date: 05/05/2022
Last modified: 06/05/2022
Created by: SCV
////////////////////////////////////////////////////////////////////////////
    """


"""++++++++++++++++++++++++++++++++++++++
Libraries
++++++++++++++++++++++++++++++++++++++"""
import qi

import time
import random

"""++++++++++++++++++++++++++++++++++++++
Constants Classes
++++++++++++++++++++++++++++++++++++++"""

"""**********************************
Name: COLORS
Function: contains basic colors for nao leds
**********************************"""
class COLORS():
    WHITE   = 0x00FFFFFF
    YELLOW  = 0x00FFFF00
    GREEN   = 0x0000FF00
    BLUE    = 0x000000FF
    RED     = 0x00FF0000
    CYAN    = 0x0000FFFF
    MAGENTA = 0x00FF00FF
```

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```
40
41  """************************************
42  Name: _LEDS_GROUPS
43  Function: private class that contains the agrupation of the leds
44  ************************************"""
45  class _LEDS_GROUPS():
46      ###################################
47      ##                HEAD             ##
48      ###################################
49
50      HEAD_FULL = ["Head/Led/Front/Right/1/Actuator/Value",
51                   "Head/Led/Front/Right/0/Actuator/Value",
52                   "Head/Led/Front/Left/0/Actuator/Value",
53                   "Head/Led/Front/Left/1/Actuator/Value",
54                   "Head/Led/Middle/Right/0/Actuator/Value",
55                   "Head/Led/Middle/Left/0/Actuator/Value",
56                   "Head/Led/Rear/Right/0/Actuator/Value",
57                   "Head/Led/Rear/Right/1/Actuator/Value",
58                   "Head/Led/Rear/Right/2/Actuator/Value",
59                   "Head/Led/Rear/Left/2/Actuator/Value",
60                   "Head/Led/Rear/Left/1/Actuator/Value",
61                   "Head/Led/Rear/Left/0/Actuator/Value"]
62
63      HEAD_RIGHT_FRONT = ["Head/Led/Front/Right/1/Actuator/Value",
64                          "Head/Led/Front/Right/0/Actuator/Value"]
65
66      HEAD_LEFT_FRONT = ["Head/Led/Front/Left/0/Actuator/Value",
67                         "Head/Led/Front/Left/1/Actuator/Value"]
68
69      HEAD_FRONT = ["Head/Led/Front/Right/1/Actuator/Value",
70                    "Head/Led/Front/Right/0/Actuator/Value",
71                    "Head/Led/Front/Left/0/Actuator/Value",
72                    "Head/Led/Front/Left/1/Actuator/Value"]
73
74      HEAD_RIGHT_MIDDLE = ["Head/Led/Middle/Right/0/Actuator/Value
            "]
75
76      HEAD_LEFT_MIDDLE = ["Head/Led/Middle/Left/0/Actuator/Value"]
77
78      HEAD_MIDDLE = ["Head/Led/Middle/Right/0/Actuator/Value",
79                     "Head/Led/Middle/Left/0/Actuator/Value"]
80
81      HEAD_RIGHT_REAR = ["Head/Led/Rear/Right/0/Actuator/Value",
82                         "Head/Led/Rear/Right/1/Actuator/Value",
83                         "Head/Led/Rear/Right/2/Actuator/Value"]
84
85      HEAD_LEFT_REAR = ["Head/Led/Rear/Left/2/Actuator/Value",
86                        "Head/Led/Rear/Left/1/Actuator/Value",
87                        "Head/Led/Rear/Left/0/Actuator/Value"]
```

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```
88
89      HEAD_REAR = ["Head/Led/Rear/Right/0/Actuator/Value",
90                   "Head/Led/Rear/Right/1/Actuator/Value",
91                   "Head/Led/Rear/Right/2/Actuator/Value",
92                   "Head/Led/Rear/Left/2/Actuator/Value",
93                   "Head/Led/Rear/Left/1/Actuator/Value",
94                   "Head/Led/Rear/Left/0/Actuator/Value"]
95      ###################################
96      ##                EYES             ##
97      ###################################
98
99      EYES_FULL = ["FaceLedRight0",
100                  "FaceLedRight1",
101                  "FaceLedRight2",
102                  "FaceLedRight3",
103                  "FaceLedRight4",
104                  "FaceLedRight5",
105                  "FaceLedRight6",
106                  "FaceLedRight7",
107                  "FaceLedLeft0",
108                  "FaceLedLeft1",
109                  "FaceLedLeft2",
110                  "FaceLedLeft3",
111                  "FaceLedLeft4",
112                  "FaceLedLeft5",
113                  "FaceLedLeft6",
114                  "FaceLedLeft7"]
115
116     EYE_RIGHT = ["FaceLedRight0",
117                  "FaceLedRight1",
118                  "FaceLedRight2",
119                  "FaceLedRight3",
120                  "FaceLedRight4",
121                  "FaceLedRight5",
122                  "FaceLedRight6",
123                  "FaceLedRight7"]
124
125     EYE_LEFT = ["FaceLedLeft0",
126                 "FaceLedLeft1",
127                 "FaceLedLeft2",
128                 "FaceLedLeft3",
129                 "FaceLedLeft4",
130                 "FaceLedLeft5",
131                 "FaceLedLeft6",
132                 "FaceLedLeft7"]
133     ###################################
134     ##                EARS             ##
135     ###################################
136     EARS_FULL = ["Ears/Led/Right/0Deg/Actuator/Value",
```

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```
                "Ears/Led/Right/36Deg/Actuator/Value",
                "Ears/Led/Right/72Deg/Actuator/Value",
                "Ears/Led/Right/108Deg/Actuator/Value",
                "Ears/Led/Right/144Deg/Actuator/Value",
                "Ears/Led/Right/180Deg/Actuator/Value",
                "Ears/Led/Right/216Deg/Actuator/Value",
                "Ears/Led/Right/252Deg/Actuator/Value",
                "Ears/Led/Right/288Deg/Actuator/Value",
                "Ears/Led/Right/324Deg/Actuator/Value",
                "Ears/Led/Left/0Deg/Actuator/Value",
                "Ears/Led/Left/36Deg/Actuator/Value",
                "Ears/Led/Left/72Deg/Actuator/Value",
                "Ears/Led/Left/108Deg/Actuator/Value",
                "Ears/Led/Left/144Deg/Actuator/Value",
                "Ears/Led/Left/180Deg/Actuator/Value",
                "Ears/Led/Left/216Deg/Actuator/Value",
                "Ears/Led/Left/252Deg/Actuator/Value",
                "Ears/Led/Left/288Deg/Actuator/Value",
                "Ears/Led/Left/324Deg/Actuator/Value"]

    EAR_RIGHT = ["Ears/Led/Right/0Deg/Actuator/Value",
                "Ears/Led/Right/36Deg/Actuator/Value",
                "Ears/Led/Right/72Deg/Actuator/Value",
                "Ears/Led/Right/108Deg/Actuator/Value",
                "Ears/Led/Right/144Deg/Actuator/Value",
                "Ears/Led/Right/180Deg/Actuator/Value",
                "Ears/Led/Right/216Deg/Actuator/Value",
                "Ears/Led/Right/252Deg/Actuator/Value",
                "Ears/Led/Right/288Deg/Actuator/Value",
                "Ears/Led/Right/324Deg/Actuator/Value"]

    EAR_LEFT = ["Ears/Led/Left/0Deg/Actuator/Value",
                "Ears/Led/Left/36Deg/Actuator/Value",
                "Ears/Led/Left/72Deg/Actuator/Value",
                "Ears/Led/Left/108Deg/Actuator/Value",
                "Ears/Led/Left/144Deg/Actuator/Value",
                "Ears/Led/Left/180Deg/Actuator/Value",
                "Ears/Led/Left/216Deg/Actuator/Value",
                "Ears/Led/Left/252Deg/Actuator/Value",
                "Ears/Led/Left/288Deg/Actuator/Value",
                "Ears/Led/Left/324Deg/Actuator/Value"]
    ###################################
    ##              FEET             ##
    ###################################
    FEET_FULL = ["RightFootLeds",
                "LeftFootLeds"]

    FOOT_RIGHT = ["RightFootLeds"]

```

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```
186     FOOT_LEFT = ["LeftFootLeds"]
187
188 """*************************************
189 Name: NAMES_LEDS_GROUPS
190 Function: class that contains the names of the leds group
191 *************************************"""
192 class NAMES_LEDS_GROUPS():
193     ###################################
194     ##              HEAD             ##
195     ###################################
196
197     HEAD_FULL = "HEAD_FULL"
198
199     HEAD_RIGHT_FRONT = "HEAD_RIGHT_FRONT"
200
201     HEAD_LEFT_FRONT = "HEAD_LEFT_FRONT"
202
203     HEAD_FRONT = "HEAD_FRONT"
204
205     HEAD_RIGHT_MIDDLE = "HEAD_RIGHT_MIDDLE"
206
207     HEAD_LEFT_MIDDLE = "HEAD_LEFT_MIDDLE"
208
209     HEAD_MIDDLE = "HEAD_MIDDLE"
210
211     HEAD_RIGHT_REAR = "HEAD_RIGHT_REAR"
212
213     HEAD_LEFT_REAR = "HEAD_LEFT_REAR"
214
215     HEAD_REAR = "HEAD_REAR"
216
217     ###################################
218     ##              EYES             ##
219     ###################################
220
221     EYES_FULL = "EYES_FULL"
222
223     EYE_RIGHT = "EYE_RIGHT"
224
225     EYE_LEFT = "EYE_LEFT"
226
227     ###################################
228     ##              EARS             ##
229     ###################################
230
231     EARS_FULL = "EARS_FULL"
232
233     EAR_RIGHT = "EAR_RIGHT"
234
```

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```
235     EAR_LEFT = "EAR_LEFT"
236
237     ###################################
238     ##                FEET             ##
239     ###################################
240
241     FEET_FULL = "FEET_FULL"
242
243     FOOT_RIGHT = "FOOT_RIGHT"
244
245     FOOT_LEFT = "FOOT_LEFT"
246
247 """+++++++++++++++++++++++++++++++++++++++
248 Class
249 +++++++++++++++++++++++++++++++++++++++"""
250 class Nao_Leds():
251
252     ###################################
253     ##                INITS            ##
254     ###################################
255
256     """-------------------------------------
257     Name: __init__
258     Function: init of the class
259     Parameters: session: nao session
260     Return: -
261     -------------------------------------"""
262     def __init__(self, session):
263         self.session = session
264
265         #Init leds_service
266         self.leds_service = self.session.service("ALLeds")
267         #Create the groups of the leds
268         self._init_groups()
269
270     """-------------------------------------
271     Name: _init_groups
272     Function: inits the groups of the leds and place them inside
            a list. The
273                 name of each group is defined by the LEDS_GROUPS
                    class
274     Parameters: -
275     Return: -
276     -------------------------------------"""
277     def _init_groups(self):
278         self.leds_service.createGroup(NAMES_LEDS_GROUPS.
                HEAD_FULL, _LEDS_GROUPS.HEAD_FULL)
279         self.leds_service.createGroup(NAMES_LEDS_GROUPS.
                HEAD_RIGHT_FRONT, _LEDS_GROUPS.HEAD_RIGHT_FRONT)
```

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```
280             self.leds_service.createGroup(NAMES_LEDS_GROUPS.
                    HEAD_LEFT_FRONT, _LEDS_GROUPS.HEAD_LEFT_FRONT)
281             self.leds_service.createGroup(NAMES_LEDS_GROUPS.
                    HEAD_FRONT, _LEDS_GROUPS.HEAD_FRONT)
282             self.leds_service.createGroup(NAMES_LEDS_GROUPS.
                    HEAD_RIGHT_MIDDLE, _LEDS_GROUPS.HEAD_RIGHT_MIDDLE)
283             self.leds_service.createGroup(NAMES_LEDS_GROUPS.
                    HEAD_LEFT_MIDDLE, _LEDS_GROUPS.HEAD_LEFT_MIDDLE)
284             self.leds_service.createGroup(NAMES_LEDS_GROUPS.
                    HEAD_MIDDLE, _LEDS_GROUPS.HEAD_MIDDLE)
285             self.leds_service.createGroup(NAMES_LEDS_GROUPS.
                    HEAD_RIGHT_REAR, _LEDS_GROUPS.HEAD_RIGHT_REAR)
286             self.leds_service.createGroup(NAMES_LEDS_GROUPS.
                    HEAD_LEFT_REAR, _LEDS_GROUPS.HEAD_LEFT_REAR)
287             self.leds_service.createGroup(NAMES_LEDS_GROUPS.
                    HEAD_REAR, _LEDS_GROUPS.HEAD_REAR)
288             self.leds_service.createGroup(NAMES_LEDS_GROUPS.
                    EYES_FULL, _LEDS_GROUPS.EYES_FULL)
289             self.leds_service.createGroup(NAMES_LEDS_GROUPS.
                    EYE_RIGHT, _LEDS_GROUPS.EYE_RIGHT)
290             self.leds_service.createGroup(NAMES_LEDS_GROUPS.EYE_LEFT
                    , _LEDS_GROUPS.EYE_LEFT)
291             self.leds_service.createGroup(NAMES_LEDS_GROUPS.
                    EARS_FULL, _LEDS_GROUPS.EARS_FULL)
292             self.leds_service.createGroup(NAMES_LEDS_GROUPS.
                    EAR_RIGHT, _LEDS_GROUPS.EAR_RIGHT)
293             self.leds_service.createGroup(NAMES_LEDS_GROUPS.EAR_LEFT
                    , _LEDS_GROUPS.EAR_LEFT)
294             self.leds_service.createGroup(NAMES_LEDS_GROUPS.
                    FEET_FULL, _LEDS_GROUPS.FEET_FULL)
295             self.leds_service.createGroup(NAMES_LEDS_GROUPS.
                    FOOT_RIGHT, _LEDS_GROUPS.FOOT_RIGHT)
296             self.leds_service.createGroup(NAMES_LEDS_GROUPS.
                    FOOT_LEFT, _LEDS_GROUPS.FOOT_LEFT)
297
298     ##################################################
299     ##              LEDS GROUPS FUNCTIONS           ##
300     ##################################################
301
302     """-------------------------------------
303     Name: turn_on_group
304     Function: turns on a group of leds
305     Parameters: group_name: one of the class NAMES_LEDS_GROUPS
306     Return: -
307     -------------------------------------"""
308     def turn_on_group(self, group_name):
309         self.leds_service.on(group_name)
310
311     """-------------------------------------
```

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```
312     Name: turn_off_group
313     Function: turns on a group of leds
314     Parameters: group_name: one of the class NAMES_LEDS_GROUPS
315     Return: -
316     ----------------------------------------"""
317     def turn_off_group(self, group_name):
318         self.leds_service.off(group_name)
319 
320     """----------------------------------------
321     Name: set_intensity
322     Function: sets the intensity of a group of leds
323     Parameters: group_name: one of the class NAMES_LEDS_GROUPS
324                 intensity: value between 0 and 1
325     Return: -
326     ----------------------------------------"""
327     def set_intensity(self, group_name, intensity):
328         self.leds_service.setIntensity(group_name, intensity)
329 
330     """----------------------------------------
331     Name: fade
332     Function: sets the intensity of a group of leds within a
            given time
333               mainly used for ears
334     Parameters: group_name: one of the class NAMES_LEDS_GROUPS
335                 intensity: value between 0 and 1
336                 duration: time to arrive to the intensity
337                 async: boolean that indicates if the action must
                        be done
338                        asyncronously
339     Return: -
340     ----------------------------------------"""
341     def fade(self, group_name, intensity, duration, async):
342         self.leds_service.fade(group_name, intensity, duration,
                _async = async)
343 
344     """----------------------------------------
345     Name: fade_rgb
346     Function: sets the color of a group of leds within a given
            time
347               not used for ears
348     Parameters: group_name: one of the class NAMES_LEDS_GROUPS
349                 color: see class COLORS
350                 duration: time to arrive to the color
351                 async: boolean that indicates if the action must
                        be done
352                        asyncronously
353     Return: -
354     ----------------------------------------"""
355     def fade_rgb(self, group_name, color, duration, async):
```

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```
356         self.leds_service.fadeRGB(group_name, color, duration,
                _async = async)
357
358     """-------------------------------------
359     Name: fade_list_rgb
360     Function: executes a list of color commands for a LED or a
            group of LEDs
361               (like a timeline for LEDs).
362               not used for ears
363     Parameters: group_name: one of the class NAMES_LEDS_GROUPS
364                 list_rgb: list with different colors (see class
                        COLORS)
365                 list_duration: list with the time to show each
                        color of list_rgb
366                 async: boolean that indicates if the action must
                        be done
367                        asyncronously
368     Return: -
369     -------------------------------------"""
370     def fade_list_rgb(self, group_name, list_rgb, list_duration,
            async):
371         self.leds_service.fadeListRGB(group_name, list_rgb,
                list_duration, _async = async)
372
373     ##############################################
374     ##                EARS FUNCTIONS                ##
375     ##############################################
376
377     """-------------------------------------
378     Name: set_ear_angle
379     Function: an animation to show a direction with the ears
380     Parameters: degree: The angle you want to show in degrees (
            int). 0 is up, 90
381                         is forwards, 180 is down and 270 is back
                            .
382                 duration: duration in seconds of the animation
383                 leave_on: If true the last led is left on at the
                        end of the
384                               animation.
385                 async: boolean that indicates if the action must
                        be done
386                        asyncronously
387     Return: -
388     -------------------------------------"""
389     def set_ear_angle(self, degree, duration, leave_on, async):
390         self.leds_service.earLedsSetAngle (degree, duration,
                leave_on, _async = async)
391
392     ##############################################
```

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```
393     ##                EYES FUNCTIONS                ##
394     ############################################
395
396     """-------------------------------------
397     Name: eyes_rotation
398     Function: rotation of the eyes of nao
399     Parameters: color: see class COLORS
400                 rotation_time: time to complete a loop
401                 animation_time: time to be doing the animation
402                 async: boolean that indicates if the action must
                        be done
403                    asyncronously
404     Return: -
405     -------------------------------------"""
406     def eyes_rotation(self, color, rotation_time, animation_time
            ,async):
407         self.leds_service.rotateEyes(color, rotation_time,
                animation_time,_async = async)
408
409     """-------------------------------------
410     Name: random_eyes_animation
411     Function: launch a random animation in eyes
412     Parameters: duration: duration of the animation in seconds
413                 async: boolean that indicates if the action must
                        be done
414                    asyncronously
415     Return: -
416     -------------------------------------"""
417     def random_eyes_animation(self, duration, async):
418         self.leds_service.randomEyes(duration, _async = async)
419
420     """-------------------------------------
421     Name: eyes_blinking
422     Function: blinking of nao's eyes
423     Parameters: -
424     Return: -
425     -------------------------------------"""
426     def eyes_blinking(self):
427         probBlinking = 0.4
428         probDoubleBlinking = 0.4
429
430         if random.uniform(0.0, 1.0) < probBlinking:
431             self.fade(NAMES_LEDS_GROUPS.EYES_FULL, 0.0,0.0,False
                    )
432             time.sleep(0.1)
433             self.fade(NAMES_LEDS_GROUPS.EYES_FULL, 0.5, 0.2,
                    False)
434         elif random.uniform(0.0,1.0) < probDoubleBlinking:
435             self.fade(NAMES_LEDS_GROUPS.EYES_FULL, 0.0, 0.0,
```

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```
                False)
436             time.sleep(0.1)
437             self.fade(NAMES_LEDS_GROUPS.EYES_FULL, 0.5, 0.2,
                    False)
438             self.fade(NAMES_LEDS_GROUPS.EYES_FULL, 0.0, 0.0,
                    False)
439             time.sleep(0.1)
440             self.fade(NAMES_LEDS_GROUPS.EYES_FULL, 0.5, 0.2,
                    False)
441
442     """-------------------------------------
443     Name: wink_eye
444     Function: wink of nao's eye
445     Parameters: eye: indicates the eye to wink: EYE_RIGHT or
            EYE_LEFT of
446                     NAMES_LEDS_GROUPS class
447     Return: -
448     -------------------------------------"""
449     def wink_eye(self, eye):
450         self.fade(eye, 0.0, 0.0,False)
451         time.sleep(0.1)
452         self.fade(eye, 0.5, 0.2,False)
453
454     ################################################
455     ##              ANIMATION FUNCTIONS           ##
456     ################################################
457
458     """-------------------------------------
459     Name: all_body_colored
460     Function: launch a green/yellow/red rasta animation on all
            body.
461     Parameters: duration: duration of the animation in seconds
462                 async: boolean that indicates if the action must
                        be done
463                        asyncronously
464     Return: -
465     -------------------------------------"""
466     def all_body_colored(self, duration, async):
467         self.leds_service.rasta(duration, _async = async)
```

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File 5: nao_motion.py

```
#! /usr/bin/env python
# -*- encoding: UTF-8 -*-
"""
    ////////////////////////////////////////////////////////////////////////////

Name: nao_motion.py
Function: File with the class to make move the robot nao
          See ALAnimationPlayer:
          https://developer.softbankrobotics.com/nao6/naoqi-
              developer-guide/naoqi-apis/naoqi-motion/
              alanimationplayer/alanimationplayer-api
          See ALMotion:
          https://developer.softbankrobotics.com/nao6/naoqi-
              developer-guide/naoqi-apis/naoqi-motion/almotion
          See ALRobotPosture:
          https://developer.softbankrobotics.com/nao6/naoqi-
              developer-guide/naoqi-apis/naoqi-motion/
              alrobotposture#alrobotposture
          #See joints:
          https://developer.softbankrobotics.com/nao6/nao-
              documentation/nao-developer-guide/kinematics-data/
              joints
Creation date: 01/08/2022
Last modified: 21/08/2022
Created by: SCV
////////////////////////////////////////////////////////////////////////////
    """


"""++++++++++++++++++++++++++++++++++++++
Libraries
++++++++++++++++++++++++++++++++++++++"""
import qi
import Movements.movements as move

"""++++++++++++++++++++++++++++++++++++++
Constants Classes
++++++++++++++++++++++++++++++++++++++"""

"""**********************************
Name: HEAD_TACTILE_GESTURES
Function: class that contains the animation tags.
See: https://developer.softbankrobotics.com/nao6/naoqi-developer
    -guide/naoqi-apis/naoqi-motion/alanimationplayer/
    alanimationplayer-advanced#animationplayer-list-behaviors-nao
**********************************"""
class ANIMATION_TAGS():
```

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```
36      AFFIRMATIVE_CONTEXT = "affirmative_context"
37      ANTERIOR = "anterior"
38      COMPARISON = "comparison"
39      CONFIRMATION = "confirmation"
40      DISAPPOINTMENT = "disappointment"
41      DIVERSITY = "diversity"
42      EXCLAMATION = "exclamation"
43      GLOBAL = "global"
44      GROUP = "group"
45      HESITATION = "hesitation"
46      INTERROGATIVE = "interrogative"
47      JOY = "joy"
48      LEFT_SIDE = "left_side"
49      LONGRANGE = "longrange"
50      NEGATIVE_CONTEXT = "negative_context"
51      OVERALL = "overall"
52      PEOPLE = "people"
53      REFUSAL = "refusal"
54      RIGHT_SIDE = "right_side"
55      SELF = "self"
56      SHORTRANGE = "shortrange"
57      TOP = "top"
58      USER = "user"
59
60  """**********************************
61  Name: ROBOT_POSTURES
62  Function: class that contains the robot postures.
63  See: http://doc.aldebaran.com/2-8/family/nao_technical/
        postures_naov6.html#naov6-postures
64  **********************************"""
65  class ROBOT_POSTURES():
66      CROUCH = "Crouch"
67      LYING_BACK = "LyingBack"
68      LYING_BELLY = "LyingBelly"
69      SIT = "Sit"
70      SIT_RELAX = "SitRelax"
71      STAND = "Stand"
72      STAND_INIT = "StandInit"
73      STAND_ZERO = "StandZero"
74
75  """**********************************
76  Name: JOINTS
77  Function: class that contains the robot joints.
78  See: https://developer.softbankrobotics.com/nao6/nao-
        documentation/nao-developer-guide/actuator-sensor-list#rhand
79  https://developer.softbankrobotics.com/nao6/nao-documentation/
        nao-developer-guide/kinematics-data/joints
80  **********************************"""
81  class JOINTS():
```

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```
82      ##############
83      #      HEAD      #
84      ##############
85      HEAD_PITCH = "HeadPitch"
86      HEAD_YAW = "HeadYaw"
87
88      ##############
89      #      RARM      #
90      ##############
91      R_SHOULDER_ROLL = "RShoulderRoll"
92      R_SHOULDER_PITCH = "RShoulderPitch"
93
94      R_ELBOW_YAW = "RElbowYaw"
95      R_ELBOW_ROLL = "RElbowRoll"
96
97      R_WRIST_YAW = "RWristYaw"
98
99      R_HAND = "RHand"
100
101     ##############
102     #      LARM      #
103     ##############
104     L_SHOULDER_ROLL = "LShoulderRoll"
105     L_SHOULDER_PITCH = "LShoulderPitch"
106
107     L_ELBOW_YAW = "LElbowYaw"
108     L_ELBOW_ROLL = "LElbowRoll"
109
110     L_WRIST_YAW = "LWristYaw"
111
112     L_HAND = "LHand"
113
114     ##############
115     #      RLEG      #
116     ##############
117     R_HIP_YAW_PITCH = "RHipYawPitch"
118     R_HIP_PITCH = "RHipPitch"
119     R_HIP_ROLL = "RHipRoll"
120
121     R_KNEE_PITCH = "RKneePitch"
122
123     R_ANKLE_PITCH = "RAnklePitch"
124     R_ANKLE_ROLL = "RAnkleRoll"
125
126     ##############
127     #      LLEG      #
128     ##############
129     L_HIP_YAW_PITCH = "LHipYawPitch"
130     L_HIP_PITCH = "LHipPitch"
```

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```
131     L_HIP_ROLL = "LHipRoll"
132
133     L_KNEE_PITCH = "LKneePitch"
134
135     L_ANKLE_PITCH = "LAnklePitch"
136     L_ANKLE_ROLL = "LAnkleRoll"
137
138 """************************************
139 Name: DEFINED_MOVEMENTS_CHOREGRAPH
140 Function: class that contains movements
141             stored from Choregraph.
142 ************************************"""
143 class DEFINED_MOVEMENTS_CHOREGRAPH():
144     # Moods
145     ## Positive
146     HAPPY = "HAPPY"
147     KISSES = "KISSES"
148     EXCITED = "EXCITED"
149     ## Neutral
150     THINKING = "THINKING"
151
152     # Entertainment
153     ## Dances
154     DISCO = "DISCO"
155     HEADBANG = "HEADBANG"
156     ## Fun
157     MYSTICAL = "MYSTICAL"
158     TAKE_PICTURE = "TAKE_PICTURE"
159     ## Music
160     SAXOPHONE = "SAXOPHONE"
161     GUITAR = "GUITAR"
162
163     #Other
164     ## Greeting
165     WAVE = "WAVE"
166     ## U4
167     SAMBA_U4 = "SAMBA_U4"
168     INITIAL_MOVE_INTERACTION = "INITIAL_MOVE_INTERACTION"
169
170 """++++++++++++++++++++++++++++++++++++++++
171 Class
172 ++++++++++++++++++++++++++++++++++++++++"""
173 class Nao_Motion():
174     """----------------------------------
175     Name: __init__
176     Function: init of the class
177     Parameters: session: nao session
178     Return: -
179     ----------------------------------"""
```

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```
180     def __init__(self, session):
181         self.session = session
182 
183         #Init tactile_gestures_service
184         self.animation_service = self.session.service("
                ALAnimationPlayer")
185 
186         #Init the motion_service
187         self.motion_service = self.session.service("ALMotion")
188 
189         #Init the robot_posture_service
190         self.robot_posture_service = self.session.service("
                ALRobotPosture")
191 
192     """--------------------------------------
193     Name: runAnimationFromTag
194     Function: runs a random animation depending on the tag
195     Parameters: tag: see class ANIMATION_TAGS
196                 async: if the animation must be done
                        asyncronously
197     Return: -
198     --------------------------------------"""
199     def runAnimationFromTag(self, tag, async):
200         self.animation_service.runTag(tag, _async=async)
201 
202     """--------------------------------------
203     Name: goToPosture
204     Function: Goes to a posture
205     Parameters: posture: see ROBOT_POSTURES
206     Return: -
207     --------------------------------------"""
208     def goToPosture(self, posture):
209         self.robot_posture_service.goToPosture(posture, 0.5)
210 
211     """--------------------------------------
212     Name: setStiffness
213     Function: sets the Stiffness of the robot.
214               0.0 the motors are off. BE CAREFUL!! the robot can
                      fall
215               1.0 the motors are on.
216               Intermedium values are allowed
217     Parameters: stiffness: value to set
218                 need_protection: (default True) boolean that if
                        its value is True, sets the robot in
                        ROBOT_POSTURES.CROUCH
219     Return: -
220     --------------------------------------"""
221     def setStiffness(self, stiffness, need_protection = True):
222         if need_protection:
```

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```
223             self.robot_posture_service.goToPosture(
                    ROBOT_POSTURES.CROUCH, 0.5)
224         self.motion_service.stiffnessInterpolation("Body",
                stiffness, 0.5)
225
226     """_____________________________________
227     Name: turnOnOffStiffness
228     Function: turns on or off the stiffness. BE CAREFUL!! the
            robot can fall
229     Parameters: on_NOToff: if True: on, off otherwise
230                 need_protection: (default True) boolean that if
                        its value is True, sets the robot in
                        ROBOT_POSTURES.CROUCH
231     Return: -
232     _____________________________________"""
233     def turnOnOffStiffness(self, on_NOToff, need_protection =
            True):
234         if need_protection:
235             self.robot_posture_service.goToPosture(
                    ROBOT_POSTURES.CROUCH, 0.5)
236         if on_NOToff:
237             self.motion_service.wakeUp()
238         else:
239             self.motion_service.rest()
240
241     """_____________________________________
242     Name: turnOnOffBreathAnimation
243     Function: turns on or off a breath animation.  in this mode,
            the robot plays a breathing animation in loop.
244                 see: https://developer.softbankrobotics.com/nao6/
                        naoqi-developer-guide/naoqi-apis/naoqi-motion/
                        almotion/idle/idle-api
245     Parameters: on_NOToff_breath: if True: on, off otherwise
246     Return: -
247     _____________________________________"""
248     def turnOnOffBreathAnimation(self, on_NOToff_breath):
249         self.motion_service.setBreathEnabled('Body',
                on_NOToff_breath)
250
251     """_____________________________________
252     Name: openCloseHand
253     Function: turns on or off a breath animation.  in this mode,
            the robot plays a breathing animation in loop.
254                 see: https://developer.softbankrobotics.com/nao6/
                        naoqi-developer-guide/naoqi-apis/naoqi-motion/
                        almotion/idle/idle-api
255     Parameters: open_NOTclose: if True: open, close otherwise
256                 hand: JOINTS.L_HAND or JOINTS.R_HAND
257     Return: -
```

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```
258     ------------------------------------"""
259     def openCloseHand(self, open_NOTclose, hand):
260         if open_close:
261             self.motion_service.openHand(hand)
262         else:
263             self.motion_service.closeHand(hand)
264
265     """------------------------------------
266     Name: performDefinedMovement
267     Function: Performs a defined movement.
268               see DEFINED_MOVEMENTS_CHOREGRAPH
269     Parameters: movement: A movement from class
270                          DEFINED_MOVEMENTS_CHOREGRAPH
271                 async: to perform the movement
272                 asyncronously. True by default.
273     Return: -
274     ------------------------------------"""
275     def performDefinedMovement(self, movement, async = True):
276         if movement == DEFINED_MOVEMENTS_CHOREGRAPH.HAPPY:
277             names, keys, times = move.happy()
278         elif movement == DEFINED_MOVEMENTS_CHOREGRAPH.KISSES:
279             names, keys, times = move.kisses()
280         elif movement == DEFINED_MOVEMENTS_CHOREGRAPH.THINKING:
281             names, keys, times = move.thinking()
282         elif movement == DEFINED_MOVEMENTS_CHOREGRAPH.DISCO:
283             names, keys, times = move.disco()
284         elif movement == DEFINED_MOVEMENTS_CHOREGRAPH.HEADBANG:
285             names, keys, times = move.headbang()
286         elif movement == DEFINED_MOVEMENTS_CHOREGRAPH.MYSTICAL:
287             names, keys, times = move.mystical()
288         elif movement == DEFINED_MOVEMENTS_CHOREGRAPH.
               TAKE_PICTURE:
289             names, keys, times = move.takePicture()
290         elif movement == DEFINED_MOVEMENTS_CHOREGRAPH.SAXOPHONE:
291             names, keys, times = move.saxophone()
292         elif movement == DEFINED_MOVEMENTS_CHOREGRAPH.GUITAR:
293             names, keys, times = move.guitar()
294         elif movement == DEFINED_MOVEMENTS_CHOREGRAPH.WAVE:
295             names, keys, times = move.wave()
296         elif movement == DEFINED_MOVEMENTS_CHOREGRAPH.SAMBA_U4:
297             names, keys, times = move.sambaU4()
298         elif movement == DEFINED_MOVEMENTS_CHOREGRAPH.
               INITIAL_MOVE_INTERACTION:
299             names, keys, times = move.initialMoveInteraction()
300
301         self.motion_service.angleInterpolation(names, keys,
               times, True, _async = async)
302
303     """------------------------------------
```

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```
304     Name: moveJointsToAngles
305     Function: Performs a defined movement.
306               see DEFINED_MOVEMENTS_CHOREGRAPH
307     Parameters: joints: list of joints. See JOINTS
308                 angles: list of the angles in radiants
309                 speed: the fraction of maximum speed to use
310                 async: to perform the movement
311                 asyncronously. True by default.
312     Example: moveJointToAngle(["LShoulderPitch"],[0.5], 0.1)
313     Return: -
314     ------------------------------------"""
315     def moveJointsToAngles(self, joints, angles, speed, async =
            True):
316         self.motion_service.setAngles(joints, angles, speed)
```

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File 6: nao_sensors.py

```
#! /usr/bin/env python
# -*- encoding: UTF-8 -*-
"""
    ////////////////////////////////////////////////////////////////////////////

Name: nao_sensors.py
Function: File with the class to get information from the
    sensors of robot nao
            See ALTactileGesture:
            https://developer.softbankrobotics.com/nao6/naoqi-
                developer-guide/naoqi-apis/naoqi-sensors-leds/
                altactilegesture#altactilegesture
Creation date: 06/05/2022
Last modified: 15/08/2022
Created by: SCV
////////////////////////////////////////////////////////////////////////////
    """


"""++++++++++++++++++++++++++++++++++++++
Libraries
++++++++++++++++++++++++++++++++++++++"""
#General
import qi

#From the project
from Sensors.nao_head_tactile_gestures import
    Nao_HeadTactileGestures
from Sensors.nao_touch import Nao_Touch

"""++++++++++++++++++++++++++++++++++++++
Constants Classes
++++++++++++++++++++++++++++++++++++++"""

class SENSORS_LIST():
    TOUCH = "0"
    HEAD_TACTILE_GESTURES = "1" #IT DOES NOT WORK!


"""++++++++++++++++++++++++++++++++++++++
Class
++++++++++++++++++++++++++++++++++++++"""
class Nao_Sensors():
    """----------------------------------
    Name: __init__
    Function: init of the class
    Parameters: session: nao session
```

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```
41                 sensors_list: list of the sensors to use (see
                       SENSORS_LIST)
42                 controller: controller to advise when an event
                       happens
43         Return: -
44         ----------------------------------------"""
45         def __init__(self, session, sensors_list, controller = None)
               :
46
47             self.controller = controller
48
49
50             self.session = session
51             ############################
52             #Init the required services#
53             ############################
54             for sensor in sensors_list:
55                 if sensor == SENSORS_LIST.TOUCH:
56                     #TODO: check the init of this class if need to
                           work different
57                     self.touch = Nao_Touch(self.session)
58                 elif sensor == SENSORS_LIST.HEAD_TACTILE_GESTURES:
59                     self.head_tactile_gestures =
                           Nao_HeadTactileGestures(self.session)
```

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File 7: nao_speech.py

```
#! /usr/bin/env python
# -*- encoding: UTF-8 -*-
"""
    ////////////////////////////////////////////////////////////////////////////

Name: nao_speech.py
Function: File with the class to control the speech of robot nao
Creation date: 04/05/2022
Last modified: 05/05/2022
Created by: SCV
////////////////////////////////////////////////////////////////////////////
    """


"""++++++++++++++++++++++++++++++++++++++
Libraries
++++++++++++++++++++++++++++++++++++++"""
import qi

"""++++++++++++++++++++++++++++++++++++++
Constants Classes
++++++++++++++++++++++++++++++++++++++"""
"""**********************************
Name: CONFIGURATION
Function: contains basic configurations for nao talks i. e. nao will move
          while talking
**********************************"""
class CONFIGURATION():
    #contextual - The robot launches some specific animations each time a
        #keyword like 'I', 'you' or 'all' is detected in an appropriate
        #grammatical context (for example, he will point at himself when he
        #talks about himself).
    #While no contextual animations is found, it randomly launches a new
        #animation.
    #You can add new associations between words and tagged animations using:
        #ALSpeakingMovementProxy::addTagsToWords
    #You can remove the associations between words and tagged animations added
        #from the previous method, using:
        #ALSpeakingMovementProxy::resetTagsToWords
    #The speaking movement takes all motor resources if they are
```

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```
        available. It
38          #stops as soon as they are asked by another animation (
                launched by
39          #ALAnimatedSpeech or ALAnimationPlayer for example).
40      CONTEXTUAL = {"bodyLanguageMode":"contextual"}
41      #disabled - The robot does not move
42      DISABLED = {"bodyLanguageMode":"disabled"}
43      #random - The robot randomly launches some short neutral
            animations which
44          #are executed one after another.
45      RANDOM = {"bodyLanguageMode":"random"}
46
47  """**********************************
48  Name: LANGUAGES
49  Function: contains the languages that nao can talk
50  **********************************"""
51  class LANGUAGES():
52      SPANISH = "Spanish"
53      ENGLISH = "English"
54
55  """++++++++++++++++++++++++++++++++++++++
56  Class
57  ++++++++++++++++++++++++++++++++++++++"""
58  class Nao_Speech():
59      """--------------------------------------
60      Name: __init__
61      Function: init of the class
62      Parameters: session: nao session
63      Return: -
64      --------------------------------------"""
65      def __init__(self, session):
66          self.session = session
67
68          #Init tts_service
69          self.tts_service = self.session.service("ALTextToSpeech"
                )
70          #Init anim_tts_service
71          self.anim_tts_service = self.session.service("
                ALAnimatedSpeech")
72          #Init dialog_service
73          self.dialog_service = self.session.service("ALDialog")
74          #Init dialog_list to have a control of the dialogs
                launched
75          self.dialog_list = []
76
77      """--------------------------------------
78      Name: set_language
79      Function: set nao's language
80      Parameters: language: language that nao will talk (see
```

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```
        LANGUAGES class)
81      Return: -
82      ----------------------------------------"""
83      def set_language(self, language = LANGUAGES.SPANISH):
84          self.tts_service.setLanguage(language)
85          self.dialog_service.setLanguage(language)
86
87      """----------------------------------------
88      Name: set_speech_speed
89      Function: set nao speech's speed
90      Parameters: speed: sets nao speech's speed
91      Return: -
92      ----------------------------------------"""
93      def set_speech_speed(self, speed):
94          self.tts_service.setParameter("speed", speed)
95
96      """----------------------------------------
97      Name: set_speech_pauses
98      Function: set nao speech's pauses
99      Parameters: pauseMiddle: sets nao speech's pauseMiddle
100                 pauseLong: sets nao speech's pauseLong
101                 pauseSentence: sets nao speech's pauseSentence
102     Return: -
103     ----------------------------------------"""
104     def set_speech_pauses(self, pauseMiddle, pauseLong,
            pauseSentence):
105         self.tts_service.setParameter("pauseMiddle", pauseMiddle
                )
106         self.tts_service.setParameter("pauseLong", pauseLong)
107         self.tts_service.setParameter("pauseSentence",
                pauseSentence)
108
109     """----------------------------------------
110     Name: say
111     Function: nao speaks
112     Parameters: message: message to say
113                 async: if the message must be said asyncronously
114     Return: -
115     ----------------------------------------"""
116     def say(self, message, async):
117         self.tts_service.say(message, _async=async)
118     """----------------------------------------
119     Name: anim_say
120     Function: nao speaks using an animation (moving its body)
121     Parameters: message: message to say
122                 async: if the message must be said asyncronously
123                 configuration: movement to express the message (
                        see CONFIGURATION class)
124     Return: -
```

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```
125         ------------------------------------"""
126         def anim_say(self, message, async = True, configuration =
                CONFIGURATION.CONTEXTUAL):
127             self.anim_tts_service.say(message, configuration, _async
                    =async)
128
129         """------------------------------------
130         Name: stop_talking
131         Function: nao stops speaking
132         Parameters: -
133         Return: -
134         ------------------------------------"""
135         def stop_talking(self):
136             self.tts_service.stopAll()
137
138         """------------------------------------
139         Name: start_dialog
140         Function: runs a dialog topic on nao
141         Parameters: file: file where the topic is detailed. For more
                information
142                         on how the topic works visit:
143                         https://developer.softbankrobotics.com/
                                nao6/naoqi-developer-guide/naoqi-apis/
                                naoqi-interaction-engines/aldialog/
                                qichat-table-content-0#dialog-rules
144                     dialog_name: string with the name that
                            identifies the dialog.
145                                 example: 'my_dialog_example'
146         Return: list of lists with the topics sent to nao. The lists
                inside contains
147                 the dialog name (to unsubscribe) and the topic name
                        (to desactivate
148                 the topic and unload it)
149         ------------------------------------"""
150         def start_dialog(self, file, dialog_name):
151             # Read the file
152             f = open(file, "r")
153             topic_content = f.read()
154
155             topic_name = self.dialog_service.loadTopicContent(
                    topic_content)
156
157             # Activating the loaded topic
158             self.dialog_service.activateTopic(topic_name)
159
160             # Starting the dialog engine - we need to type an
                    arbitrary string as the identifier
161             # We subscribe only ONCE, regardless of the number of
                    topics we have activated
```

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```
162             self.dialog_service.subscribe(dialog_name)
163
164             # append the topic running on nao in our list
165             self.dialog_list.append([dialog_name, topic_name])
166
167             #return the new list
168             return self.dialog_list
169
170         """_____________________________________
171         Name: stop_dialog
172         Function: stops a dialog topic on nao
173         Parameters: dialog_name: string with the name that
                identifies the dialog.
174                                 example: 'my_dialog_example'
175                     topic_name: name of the topic
176         Return: the list without the stopped topic
177         _____________________________________"""
178         def stop_dialog(self, dialog_name, topic_name):
179             # stopping the dialog engine
180             self.dialog_service.unsubscribe(dialog_name)
181
182             # Deactivating the topic
183             self.dialog_service.deactivateTopic(topic_name)
184
185             # now that the dialog engine is stopped and there are no
                    more activated topics,
186             # we can unload our topic and free the associated memory
187             self.dialog_service.unloadTopic(topic_name)
188
189             #erase from list the topic stopped
190             self.dialog_list.remove([dialog_name, topic_name])
191
192             #return the new list
193             return self.dialog_list
194
195         """_____________________________________
196         Name: stop_all_dialogs
197         Function: stops all dialogs topics on nao
198         Parameters: -
199         Return: -
200         _____________________________________"""
201         def stop_all_dialogs(self):
202             #for each topic running on nao
203             for topic in self.dialog_list:
204                 #stop it
205                 self.stop_dialog(topic[0], topic[1])
```

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File 8: nao_vision.py

```python
#! /usr/bin/env python
# -*- encoding: UTF-8 -*-
"""
    ////////////////////////////////////////////////////////////////////////////////

Name: nao_vision.py
Function: File with the class to control the vision of robot nao
Creation date: 22/07/2022
Last modified: 22/07/2022
Created by: CRR
////////////////////////////////////////////////////////////////////////////////
    """

"""++++++++++++++++++++++++++++++++++++++
Libraries
++++++++++++++++++++++++++++++++++++++"""
import qi
import numpy as np

# PIL mode
from PIL import Image
import matplotlib.pyplot as plt

# Opencv mode
import cv2

"""++++++++++++++++++++++++++++++++++++++
Constants
++++++++++++++++++++++++++++++++++++++"""
# Nao robot IP adress
IP_ADRESS = "172.16.2.155"

# Camera configuration
NAME = "demo"
#Camara del cap
CAMERA_INDEX = 0
#Camara de la boca
#CAMERA_INDEX = 1
RESOLUTION = 2
COLOR_SPACE = 13
FPS = 30

"""++++++++++++++++++++++++++++++++++++++
Class
++++++++++++++++++++++++++++++++++++++"""
class Nao_Vision():
    """----------------------------------
```

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```
    Name: __init__
    Function: init of the class
    Parameters: session: nao session
                # http://doc.aldebaran.com/2-5/naoqi/vision/
                    alvideodevice-api.html#ALVideoDeviceProxy::
                    subscribeCamera__ssCR.iCR.iCR.iCR.iCR
                name: name of the subscribing module
                camera_index: index of the camera in the video
                    system (see Camera Indexes).
                resolution: resolution requested (see Supported
                    resolutions).
                color_space: colorspace requested (see Supported
                     colorspaces).
                fps: fps (frames per second) requested to the
                    video source (see Supported framerates).
    Return: -
    ----------------------------------------"""
    def __init__(self, session, name = "demo", camera_index = 0,
        resolution = 2, color_space = 13, fps = 30):
        self.session = session
        self.face_detection_service = self.session.service("
            ALFaceDetection")
        self.video_service = self.session.service("ALVideoDevice
            ")
        self.subscriber = self.video_service.subscribeCamera(
            name, camera_index, resolution, color_space, fps)

    """----------------------------------------
    Name: setPeopleRecognition
    Function: turns on or off the face detector of nao
    Parameters: on_NOToff: True: On, False: Off
    Return: imatge (<class: numpy.numpy.ndarray>)
    ----------------------------------------"""
    def setPeopleRecognition(self, on_NOToff):
        self.face_detection_service.setRecognitionEnabled(
            on_NOToff)
        self.face_detection_service.setTrackingEnabled(on_NOToff
            )

    """----------------------------------------
    Name: get_opencv_image
    Function: obtenir la imatge capturada pel robot nao per
        treballar amb cv2
    Parameters: -
    Return: imatge (<class: numpy.numpy.ndarray>)
    ----------------------------------------"""
    def get_opencv_image(self):
        imageNAO = self.video_service.getImageRemote(self.
            subscriber)
```

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```
80          if imageNAO is None:
81              pass
82          else:
83              imageWidth = imageNAO[0]
84              imageHeight = imageNAO[1]
85              array = imageNAO[6]
86
87              img_cv2 = (np.reshape(np.frombuffer(array, dtype='%
                    iuint8' % imageNAO[2]), (imageHeight, imageWidth,
                     imageNAO[2])))
88              # https://stackoverflow.com/questions/22593451/how-
                    to-import-opencv-on-nao-in-python
89              return img_cv2
90          return None
91
92      """--------------------------------------
93      Name: get_pil_image
94      Function: obtenir la imatge capturada pel robot nao per
            treballar amb pil
95      Parameters: -
96      Return: imatge (<class: PIL.Image.Image>)
97      --------------------------------------"""
98      def get_pil_image(self):
99          imageNAO = self.video_service.getImageRemote(self.
                subscriber)
100         if imageNAO is None:
101             pass
102         else:
103             imageWidth = imageNAO[0]
104             imageHeight = imageNAO[1]
105             array = imageNAO[6]
106
107             # Use PIL to create an image from the new array of
                    pixels
108             img_pil = Image.frombytes("RGB", (imageWidth,
                    imageHeight), array)
109             return img_pil
110         return None
```

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1.1 Movements

File 9: __init__.py

```
1 from . import *
```

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File 10: movements.py

```
#! /usr/bin/env python
# -*- encoding: UTF-8 -*-
"""
    ////////////////////////////////////////////////////////////////////////////

Name: movements.py
Function: File with some of the predefined movements from
    Choregraph
          See: http://doc.aldebaran.com/2-4/software/choregraphe
              /panels/timeline_panel.html
          In this web it is explained how to extract the
              movements from Choregraph.
          Note: Once you indicate the language you want to
              export the movement,
          it is saved in the clipboard. Therefore, you just have
               to paste it
          wherever you want it.
Creation date: 29/12/2022
Last modified: 29/12/2022
Created by: SCV
////////////////////////////////////////////////////////////////////////////
    """


"""++++++++++++++++++++++++++++++++++++++
Libraries
++++++++++++++++++++++++++++++++++++++"""
import qi

"""++++++++++++++++++++++++++++++++++++++
Functions:

Summary of the movements:

--------------------
Moods
--------------------
    ////////
    Positive
    ////////
        happy
        kisses
        excited
    ////////
    Neutral
    ////////
        thinking
```

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```
40
41  ------------------
42  Entertainment
43  ------------------
44      ////////
45      Dances
46      ////////
47          disco
48          headbang
49
50      ////////
51      Fun
52      ////////
53          mystical
54          takePicture
55
56      ////////
57      Music
58      ////////
59          saxophone
60          guitar
61
62  ------------------
63  Other
64  ------------------
65      ////////
66      Greeting
67      ////////
68          wave
69
70      ////////
71      U4
72      ////////
73          sambaU4
74          initialMoveInteraction
75
76
77  ++++++++++++++++++++++++++++++++++++"""
78
79  """**********************************
80  Name: happy
81  Function: Makes a happy movement.
82  **********************************"""
83  def happy ():
84      names = list()
85      times = list()
86      keys = list()
87
88      names.append("HeadPitch")
```

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```
89      times.append([0.76, 0.88, 1.04, 1.2, 1.4, 1.56, 1.72, 1.88,
            2.12, 2.28, 2.44, 2.6, 2.8, 2.96, 3.44])
90      keys.append([-0.261799, -0.14802, -0.216196, -0.17832,
            -0.261799, -0.144232, -0.212408, -0.174533, -0.261799,
            -0.144232, -0.212408, -0.174533, -0.261799, -0.186331,
            -0.200952])
91
92      names.append("HeadYaw")
93      times.append([0.56, 0.92, 1.56, 2.28, 2.92, 3.44])
94      keys.append([-0.0107379, 0.0349066, -0.0349066, 0.0349066,
            -0.0349066, -0.00306797])
95
96      names.append("HipPitch")
97      times.append([0.76, 3.32, 3.44])
98      keys.append([-0.176278, -0.0352817, -0.0322137])
99
100     names.append("HipRoll")
101     times.append([0.76, 1.4, 2.12, 2.8, 3.32, 3.44])
102     keys.append([0.0872665, -0.0872665, 0.0872665, -0.0872665,
            -0.00153399, 0.00306797])
103
104     names.append("KneePitch")
105     times.append([0.76, 3.32, 3.44])
106     keys.append([0.0610865, -0.00306797, 0.00613595])
107
108     names.append("LElbowRoll")
109     times.append([0.76, 1.08, 1.4, 1.76, 2.12, 2.48, 2.8, 3.12,
            3.44])
110     keys.append([-0.925025, -0.670206, -1.0664, -0.670206,
            -0.925025, -0.670206, -1.0664, -0.670206, -0.523087])
111
112     names.append("LElbowYaw")
113     times.append([0.76, 1.4, 2.12, 2.8, 3.44])
114     keys.append([-1.10828, -1.75472, -1.10828, -1.75472,
            -1.23025])
115
116     names.append("LHand")
117     times.append([0.76, 1.08, 1.4, 1.76, 2.12, 2.48, 2.8, 3.12,
            3.44])
118     keys.append([0.020089, 0.34, 0.173538, 0.34, 0.020089, 0.34,
             0.173538, 0.34, 0.582601])
119
120     names.append("LShoulderPitch")
121     times.append([0.76, 1.4, 2.12, 2.8, 3.44])
122     keys.append([1.31598, 1.77151, 1.31598, 1.77151, 1.56006])
123
124     names.append("LShoulderRoll")
125     times.append([0.76, 1.4, 2.12, 2.8, 3.44])
126     keys.append([0.258309, 0.251327, 0.258309, 0.251327,
```

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```
        0.14266])
127
128     names.append("LWristYaw")
129     times.append([0.76, 1.4, 2.12, 2.8, 3.44])
130     keys.append([-0.111693, 0.012626, -0.111693, 0.012626,
            0.0152981])
131
132     names.append("RElbowRoll")
133     times.append([0.76, 1.08, 1.4, 1.76, 2.12, 2.48, 2.8, 3.12,
            3.44])
134     keys.append([1.0664, 0.694641, 0.925025, 0.694641, 1.0664,
            0.694641, 0.925025, 0.694641, 0.523087])
135
136     names.append("RElbowYaw")
137     times.append([0.76, 1.4, 2.12, 2.8, 3.44])
138     keys.append([1.75472, 1.10828, 1.75472, 1.10828, 1.22412])
139
140     names.append("RHand")
141     times.append([0.76, 1.08, 1.4, 1.76, 2.12, 2.48, 2.8, 3.12,
            3.44])
142     keys.append([0.173538, 0.29, 0.020089, 0.29, 0.173538, 0.29,
             0.020089, 0.29, 0.585237])
143
144     names.append("RShoulderPitch")
145     times.append([0.76, 1.4, 2.12, 2.8, 3.44])
146     keys.append([1.77151, 1.31598, 1.77151, 1.31598, 1.55546])
147
148     names.append("RShoulderRoll")
149     times.append([0.76, 1.4, 2.12, 2.8, 3.44])
150     keys.append([-0.251327, -0.258309, -0.251327, -0.258309,
            -0.145728])
151
152     names.append("RWristYaw")
153     times.append([0.76, 1.4, 2.12, 2.8, 3.44])
154     keys.append([-0.012626, 0.111693, -0.012626, 0.111693,
            0.0137641])
155
156     return names, keys, times
157
158 """*********************************
159 Name: kisses
160 Function: Makes kisses.
161 *********************************"""
162 def kisses():
163     names = list()
164     times = list()
165     keys = list()
166
167     names.append("HeadPitch")
```

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```
168     times.append([0.8, 1.6, 2.48, 3.56, 4.28, 5.48])
169     keys.append([-0.320648, -0.013848, -0.366667, -0.296706,
            -0.400415, -0.245482])
170
171     names.append("HeadYaw")
172     times.append([0.8, 1.6, 2.48, 3.56, 4.28, 5.48])
173     keys.append([-0.075208, -0.04913, -0.032256, -0.032256,
            -0.0353239, -0.036858])
174
175     names.append("LAnklePitch")
176     times.append([1.48, 2.36, 3.44, 4.16, 5.36])
177     keys.append([0.05825, 0.164096, 0.253067, 0.251533,
            0.118076])
178
179     names.append("LAnkleRoll")
180     times.append([1.48, 2.36, 3.44, 4.16, 5.36])
181     keys.append([-0.0889301, -0.039842, -0.015298, -0.015298,
            -0.085862])
182
183     names.append("LElbowRoll")
184     times.append([0.72, 1.52, 2.4, 3.48, 4.2, 5.4])
185     keys.append([-0.535324, -1.5621, -1.55697, -0.785367,
            -0.500042, -0.377323])
186
187     names.append("LElbowYaw")
188     times.append([0.72, 1.52, 2.4, 3.48, 4.2, 5.4])
189     keys.append([-1.93288, -0.802324, -0.87749, -1.77181,
            -1.91447, -1.14287])
190
191     names.append("LHand")
192     times.append([1.52, 2.4, 3.48, 4.2, 5.4])
193     keys.append([0.73166, 0.702933, 0.8, 0.676387, 0.109844])
194
195     names.append("LHipPitch")
196     times.append([1.48, 2.36, 3.44, 4.16, 5.36])
197     keys.append([0.358999, 0.101286, -0.032172, -0.032172,
            0.213269])
198
199     names.append("LHipRoll")
200     times.append([1.48, 2.36, 3.44, 4.16, 5.36])
201     keys.append([0.115092, 0.027654, -0.00609404, -0.00302603,
            0.0951499])
202
203     names.append("LHipYawPitch")
204     times.append([1.48, 2.36, 3.44, 4.16, 5.36])
205     keys.append([-0.271475, -0.292952, -0.331302, -0.331302,
            -0.312894])
206
207     names.append("LKneePitch")
```

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```
208     times.append([1.48, 2.36, 3.44, 4.16, 5.36])
209     keys.append([-0.0923461, -0.0923461, -0.0923461, -0.0923461,
            -0.0890139])
210
211     names.append("LShoulderPitch")
212     times.append([0.72, 1.52, 2.4, 3.48, 4.2, 5.4])
213     keys.append([0.863599, 0.366584, 0.187106, 0.955639,
            1.39743, 1.48027])
214
215     names.append("LShoulderRoll")
216     times.append([0.72, 1.52, 2.4, 3.48, 4.2, 5.4])
217     keys.append([0.030638, 0.024502, 0.015298, 0.914223,
            0.58748, 0.067454])
218
219     names.append("LWristYaw")
220     times.append([1.52, 2.4, 3.48, 4.2, 5.4])
221     keys.append([-1.19503, -1.12446, -1.53589, -1.13213,
            -0.139636])
222
223     names.append("RAnklePitch")
224     times.append([1.48, 2.36, 3.44, 4.16, 5.36])
225     keys.append([0.047596, 0.16418, 0.251617, 0.254685,
            0.107422])
226
227     names.append("RAnkleRoll")
228     times.append([1.48, 2.36, 3.44, 4.16, 5.36])
229     keys.append([0.07214, 0.0537319, 0.01078, 0.012314,
            0.04913])
230
231     names.append("RElbowRoll")
232     times.append([0.64, 1.44, 2.32, 3.4, 4.12, 5.32])
233     keys.append([0.527739, 1.55859, 1.5621, 0.716419, 0.418823,
            0.437231])
234
235     names.append("RElbowYaw")
236     times.append([0.64, 1.44, 2.32, 3.4, 4.12, 5.32])
237     keys.append([2.0856, 0.882007, 0.677985, 1.94047, 2.08466,
            1.51095])
238
239     names.append("RHand")
240     times.append([1.44, 2.32, 3.4, 4.12, 5.32])
241     keys.append([0.789478, 0.758933, 0.909091, 0.730569,
            0.22548])
242
243     names.append("RHipPitch")
244     times.append([1.48, 2.36, 3.44, 4.16, 5.36])
245     keys.append([0.371186, 0.0966, -0.0337899, -0.0353239,
            0.217786])
246
```

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```
247     names.append("RHipRoll")
248     times.append([1.48, 2.36, 3.44, 4.16, 5.36])
249     keys.append([-0.107338, -0.0551821, 0.00617796, 0.00617796,
            -0.05825])
250
251     names.append("RKneePitch")
252     times.append([1.48, 2.36, 3.44, 4.16, 5.36])
253     keys.append([-0.0996681, -0.102736, -0.103083, -0.102736,
            -0.076658])
254
255     names.append("RShoulderPitch")
256     times.append([0.64, 1.44, 2.32, 3.4, 4.12, 5.32])
257     keys.append([1.01095, 0.408086, 0.030722, 1.10606, 1.39752,
            1.53711])
258
259     names.append("RShoulderRoll")
260     times.append([0.64, 1.44, 2.32, 3.4, 4.12, 5.32])
261     keys.append([-0.17185, -0.0353239, -0.108956, -0.849878,
            -0.650458, -0.0429939])
262
263     names.append("RWristYaw")
264     times.append([1.44, 2.32, 3.4, 4.12, 5.32])
265     keys.append([1.00319, 0.993989, 1.39626, 0.992455,
            0.00302603])
266
267     return names, keys, times
268
269 """*********************************
270 Name: excited
271 Function: Makes a excited movement.
272 *********************************"""
273 def excited():
274     names = list()
275     times = list()
276     keys = list()
277
278     names.append("HeadPitch")
279     times.append([0.56, 0.8, 0.92, 1.04, 1.2, 1.32, 1.48, 1.6,
            2.04])
280     keys.append([-0.328028, -0.252647, -0.338728, -0.266191,
            -0.338728, -0.266191, -0.338728, -0.266191, -0.272682])
281
282     names.append("HeadYaw")
283     times.append([0.56, 2.04])
284     keys.append([-0.016916, -0.016916])
285
286     names.append("HipPitch")
287     times.append([0.76, 1.48, 2.08])
288     keys.append([-0.0383496, -0.345575, -0.0383496])
```

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```
289
290     names.append("HipRoll")
291     times.append([0.76, 2.08])
292     keys.append([0, 0])
293
294     names.append("KneePitch")
295     times.append([0.76, 2.08])
296     keys.append([0.00153399, 0.00153399])
297
298     names.append("LElbowRoll")
299     times.append([0.68, 0.96, 1.04, 1.2, 1.32, 1.48, 1.56, 1.72,
            1.88, 2.04, 2.2])
300     keys.append([-1.49226, -1.50021, -1.30027, -1.50021,
            -1.30027, -1.50021, -1.30027, -1.50021, -1.30027,
            -1.50021, -1.30027])
301
302     names.append("LElbowYaw")
303     times.append([0.96, 1.2, 1.48, 1.72, 2.04])
304     keys.append([-1.42053, -1.42053, -1.42053, -1.42053,
            -1.42053])
305
306     names.append("LHand")
307     times.append([0.68, 0.96, 1.04, 1.2, 1.32, 1.48, 1.56, 1.72,
            1.88, 2.04, 2.2])
308     keys.append([0.63, 0.27, 0.02, 0.24, 0.02, 0.28, 0.02, 0.26,
            0.02, 0.24, 0.02])
309
310     names.append("LShoulderPitch")
311     times.append([0.6, 0.88, 1, 1.16, 1.24, 1.36, 1.52, 1.64,
            1.8, 1.96, 2.12])
312     keys.append([0.945968, 1.15541, 1.21475, 1.15541, 1.21475,
            1.15541, 1.21475, 1.15541, 1.21475, 1.15541, 1.21475])
313
314     names.append("LShoulderRoll")
315     times.append([0.6, 0.88, 1.16, 1.36, 1.64, 1.96])
316     keys.append([0.223402, 0.00872665, 0.00872665, 0.00872665,
            0.00872665, 0.00872665])
317
318     names.append("LWristYaw")
319     times.append([0.68, 0.96, 1.2, 1.48, 1.72, 2.04])
320     keys.append([-0.630064, 0.101202, 0.101202, 0.101202,
            0.101202, 0.101202])
321
322     names.append("RElbowRoll")
323     times.append([0.68, 0.8, 0.96, 1.08, 1.24, 1.32, 1.48, 1.6,
            1.76, 1.92, 2.08])
324     keys.append([1.49226, 1.48649, 1.30027, 1.48649, 1.30027,
            1.48649, 1.30027, 1.48649, 1.30027, 1.48649, 1.30027])
325
```

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```
326     names.append("RElbowYaw")
327     times.append([0.8, 1.08, 1.32, 1.6, 1.92])
328     keys.append([1.33914, 1.33914, 1.33914, 1.33914, 1.33914])
329
330     names.append("RHand")
331     times.append([0.68, 0.8, 0.96, 1.08, 1.24, 1.32, 1.48, 1.6,
            1.76, 1.92, 2.08])
332     keys.append([0.63, 0.27, 0.02, 0.24, 0.02, 0.28, 0.02, 0.26,
             0.02, 0.24, 0.02])
333
334     names.append("RShoulderPitch")
335     times.append([0.6, 0.76, 0.92, 1.04, 1.16, 1.28, 1.4, 1.56,
            1.68, 1.84, 2])
336     keys.append([0.945968, 1.15541, 1.21475, 1.15541, 1.21475,
            1.15541, 1.21475, 1.15541, 1.21475, 1.15541, 1.21475])
337
338     names.append("RShoulderRoll")
339     times.append([0.6, 0.76, 1.04, 1.28, 1.56, 1.84])
340     keys.append([-0.223402, -0.00872665, -0.00872665,
            -0.00872665, -0.00872665, -0.00872665])
341
342     names.append("RWristYaw")
343     times.append([0.68, 0.8, 1.08, 1.32, 1.6, 1.92])
344     keys.append([0.630064, 0.110406, 0.110406, 0.110406,
            0.110406, 0.110406])
345
346     return names, keys, times
347
348 """************************************
349 Name: thinking
350 Function: Makes a thinking movement.
351 ************************************"""
352 def thinking ():
353     names = list()
354     times = list()
355     keys = list()
356
357     names.append("HeadPitch")
358     times.append([0.72, 1.2, 3.16, 4.72, 5.2, 5.56, 7.12, 7.68,
            8.08, 10.96, 11.68, 12.2, 14.44])
359     keys.append([-0.113446, 0.224996, 0.200713, 0.240855,
            0.125664, -0.20886, -0.235619, -0.106465, 0.148448,
            0.18675, 0.0767945, 0.264581, 0.289725])
360
361     names.append("HeadYaw")
362     times.append([1.2, 4.72, 5.56, 7.12, 8.08, 10.96, 12.2,
            14.44])
363     keys.append([0.154895, 0.157081, -0.305068, -0.312414,
            0.269472, 0.286234, -0.124212, -0.1309])
```

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```
364
365     names.append("HipPitch")
366     times.append([1.08, 4.6, 5.44, 7, 7.96, 10.84, 12.08,
            14.32])
367     keys.append([-0.0599121, -0.0599156, -0.0599151, -0.0599156,
             -0.0599133, -0.0599156, 0.0059022, 0.00698132])
368
369     names.append("HipRoll")
370     times.append([1.08, 4.6, 5.44, 7, 7.96, 10.84, 12.08,
            14.32])
371     keys.append([-0.0558505, -0.0575959, -0.000865071, 0,
            -0.0542387, -0.0558505, -0.00089844, 0])
372
373     names.append("KneePitch")
374     times.append([1.08, 4.6, 5.44, 7, 7.96, 10.84, 12.08,
            14.32])
375     keys.append([-0.0499039, -0.0499079, -0.0499075, -0.0499079,
             -0.0499056, -0.0499079, -0.0499155, -0.0499084])
376
377     names.append("LAnklePitch")
378     times.append([1.08, 4.6, 5.44, 7, 7.96, 10.84, 12.08,
            14.32])
379     keys.append([0.121144, 0.122678, 0.12728, 0.12728, 0.093532,
             0.093532, 0.0628521, 0.0628521])
380
381     names.append("LAnkleRoll")
382     times.append([1.08, 4.6, 5.44, 7, 7.96, 10.84, 12.08,
            14.32])
383     keys.append([-0.00302602, -0.00302602, 0.062936, 0.06447,
            0.0521979, 0.0537319, 0.00310993, 0.00310993])
384
385     names.append("LElbowRoll")
386     times.append([0.64, 1.12, 4.64, 5.12, 5.48, 7.04, 7.6, 8,
            10.88, 11.6, 12.12, 14.36])
387     keys.append([-0.799361, -1.48487, -1.51669, -1.53414,
            -1.37739, -1.36485, -1.07861, -1.4818, -1.54462,
            -1.39277, -1.49101, -1.51717])
388
389     names.append("LElbowYaw")
390     times.append([0.64, 1.12, 4.64, 5.48, 7.04, 7.6, 8, 10.88,
            11.6, 12.12, 14.36])
391     keys.append([-1.40324, -0.955723, -0.909316, -1.54856,
            -1.55509, -0.720821, -0.474047, -0.474047, -0.303687,
            -0.713353, -0.736278])
392
393     names.append("LHand")
394     times.append([0.64, 1.12, 1.68, 2.08, 2.68, 3.08, 3.76,
            4.16, 4.64, 5.12, 5.48, 7.04, 7.6, 8, 10.88, 11.6, 12.12,
             14.36])
```

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```
395     keys.append([0.96, 0.7036, 0.44, 0.73, 0.44, 0.73, 0.44,
            0.73, 0.65, 0.52, 0.844074, 0.87, 0.61, 0.3188, 0.2956,
            0.69, 0.5032, 0.4932])
396
397     names.append("LHipPitch")
398     times.append([1.08, 4.6, 5.44, 7, 7.96, 10.84, 12.08,
            14.32])
399     keys.append([0.12583, 0.12583, 0.122762, 0.122762, 0.179519,
             0.179519, 0.266959, 0.266959])
400
401     names.append("LHipRoll")
402     times.append([1.08, 4.6, 5.44, 7, 7.96, 10.84, 12.08,
            14.32])
403     keys.append([-0.00609397, -0.00609397, -0.0674542,
            -0.0674542, -0.0475121, -0.0475121, 0.0107799,
            0.0107799])
404
405     names.append("LHipYawPitch")
406     times.append([1.08, 4.6, 5.44, 7, 7.96, 10.84, 12.08,
            14.32])
407     keys.append([-0.239262, -0.239262, -0.239262, -0.237728,
            -0.237728, -0.237728, -0.236194, -0.236194])
408
409     names.append("LKneePitch")
410     times.append([1.08, 4.6, 5.44, 7, 7.96, 10.84, 12.08,
            14.32])
411     keys.append([-0.090548, -0.0890141, -0.0923279, -0.0923279,
            -0.0890141, -0.0890141, -0.0890141, -0.0890141])
412
413     names.append("LShoulderPitch")
414     times.append([1.12, 4.64, 5.12, 5.48, 7.04, 8, 10.88, 12.12,
             14.36])
415     keys.append([-0.512397, -0.581195, 0.0994838, 0.44047,
            0.467748, 0.418739, 0.361981, 1.82235, 1.83624])
416
417     names.append("LShoulderRoll")
418     times.append([1.12, 4.64, 5.48, 7.04, 8, 10.88, 11.6, 12.12,
             14.36])
419     keys.append([0.328234, 0.342085, 0.233874, 0.233876,
            -0.217869, -0.243948, 0.804597, 0.530721, 0.536942])
420
421     names.append("LWristYaw")
422     times.append([0.64, 1.12, 4.64, 5.48, 7.04, 8, 10.88, 12.12,
             14.36])
423     keys.append([-0.895354, -0.833004, -0.862194, 0.0192082,
            0.0331606, -0.60904, -0.65506, -0.182588, -0.171766])
424
425     names.append("RAnklePitch")
426     times.append([1.08, 4.6, 5.44, 7, 7.96, 10.84, 12.08,
```

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```
        14.32])
427     keys.append([0.115092, 0.116626, 0.1335, 0.1335, 0.099752,
            0.099752, 0.0537319, 0.0552659])
428
429     names.append("RAnkleRoll")
430     times.append([1.08, 4.6, 5.44, 7, 7.96, 10.84, 12.08,
            14.32])
431     keys.append([-0.0183661, -0.0183661, 0.0353239, 0.0353239,
            0.030722, 0.030722, -0.00302602, -0.00302602])
432
433     names.append("RElbowRoll")
434     times.append([0.56, 1.04, 4.56, 5.04, 5.4, 6.96, 7.52, 7.92,
             10.8, 12.04, 14.28])
435     keys.append([0.574213, 0.382009, 0.361283, 0.375246,
            0.25889, 0.249582, 1.50273, 1.49109, 1.51717, 1.48495,
            1.51717])
436
437     names.append("RElbowYaw")
438     times.append([0.56, 1.04, 4.56, 5.4, 6.96, 7.92, 10.8,
            12.04, 14.28])
439     keys.append([1.47829, 1.23483, 1.2217, 1.2217, 1.2217,
            0.768491, 0.736278, 0.716335, 0.736278])
440
441     names.append("RHand")
442     times.append([0.56, 1.04, 4.56, 5.04, 5.4, 6.96, 7.52, 7.92,
             10.8, 12.04, 14.28])
443     keys.append([0.54, 0.3504, 0.33, 0.31, 0.412984, 0.43, 0.69,
             0.52, 0.4932, 0.508, 0.4932])
444
445     names.append("RHipPitch")
446     times.append([1.08, 4.6, 5.44, 7, 7.96, 10.84, 12.08,
            14.32])
447     keys.append([0.13495, 0.136484, 0.11961, 0.11961, 0.177901,
            0.179436, 0.277612, 0.276078])
448
449     names.append("RHipRoll")
450     times.append([1.08, 4.6, 5.44, 7, 7.96, 10.84, 12.08,
            14.32])
451     keys.append([0.0245859, 0.0245859, -0.0275701, -0.0275701,
            -0.0275701, -0.0275701, -0.00302602, -0.00302602])
452
453     names.append("RHipYawPitch")
454     times.append([1.08, 4.6, 5.44, 7, 7.96, 10.84, 12.08,
            14.32])
455     keys.append([-0.239262, -0.239262, -0.239262, -0.237728,
            -0.237728, -0.237728, -0.236194, -0.236194])
456
457     names.append("RKneePitch")
458     times.append([1.08, 4.6, 5.44, 7, 7.96, 10.84, 12.08,
```

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```
            14.32])
459         keys.append([-0.0923279, -0.0923279, -0.0923279, -0.0923279,
                -0.0923279, -0.0923279, -0.0923279, -0.0923279])
460
461         names.append("RShoulderPitch")
462         times.append([1.04, 4.56, 5.4, 6.96, 7.92, 10.8, 12.04,
                14.28])
463         keys.append([1.54785, 1.57, 1.43506, 1.43292, 1.8071,
                1.83624, 1.81476, 1.83624])
464
465         names.append("RShoulderRoll")
466         times.append([1.04, 4.56, 5.4, 6.96, 7.52, 7.92, 10.8,
                12.04, 14.28])
467         keys.append([-0.108956, -0.12, -0.119999, -0.12, -0.640536,
                -0.533873, -0.536942, -0.526205, -0.536942])
468
469         names.append("RWristYaw")
470         times.append([0.56, 1.04, 4.56, 5.4, 6.96, 7.92, 10.8,
                12.04, 14.28])
471         keys.append([0.497419, 0.030638, -0.0331613, -0.033162,
                -0.0331613, 0.145688, 0.171766, 0.176367, 0.171766])
472
473         return names, keys, times
474
475 """************************************
476 Name: disco
477 Function: Dances like if  it is in the
478           disco.
479 ************************************"""
480 def disco ():
481         names = list()
482         times = list()
483         keys = list()
484
485         names.append("HeadPitch")
486         times.append([1.64, 2.44, 3.36, 4.16, 5.04, 5.84, 6.76,
                7.56, 8.64, 9.44, 10.36, 11.16, 12, 12.8, 13.68, 14.48,
                15.8])
487         keys.append([-0.476475, 0.338594, -0.476475, 0.338594,
                -0.476475, 0.338594, -0.476475, 0.338594, -0.476475,
                0.338594, -0.476475, 0.338594, -0.476475, 0.338594,
                -0.476475, 0.338594, -0.17185])
488
489         names.append("HeadYaw")
490         times.append([1.64, 2.44, 3.36, 4.16, 5.04, 5.84, 6.76,
                7.56, 8.64, 9.44, 10.36, 11.16, 12, 12.8, 13.68, 14.48,
                15.8])
491         keys.append([-0.745256, 0.289725, -0.745256, 0.289725,
                -0.745256, 0.289725, -0.745256, 0.289725, 0.745256,
```

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```
        -0.289725, 0.745256, -0.289725, 0.745256, -0.289725,
        0.745256, -0.289725, 0.00916195])
492
493     names.append("LAnklePitch")
494     times.append([0.68, 1.56, 2.36, 3.28, 4.08, 4.96, 5.76,
        6.68, 7.48, 8.56, 9.36, 10.28, 11.08, 11.92, 12.72, 13.6,
         14.4, 15.72])
495     keys.append([-0.046062, 0.0444441, 0.161028, 0.0444441,
        0.161028, 0.0444441, 0.161028, 0.0444441, 0.161028,
        0.092082, 0.082878, 0.092082, 0.082878, 0.092082,
        0.082878, 0.092082, 0.082878, 0.0873961])
496
497     names.append("LAnkleRoll")
498     times.append([0.68, 1.56, 2.36, 3.28, 4.08, 4.96, 5.76,
        6.68, 7.48, 8.56, 9.36, 10.28, 11.08, 11.92, 12.72, 13.6,
         14.4, 15.72])
499     keys.append([-0.0183661, 0.062936, -0.248467, 0.062936,
        -0.248467, 0.062936, -0.248467, 0.062936, -0.248467,
        -0.26389, 0.0904641, -0.26389, 0.0904641, -0.26389,
        0.0904641, -0.26389, 0.0904641, -0.121144])
500
501     names.append("LElbowRoll")
502     times.append([0.8, 1.24, 1.64, 2.44, 3.36, 4.16, 5.04, 5.84,
         6.76, 7.56, 8.12, 8.72, 9.12, 9.52, 10, 10.44, 10.84,
        11.24, 11.72, 12.08, 12.48, 12.88, 13.36, 13.76, 14.16,
        14.56, 15.04, 15.88])
503     keys.append([-1.37289, -1.12923, -0.369652, -0.202446,
        -0.369652, -0.202446, -0.369652, -0.202446, -0.369652,
        -0.202446, -1.54462, -0.138102, -1.309, -0.257754,
        -1.4591, -0.138102, -1.309, -0.257754, -1.4591,
        -0.138102, -1.309, -0.257754, -1.4591, -0.138102, -1.309,
         -0.257754, -1.4591, -0.424876])
504
505     names.append("LElbowYaw")
506     times.append([0.8, 1.24, 1.64, 2.44, 3.36, 4.16, 5.04, 5.84,
         6.76, 7.56, 8.12, 8.72, 9.12, 9.52, 10, 10.44, 10.84,
        11.24, 11.72, 12.08, 12.48, 12.88, 13.36, 13.76, 14.16,
        14.56, 15.04, 15.88])
507     keys.append([-0.65506, -1.76453, -0.380475, -0.618244,
        -0.380475, -0.618244, -0.380475, -0.618244, -0.380475,
        -0.618244, -1.65632, 0.851412, 0.0750492, 0.00157596,
        0.460767, 0.851412, 0.0750492, 0.00157596, 0.460767,
        0.851412, 0.0750492, 0.00157596, 0.460767, 0.851412,
        0.0750492, 0.00157596, -0.682424, -1.21037])
508
509     names.append("LHand")
510     times.append([0.8, 1.24, 1.64, 2.44, 3.36, 4.16, 5.04, 5.84,
         6.76, 7.56, 8.12, 8.72, 9.12, 9.52, 10, 10.44, 10.84,
        11.24, 11.72, 12.08, 12.48, 12.88, 13.36, 13.76, 14.16,
```

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```
        14.56, 15.04, 15.88])
511     keys.append([0.2, 0.6, 0.2648, 0.264, 0.2648, 0.264, 0.2648,
            0.264, 0.2648, 0.264, 0.13, 0.678, 0.3, 0.6784, 0.3,
            0.678, 0.3, 0.6784, 0.3, 0.678, 0.3, 0.6784, 0.3, 0.678,
            0.3, 0.6784, 0.3, 0.2968])
512
513     names.append("LHipPitch")
514     times.append([0.68, 1.56, 2.36, 3.28, 4.08, 4.96, 5.76,
            6.68, 7.48, 8.56, 9.36, 10.28, 11.08, 11.92, 12.72, 13.6,
            14.4, 15.72])
515     keys.append([-0.153358, 0.185656, 0.147306, 0.185656,
            0.147306, 0.185656, 0.147306, 0.185656, 0.147306,
            0.101202, 0.259204, 0.101202, 0.259204, 0.101202,
            0.259204, 0.101202, 0.259204, 0.139636])
516
517     names.append("LHipRoll")
518     times.append([0.68, 1.56, 2.36, 3.28, 4.08, 4.96, 5.76,
            6.68, 7.48, 8.56, 9.36, 10.28, 11.08, 11.92, 12.72, 13.6,
            14.4, 15.72])
519     keys.append([0.00464395, -0.144154, 0.329852, -0.144154,
            0.329852, -0.144154, 0.329852, -0.144154, 0.329852,
            0.297554, -0.14117, 0.297554, -0.14117, 0.297554,
            -0.14117, 0.297554, -0.14117, 0.10282])
520
521     names.append("LHipYawPitch")
522     times.append([0.68, 1.56, 2.36, 3.28, 4.08, 4.96, 5.76,
            6.68, 7.48, 8.56, 9.36, 10.28, 11.08, 11.92, 12.72, 13.6,
            14.4, 15.72])
523     keys.append([-0.443284, -0.37272, -0.357381, -0.37272,
            -0.357381, -0.37272, -0.357381, -0.37272, -0.357381,
            -0.37272, -0.357381, -0.37272, -0.357381, -0.37272,
            -0.357381, -0.37272, -0.357381, -0.170232])
524
525     names.append("LKneePitch")
526     times.append([0.68, 1.56, 2.36, 3.28, 4.08, 4.96, 5.76,
            6.68, 7.48, 8.56, 9.36, 10.28, 11.08, 11.92, 12.72, 13.6,
            14.4, 15.72])
527     keys.append([0.404934, -0.090548, -0.0798099, -0.090548,
            -0.0798099, -0.090548, -0.0798099, -0.090548, -0.0798099,
            -0.0904641, -0.0904641, -0.0904641, -0.0904641,
            -0.0904641, -0.0904641, -0.0904641, -0.0904641,
            -0.0782759])
528
529     names.append("LShoulderPitch")
530     times.append([0.8, 1.64, 2.44, 3.36, 4.16, 5.04, 5.84, 6.76,
            7.56, 8.12, 8.72, 9.52, 10.44, 11.24, 12.08, 12.88,
            13.76, 14.56, 15.36, 15.88])
531     keys.append([0.639635, 1.74718, 1.85611, 1.74718, 1.85611,
            1.74718, 1.85611, 1.74718, 1.85611, 1.21475, -1.19188,
```

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```
        0.995607, -1.19188, 0.995607, -1.19188, 0.995607,
        -1.19188, 0.995607, 1.06465, 1.47106])
532
533     names.append("LShoulderRoll")
534     times.append([0.8, 1.64, 2.44, 3.36, 4.16, 5.04, 5.84, 6.76,
         7.56, 8.12, 8.72, 9.12, 9.52, 10, 10.44, 10.84, 11.24,
        11.72, 12.08, 12.48, 12.88, 13.36, 13.76, 14.16, 14.56,
        15.04, 15.88])
535     keys.append([0.340507, 0.24233, 0.196309, 0.24233, 0.196309,
         0.24233, 0.196309, 0.24233, 0.196309, 0.165806,
        0.328317, 0.595157, -0.314159, 0.595157, 0.328317,
        0.595157, -0.314159, 0.595157, 0.328317, 0.595157,
        -0.314159, 0.595157, 0.328317, 0.595157, -0.314159,
        0.595157, 0.153358])
536
537     names.append("LWristYaw")
538     times.append([0.8, 1.24, 1.64, 2.44, 3.36, 4.16, 5.04, 5.84,
         6.76, 7.56, 8.72, 9.52, 10.44, 11.24, 12.08, 12.88,
        13.76, 14.56, 15.88])
539     keys.append([0.11961, -1.45037, -0.395814, -0.420357,
        -0.395814, -0.420357, -0.395814, -0.420357, -0.395814,
        -0.420357, -0.107338, -0.400331, -0.107338, -0.400331,
        -0.107338, -0.400331, -0.107338, -0.400331, 0.0827939])
540
541     names.append("RAnklePitch")
542     times.append([0.68, 1.56, 2.36, 3.28, 4.08, 4.96, 5.76,
        6.68, 7.48, 8.56, 9.36, 10.28, 11.08, 11.92, 12.72, 13.6,
         14.4, 15.72])
543     keys.append([-0.052114, 0.092082, 0.082878, 0.092082,
        0.082878, 0.092082, 0.082878, 0.092082, 0.082878,
        0.0444441, 0.161028, 0.0444441, 0.161028, 0.0444441,
        0.161028, 0.0444441, 0.161028, 0.093616])
544
545     names.append("RAnkleRoll")
546     times.append([0.68, 1.56, 2.36, 3.28, 4.08, 4.96, 5.76,
        6.68, 7.48, 8.56, 9.36, 10.28, 11.08, 11.92, 12.72, 13.6,
         14.4, 15.72])
547     keys.append([0.0966839, 0.26389, -0.0904641, 0.26389,
        -0.0904641, 0.26389, -0.0904641, 0.26389, -0.0904641,
        -0.062936, 0.248467, -0.062936, 0.248467, -0.062936,
        0.248467, -0.062936, 0.248467, 0.119694])
548
549     names.append("RElbowRoll")
550     times.append([0.88, 1.32, 1.72, 2.12, 2.52, 3, 3.44, 3.84,
        4.24, 4.72, 5.12, 5.52, 5.92, 6.4, 6.84, 7.24, 7.64,
        8.12, 8.64, 9.44, 10.36, 11.16, 12, 12.8, 13.68, 14.48,
        15.08, 15.4, 15.8])
551     keys.append([1.34689, 1.1205, 0.138102, 1.309, 0.257754,
        1.4591, 0.138102, 1.309, 0.257754, 1.4591, 0.138102,
```

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        1.309, 0.257754, 1.4591, 0.138102, 1.309, 0.257754,
        1.54462, 0.369652, 0.202446, 0.369652, 0.202446,
        0.369652, 0.202446, 0.369652, 0.202446, 0.82205,
        0.886627, 0.429562])
552
553     names.append("RElbowYaw")
554     times.append([0.88, 1.32, 1.72, 2.12, 2.52, 3, 3.44, 3.84,
        4.24, 4.72, 5.12, 5.52, 5.92, 6.4, 6.84, 7.24, 7.64,
        8.12, 8.64, 9.44, 10.36, 11.16, 12, 12.8, 13.68, 14.48,
        15.08, 15.4, 15.8])
555     keys.append([0.59515, 0.567232, -0.851412, -0.0750492,
        -0.00157596, -0.460767, -0.851412, -0.0750492,
        -0.00157596, -0.460767, -0.851412, -0.0750492,
        -0.00157596, -0.460767, -0.851412, -0.0750492,
        -0.00157596, 1.65632, 0.380475, 0.618244, 0.380475,
        0.618244, 0.380475, 0.618244, 0.380475, 0.618244,
        1.57952, 1.03323, 1.21028])
556
557     names.append("RHand")
558     times.append([0.88, 1.32, 1.72, 2.12, 2.52, 3, 3.44, 3.84,
        4.24, 4.72, 5.12, 5.52, 5.92, 6.4, 6.84, 7.24, 7.64,
        8.12, 8.64, 9.44, 10.36, 11.16, 12, 12.8, 13.68, 14.48,
        15.4, 15.8])
559     keys.append([0.2, 0.5, 0.678, 0.3, 0.6784, 0.3, 0.678, 0.3,
        0.6784, 0.3, 0.678, 0.3, 0.6784, 0.3, 0.678, 0.3, 0.6784,
         0.13, 0.2648, 0.264, 0.2648, 0.264, 0.2648, 0.264,
        0.2648, 0.264, 0.24, 0.2976])
560
561     names.append("RHipPitch")
562     times.append([0.68, 1.56, 2.36, 3.28, 4.08, 4.96, 5.76,
        6.68, 7.48, 8.56, 9.36, 10.28, 11.08, 11.92, 12.72, 13.6,
         14.4, 15.72])
563     keys.append([-0.177985, 0.101202, 0.259204, 0.101202,
        0.259204, 0.101202, 0.259204, 0.101202, 0.259204,
        0.185656, 0.147306, 0.185656, 0.147306, 0.185656,
        0.147306, 0.185656, 0.147306, 0.131882])
564
565     names.append("RHipRoll")
566     times.append([0.68, 1.56, 2.36, 3.28, 4.08, 4.96, 5.76,
        6.68, 7.48, 8.56, 9.36, 10.28, 11.08, 11.92, 12.72, 13.6,
         14.4, 15.72])
567     keys.append([-0.11961, -0.297554, 0.14117, -0.297554,
        0.14117, -0.297554, 0.14117, -0.297554, 0.14117,
        0.144154, -0.329852, 0.144154, -0.329852, 0.144154,
        -0.329852, 0.144154, -0.329852, -0.0966001])
568
569     names.append("RHipYawPitch")
570     times.append([1.56, 3.28, 4.96, 6.68, 8.56, 10.28, 11.92,
        13.6, 15.72])
```

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571     keys.append([-0.37272, -0.37272, -0.37272, -0.37272,
            -0.37272, -0.37272, -0.37272, -0.37272, -0.170232])
572
573     names.append("RKneePitch")
574     times.append([0.68, 1.56, 2.36, 3.28, 4.08, 4.96, 5.76,
            6.68, 7.48, 8.56, 9.36, 10.28, 11.08, 11.92, 12.72, 13.6,
             14.4, 15.72])
575     keys.append([0.426494, -0.0904641, -0.0904641, -0.0904641,
            -0.0904641, -0.0904641, -0.0904641, -0.0904641,
            -0.0904641, -0.090548, -0.0798099, -0.090548, -0.0798099,
             -0.090548, -0.0798099, -0.090548, -0.0798099,
            -0.091998])
576
577     names.append("RShoulderPitch")
578     times.append([0.88, 1.72, 2.52, 3.44, 4.24, 5.12, 5.92,
            6.84, 7.64, 8.12, 8.64, 9.44, 10.36, 11.16, 12, 12.8,
            13.68, 14.48, 15.4, 15.8])
579     keys.append([0.915841, -1.19188, 0.995607, -1.19188,
            0.995607, -1.19188, 0.995607, -1.19188, 0.995607,
            1.21475, 1.74718, 1.85611, 1.74718, 1.85611, 1.74718,
            1.85611, 1.74718, 1.85611, 1.18508, 1.47268])
580
581     names.append("RShoulderRoll")
582     times.append([0.88, 1.32, 1.72, 2.12, 2.52, 3, 3.44, 3.84,
            4.24, 4.72, 5.12, 5.52, 5.92, 6.4, 6.84, 7.24, 7.64,
            8.12, 8.64, 9.44, 10.36, 11.16, 12, 12.8, 13.68, 14.48,
            15.08, 15.8])
583     keys.append([-0.266959, -0.670206, -0.328317, -0.595157,
            0.314159, -0.595157, -0.328317, -0.595157, 0.314159,
            -0.595157, -0.328317, -0.595157, 0.314159, -0.595157,
            -0.328317, -0.595157, 0.314159, -0.165806, -0.24233,
            -0.196309, -0.24233, -0.196309, -0.24233, -0.196309,
            -0.24233, -0.196309, -0.455531, -0.16418])
584
585     names.append("RWristYaw")
586     times.append([0.88, 1.32, 1.72, 2.52, 3.44, 4.24, 5.12,
            5.92, 6.84, 7.64, 8.64, 9.44, 10.36, 11.16, 12, 12.8,
            13.68, 14.48, 15.8])
587     keys.append([-0.401949, 1.39277, 0.107338, 0.400331,
            0.107338, 0.400331, 0.107338, 0.400331, 0.107338,
            0.400331, 0.395814, 0.420357, 0.395814, 0.420357,
            0.395814, 0.420357, 0.395814, 0.420357, 0.108872])
588
589     return names, keys, times
590
591 """*********************************
592 Name: headbang
593 Function: Dances like a headbang.
594 *********************************"""
```

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```
595 def headbang():
596     names = list()
597     times = list()
598     keys = list()
599 
600     names.append("HeadPitch")
601     times.append([0.6, 1.16, 1.88, 2.44, 3.12, 3.64, 4.2, 4.92,
            5.56, 6.24, 6.88, 7.6, 8.24, 8.92, 9.28, 9.6, 9.96,
            10.28, 10.56, 10.84, 11.12, 11.48, 12.04, 12.48])
602     keys.append([-0.214801, 0.217786, -0.312978, 0.205514,
            -0.309909, 0.185572, -0.185656, 0.315962, -0.242414,
            0.21932, -0.34826, 0.236194, -0.320648, 0.259876,
            -0.392432, 0.230731, -0.363768, 0.1451, -0.310897,
            0.113427, -0.138207, 0.201243, 0.153801, -0.177985])
603 
604     names.append("HeadYaw")
605     times.append([0.6, 1.16, 1.88, 2.44, 3.12, 3.64, 4.2, 4.92,
            5.56, 6.24, 6.88, 7.6, 8.24, 8.92, 9.28, 9.6, 9.96,
            10.28, 10.56, 10.84, 11.12, 11.48, 12.48])
606     keys.append([-0.0859459, -0.0798099, -0.067538, -0.0966839,
            -0.055266, -0.030722, -0.021518, -0.058334, -0.019984,
            -0.0445279, -0.0568, -0.0690719, -0.10282, -0.194861,
            -0.165714, -0.075208, -0.012314, -4.19617e-05, -0.032256,
             -0.0429939, -0.055266, 0.032172, -0.00157596])
607 
608     names.append("LAnklePitch")
609     times.append([1.04, 1.76, 3, 4.08, 5.44, 6.12, 7.48, 8.8,
            10.16, 11.24, 12.56])
610     keys.append([0.138018, 0.0475121, 0.041376, 0.12728,
            0.0475121, 0.016832, 0.016832, -0.242414, -0.242414,
            -0.242414, 0.067454])
611 
612     names.append("LAnkleRoll")
613     times.append([1.04, 1.76, 3, 4.08, 5.44, 6.12, 7.48, 8.8,
            10.16, 11.24, 12.56])
614     keys.append([-0.0966, -0.148756, -0.15029, -0.13495,
            -0.136484, -0.147222, -0.148756, -0.162562, -0.162562,
            -0.162562, -0.110406])
615 
616     names.append("LElbowRoll")
617     times.append([0.52, 1.08, 1.8, 2.36, 3.04, 3.56, 4.12, 4.84,
             5.48, 6.16, 6.8, 7.52, 8.16, 8.84, 9.52, 10.2, 10.76,
            11.4, 12.4])
618     keys.append([-0.731675, -0.521518, -0.519984, -0.631966,
            -0.547595, -0.555266, -0.993989, -1.54623, -1.35448,
            -0.699462, -1.54623, -0.506179, -1.54776, -1.0216,
            -1.15199, -1.20261, -0.937231, -1.25784, -0.590548])
619 
620     names.append("LElbowYaw")
```

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```
621     times.append([0.52, 1.08, 1.8, 2.36, 3.04, 3.56, 4.12, 4.84,
            5.48, 6.16, 6.8, 7.52, 8.16, 8.84, 9.52, 10.2, 10.76,
            11.4, 12.4])
622     keys.append([-1.07691, -1.54171, -1.71505, -1.79329,
            -1.81937, -1.66443, -1.76875, -1.2165, -0.86982,
            -0.589097, -1.39752, -0.490923, -1.19656, -1.16128,
            -0.940383, -0.934249, -0.903567, -0.791585, -1.2165])
623
624     names.append("LHand")
625     times.append([1.08, 1.8, 3.04, 4.12, 5.48, 6.16, 7.52, 8.84,
            9.52, 10.2, 11.4, 12.4])
626     keys.append([0.230571, 0.230935, 0.230935, 0.224389,
            0.618182, 0.743636, 0.715296, 0.688387, 0.6992, 0.6992,
            0.684, 0.232025])
627
628     names.append("LHipPitch")
629     times.append([1.04, 1.76, 3, 4.08, 5.44, 6.12, 7.48, 8.8,
            10.16, 11.24, 12.56])
630     keys.append([0.0261199, 0.205598, 0.204064, 0.0982179,
            -0.161028, 0.021518, -0.288349, -0.805309, -0.805309,
            -0.805309, 0.211735])
631
632     names.append("LHipRoll")
633     times.append([1.04, 1.76, 3, 4.08, 5.44, 6.12, 7.48, 8.8,
            10.16, 11.24, 12.56])
634     keys.append([0.073674, 0.154976, 0.153442, 0.124296,
            0.105888, 0.14117, 0.138102, 0.090548, 0.090548,
            0.090548, 0.121228])
635
636     names.append("LHipYawPitch")
637     times.append([1.04, 1.76, 3, 4.08, 5.44, 6.12, 7.48, 8.8,
            10.16, 11.24, 12.56])
638     keys.append([-0.214717, -0.223922, -0.233125, -0.256136,
            -0.355846, -0.305225, -0.355846, -0.463226, -0.463226,
            -0.463226, -0.14262])
639
640     names.append("LKneePitch")
641     times.append([1.04, 1.76, 3, 4.08, 5.44, 6.12, 7.48, 8.8,
            10.16, 11.24, 12.56])
642     keys.append([-0.0923279, -0.0874799, -0.090548, -0.0923279,
            0.154892, 0.110406, 0.332836, 0.998592, 0.998592,
            0.998592, -0.092082])
643
644     names.append("LShoulderPitch")
645     times.append([0.52, 1.08, 1.8, 2.36, 3.04, 3.56, 4.12, 4.84,
            5.48, 6.16, 6.8, 7.52, 8.16, 8.84, 9.52, 10.2, 10.76,
            11.4, 12.4])
646     keys.append([1.54776, 1.6981, 1.69043, 1.57998, 1.67509,
            1.60759, 1.84382, 0.493905, -0.909704, -0.719487,
```

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```
        -0.411154, -0.955723, 0.34971, 1.41124, 1.33914, 1.43885,
         1.52015, 1.37289, 1.59685])
647
648     names.append("LShoulderRoll")
649     times.append([0.52, 1.08, 1.8, 2.36, 3.04, 3.56, 4.12, 4.84,
         5.48, 6.16, 6.8, 7.52, 8.16, 8.84, 9.52, 10.2, 10.76,
        11.4, 12.4])
650     keys.append([0.116542, 0.171766, 0.174835, 0.11961,
        0.122678, 0.11194, 0.128814, 0.421808, 0.59515, 0.423342,
         1.12438, 0.193243, 0.461692, 0.368118, 0.412605,
        0.415673, 0.363515, 0.412605, 0.174835])
651
652     names.append("LWristYaw")
653     times.append([1.08, 1.8, 3.04, 4.12, 5.48, 6.16, 7.52, 8.84,
         9.52, 10.2, 11.4, 12.4])
654     keys.append([0.095066, 0.0966, 0.095066, 0.0889301,
        0.575959, 0.314159, 0.31903, 0.282215, -0.276162,
        -0.188724, 0.0429101, 0.116542])
655
656     names.append("RAnklePitch")
657     times.append([1.04, 1.76, 3, 4.08, 5.44, 6.12, 7.48, 8.8,
        10.16, 11.24, 12.56])
658     keys.append([0.145772, 0.0568, 0.055266, 0.14117, 0.046062,
        0.0261199, 0.012314, -0.223922, -0.223922, -0.223922,
        0.0767419])
659
660     names.append("RAnkleRoll")
661     times.append([1.04, 1.76, 3, 4.08, 5.44, 6.12, 7.48, 8.8,
        10.16, 11.24, 12.56])
662     keys.append([0.06447, 0.073674, 0.0782759, 0.0874799,
        0.066004, 0.092082, 0.10282, 0.090548, 0.090548,
        0.090548, 0.066004])
663
664     names.append("RElbowRoll")
665     times.append([0.44, 1, 1.72, 2.28, 2.96, 3.48, 4.04, 4.76,
        5.4, 6.08, 6.72, 7.44, 8.08, 8.76, 9.44, 10.12, 10.68,
        11.32, 12.32])
666     keys.append([1.55245, 0.994073, 1.51103, 0.879025, 1.56207,
        1.04009, 1.56207, 0.579894, 1.37604, 0.607505, 1.45734,
        0.605971, 1.54938, 0.676537, 0.89283, 1.00174, 0.797722,
        1.1352, 0.440299])
667
668     names.append("RElbowYaw")
669     times.append([0.44, 1, 1.72, 2.28, 2.96, 3.48, 4.04, 4.76,
        5.4, 6.08, 6.72, 7.44, 8.08, 8.76, 9.44, 10.12, 10.68,
        11.32, 12.32])
670     keys.append([1.4005, 0.179436, 0.547595, 0.187106, 0.5568,
        0.323633, 0.546063, 0.20398, 0.447886, 0.262272,
        0.671851, 0.357381, 1.62907, 0.093532, 0.450955,
```

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```
        0.466294, 0.513848, 0.639635, 1.17347])

    names.append("RHand")
    times.append([1, 1.72, 2.96, 4.04, 5.4, 6.08, 7.44, 8.76,
        9.44, 10.12, 11.32, 12.32])
    keys.append([0.745455, 0.514873, 0.514873, 0.781818,
        0.787273, 0.7, 0.818182, 0.514873, 0.6944, 0.7988,
        0.5424, 0.410207])

    names.append("RHipPitch")
    times.append([1.04, 1.76, 3, 4.08, 5.44, 6.12, 7.48, 8.8,
        10.16, 11.24, 12.56])
    keys.append([0.00456004, 0.213183, 0.213183, 0.0797261,
        -0.139636, -0.00771196, -0.233209, -0.799256, -0.799256,
        -0.799256, 0.193243])

    names.append("RHipRoll")
    times.append([1.04, 1.76, 3, 4.08, 5.44, 6.12, 7.48, 8.8,
        10.16, 11.24, 12.56])
    keys.append([-0.05058, -0.0643861, -0.0643861, -0.076658,
        -0.016832, -0.078192, -0.0459781, 0.00924586, 0.00924586,
         0.00924586, -0.0735901])

    names.append("RKneePitch")
    times.append([1.04, 1.76, 3, 4.08, 5.44, 6.12, 7.48, 8.8,
        10.16, 11.24, 12.56])
    keys.append([-0.0923279, -0.0923279, -0.0923279, -0.0923279,
         0.130432, 0.113558, 0.274628, 0.960325, 0.960325,
        0.960325, -0.076658])

    names.append("RShoulderPitch")
    times.append([0.44, 1, 1.72, 2.28, 2.96, 3.48, 4.04, 4.76,
        5.4, 6.08, 6.72, 7.44, 8.08, 8.76, 9.44, 10.12, 10.68,
        11.32, 12.32])
    keys.append([0.744032, -0.808375, -1.13052, -0.777696,
        -0.780764, -0.84826, -0.858999, -1.12898, -1.13512,
        -0.880473, -1.01086, -0.970981, 0.158044, 0.320648,
        1.05083, 1.16281, 1.22878, 1.23798, 1.48342])

    names.append("RShoulderRoll")
    times.append([0.44, 1, 1.72, 2.28, 2.96, 3.48, 4.04, 4.76,
        5.4, 6.08, 6.72, 7.44, 8.08, 8.76, 9.44, 10.12, 10.68,
        11.32, 12.32])
    keys.append([-0.0614019, -0.602903, -1.28553, -0.546147,
        -1.30548, -0.527739, -1.40365, -0.230143, -1.01555,
        -0.38661, -1.34843, -0.326783, -0.900499, -0.205598,
        -0.362067, -0.415757, -0.351328, -0.37127, -0.122762])

    names.append("RWristYaw")
```

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```
697     times.append([1, 1.72, 2.96, 4.04, 5.4, 6.08, 7.44, 8.76,
            9.44, 10.12, 11.32, 12.32])
698     keys.append([-0.122173, -0.119694, -0.119694, -0.130432,
            -0.138102, -0.139636, -0.145772, -0.22554, 0.662646,
            0.529187, 0.0873961, 0.161028])
699
700     return names, keys, times
701
702 """**********************************
703 Name: mystical
704 Function: It does a mystical movement.
705 **********************************"""
706 def mystical():
707     names = list()
708     times = list()
709     keys = list()
710
711     names.append("HeadPitch")
712     times.append([1.36, 3.28, 4.64, 6.12, 7.12, 7.96])
713     keys.append([0.265341, -0.543078, -0.650458, -0.671952,
            -0.436332, -0.2102])
714
715     names.append("HeadYaw")
716     times.append([1.36, 3.28, 4.64, 6.12, 7.96])
717     keys.append([-0.036858, -0.039926, -0.0598679, -0.055266,
            -0.019984])
718
719     names.append("LAnklePitch")
720     times.append([3.16, 4.52, 6, 7.84])
721     keys.append([0.030638, -0.019984, -0.016916, 0.0720561])
722
723     names.append("LAnkleRoll")
724     times.append([3.16, 4.52, 6, 7.84])
725     keys.append([-0.15029, -0.1733, -0.170232, -0.107338])
726
727     names.append("LElbowRoll")
728     times.append([1.28, 3.2, 4.56, 6.04, 7.04, 7.88])
729     keys.append([-0.38806, -0.538392, -0.931096, -0.829852,
            -1.39626, -0.420274])
730
731     names.append("LElbowYaw")
732     times.append([1.28, 2.32, 3.2, 4.56, 6.04, 7.88])
733     keys.append([-1.97583, -0.872665, -1.72272, -1.30854,
            -1.31008, -1.16128])
734
735     names.append("LHand")
736     times.append([3.2, 4.56, 6.04, 7.88])
737     keys.append([0.598182, 0.872727, 0.875296, 0.3008])
738
```

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```
739     names.append("LHipPitch")
740     times.append([3.16, 4.52, 6, 7.84])
741     keys.append([0.403483, 0.47865, 0.480184, 0.204064])
742
743     names.append("LHipRoll")
744     times.append([3.16, 4.52, 6, 7.84])
745     keys.append([0.199461, 0.236277, 0.237812, 0.112024])
746
747     names.append("LHipYawPitch")
748     times.append([3.16, 4.52, 6, 7.84])
749     keys.append([-0.380389, -0.355846, -0.36505, -0.161028])
750
751     names.append("LKneePitch")
752     times.append([3.16, 4.52, 6, 7.84])
753     keys.append([-0.0923461, -0.0923461, -0.082878, -0.090548])
754
755     names.append("LShoulderPitch")
756     times.append([1.28, 3.2, 4.56, 6.04, 7.88])
757     keys.append([1.45112, -0.624379, -0.68574, -0.710284,
            1.50788])
758
759     names.append("LShoulderRoll")
760     times.append([1.28, 2.32, 3.2, 4.56, 6.04, 7.88])
761     keys.append([0.342041, 1.01229, 0.590548, 0.320565,
            0.282215, 0.084328])
762
763     names.append("LWristYaw")
764     times.append([3.2, 4.56, 6.04, 7.04, 7.88])
765     keys.append([-0.261799, -1.01229, -1.15192, -1.15192,
            0.128814])
766
767     names.append("RAnklePitch")
768     times.append([3.16, 4.52, 6, 7.84])
769     keys.append([0.00617796, -0.0459781, -0.0275701, 0.06447])
770
771     names.append("RAnkleRoll")
772     times.append([3.16, 4.52, 6, 7.84])
773     keys.append([0.090548, 0.101286, 0.101286, 0.066004])
774
775     names.append("RElbowRoll")
776     times.append([1.2, 3.12, 4.48, 5.96, 6.96, 7.8])
777     keys.append([0.449504, 0.495523, 0.872888, 0.704148,
            1.36136, 0.437231])
778
779     names.append("RElbowYaw")
780     times.append([1.2, 2.24, 3.12, 4.48, 5.96, 7.8])
781     keys.append([2.0856, 0.750492, 1.38669, 1.21949, 1.22716,
            1.15506])
782
```

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```
783     names.append("RHand")
784     times.append([3.12, 4.48, 5.96, 7.8])
785     keys.append([0.650909, 0.854545, 0.852024, 0.3016])
786
787     names.append("RHipPitch")
788     times.append([3.16, 4.52, 6, 7.84])
789     keys.append([0.44175, 0.485624, 0.484702, 0.187106])
790
791     names.append("RHipRoll")
792     times.append([3.16, 4.52, 6, 7.84])
793     keys.append([-0.130348, -0.144154, -0.151824, -0.068988])
794
795     names.append("RKneePitch")
796     times.append([3.16, 4.52, 6, 7.84])
797     keys.append([-0.103083, -0.0966, -0.0904641, -0.0735901])
798
799     names.append("RShoulderPitch")
800     times.append([1.2, 3.12, 4.48, 5.96, 7.8])
801     keys.append([1.43126, -0.705598, -0.710201, -0.808375,
            1.52637])
802
803     names.append("RShoulderRoll")
804     times.append([1.2, 2.24, 3.12, 4.48, 5.96, 7.8])
805     keys.append([-0.362067, -1.15192, -0.745566, -0.322183,
            -0.26389, -0.081344])
806
807     names.append("RWristYaw")
808     times.append([3.12, 4.48, 5.96, 6.96, 7.8])
809     keys.append([0.436332, 1.01229, 1.00933, 1.11701, 0.1733])
810
811     return names, keys, times
812
813 """**********************************
814 Name: takePicture
815 Function: It simulates that it takes a
816           picture.
817 **********************************"""
818 def takePicture ():
819     names = list()
820     times = list()
821     keys = list()
822
823     names.append("HeadPitch")
824     times.append([0.52, 1, 1.8, 2.4, 3.16, 3.8])
825     keys.append([0.118682, -0.0568, -0.136136, -0.0982179,
            0.0890118, -0.174919])
826
827     names.append("HeadYaw")
828     times.append([1, 1.8, 2.4, 3.8])
```

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```
829     keys.append([-0.0429939, -0.04913, -0.0521979, -0.019984])
830
831     names.append("LAnklePitch")
832     times.append([0.44, 0.92, 2.36, 2.72, 3.2, 3.84])
833     keys.append([0.0858622, 0.0689882, 0.0733038, 0.0733038,
            0.0858622, 0.0981341])
834
835     names.append("LAnkleRoll")
836     times.append([0.44, 0.92, 2.36, 2.72, 3.2, 3.84])
837     keys.append([-0.128814, -0.151824, -0.116542, -0.116542,
            -0.128814, -0.115008])
838
839     names.append("LElbowRoll")
840     times.append([0.44, 0.92, 1.72, 2.16, 2.56, 3.12, 3.72])
841     keys.append([-0.940732, -1.54462, -1.54462, -1.54462,
            -1.53242, -1.4207, -0.444818])
842
843     names.append("LElbowYaw")
844     times.append([0.92, 1.72, 2.16, 2.56, 3.72])
845     keys.append([-0.679603, -0.475581, -0.466378, -0.461776,
            -1.16742])
846
847     names.append("LHand")
848     times.append([0.44, 0.92, 1.72, 2.16, 2.28, 2.4, 2.56,
            3.72])
849     keys.append([1, 1, 1, 0.9096, 0.45, 0.91, 0.9092, 0.3024])
850
851     names.append("LHipPitch")
852     times.append([0.44, 0.92, 2.36, 2.72, 3.2, 3.84])
853     keys.append([-0.303691, 0.176453, 0.179519, 0.179519,
            -0.303691, 0.136568])
854
855     names.append("LHipRoll")
856     times.append([0.44, 0.92, 2.36, 2.72, 3.2, 3.84])
857     keys.append([0.0966839, 0.159578, 0.121228, 0.121228,
            0.0966839, 0.115092])
858
859     names.append("LHipYawPitch")
860     times.append([0.44, 0.92, 2.36, 2.72, 3.2, 3.84])
861     keys.append([-0.239262, -0.174835, -0.171766, -0.171766,
            -0.239262, -0.171766])
862
863     names.append("LKneePitch")
864     times.append([0.44, 0.92, 2.36, 2.72, 3.2, 3.84])
865     keys.append([0.246933, -0.0828778, -0.0923279, -0.0923279,
            0.246933, -0.090548])
866
867     names.append("LShoulderPitch")
868     times.append([0.92, 1.72, 2.16, 2.56, 3.72])
```

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```
869     keys.append([-0.262356, -0.357464, -0.285367, -0.27923,
            1.50635])
870
871     names.append("LShoulderRoll")
872     times.append([0.44, 0.92, 1.72, 2.16, 2.56, 3.72])
873     keys.append([0.654498, 0.291418, 0.699462, 0.747017,
            0.728609, 0.116542])
874
875     names.append("LWristYaw")
876     times.append([0.44, 0.92, 1.72, 2.16, 2.56, 3.72])
877     keys.append([-1.16064, -0.521602, -0.702614, -0.684206,
            -0.690342, 0.130348])
878
879     names.append("RAnklePitch")
880     times.append([0.44, 0.92, 2.36, 2.72, 3.2, 3.84])
881     keys.append([0.14884, 0.073674, 0.0733038, 0.0733038,
            0.14884, 0.099752])
882
883     names.append("RAnkleRoll")
884     times.append([0.44, 0.92, 2.36, 2.72, 3.2, 3.84])
885     keys.append([0.11049, 0.0874801, 0.081344, 0.081344,
            0.11049, 0.0767419])
886
887     names.append("RElbowRoll")
888     times.append([0.36, 0.84, 1.64, 2.16, 2.56, 3.12, 3.64])
889     keys.append([1.03673, 1.54462, 1.54462, 1.54462, 1.53251,
            1.43466, 0.418823])
890
891     names.append("RElbowYaw")
892     times.append([0.84, 1.64, 2.16, 2.56, 3.64])
893     keys.append([0.656511, 0.467829, 0.498508, 0.475497,
            1.15353])
894
895     names.append("RHand")
896     times.append([0.36, 0.84, 1.64, 2.16, 2.28, 2.4, 2.56,
            3.64])
897     keys.append([1, 0.9004, 0.9012, 0.8996, 0.37, 0.9, 0.9004,
            0.3052])
898
899     names.append("RHipPitch")
900     times.append([0.44, 0.92, 2.36, 2.72, 3.2, 3.84])
901     keys.append([-0.265424, 0.174835, 0.179436, 0.179436,
            -0.265424, 0.133416])
902
903     names.append("RHipRoll")
904     times.append([0.44, 0.92, 2.36, 2.72, 3.2, 3.84])
905     keys.append([-0.061318, -0.05058, -0.075124, -0.075124,
            -0.061318, -0.06592])
906
```

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```
907         names.append("RHipYawPitch")
908         times.append([0.44, 0.92, 3.2])
909         keys.append([-0.239262, -0.174835, -0.239262])
910 
911         names.append("RKneePitch")
912         times.append([0.44, 0.92, 2.36, 2.72, 3.2, 3.84])
913         keys.append([0.142704, -0.0904641, -0.0904641, -0.0904641,
                0.142704, -0.091998])
914 
915         names.append("RShoulderPitch")
916         times.append([0.84, 1.64, 2.16, 2.56, 3.64])
917         keys.append([-0.251533, -0.358915, -0.291418, -0.285283,
                1.5049])
918 
919         names.append("RShoulderRoll")
920         times.append([0.36, 0.84, 1.64, 2.16, 2.56, 3.64])
921         keys.append([-0.640536, -0.420357, -0.785451, -0.767043,
                -0.763974, -0.127364])
922 
923         names.append("RWristYaw")
924         times.append([0.36, 0.84, 1.64, 2.16, 2.56, 3.64])
925         keys.append([0.994838, 0.547595, 0.751617, 0.736278,
                0.736278, 0.177901])
926 
927         return names, keys, times
928 
929 """**********************************
930 Name: saxophone
931 Function: It simulates that it plays a
932           saxophone.
933 **********************************"""
934 def saxophone ():
935         names = list()
936         times = list()
937         keys = list()
938 
939         names.append("HeadPitch")
940         times.append([0.4, 0.88, 1.12, 1.36, 1.6, 1.84, 2.08, 2.32,
                2.56, 2.8, 3.04, 3.28, 3.52, 3.76, 4, 4.24, 4.48, 4.72,
                4.96, 5.2, 5.44, 5.68, 5.92, 6.16, 6.4, 6.64, 6.88, 7.12,
                 7.36, 7.6, 7.84, 8.08, 8.36, 9.84])
941         keys.append([-0.523136, -0.303464, -0.0301958, -0.303464,
                -0.0301958, -0.303464, -0.0301958, -0.303464, -0.0301958,
                 -0.303464, -0.0301958, -0.303464, -0.0301958, -0.303464,
                 -0.0301958, -0.303464, -0.0301958, -0.303464,
                -0.0301958, -0.303464, -0.0301958, -0.303464, -0.0301958,
                 -0.303464, -0.0301958, -0.303464, -0.0301958, -0.303464,
                 -0.0301958, -0.303464, -0.0301958, -0.303464,
                -0.0301958, -0.190258])
```

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```
942
943     names.append("HeadYaw")
944     times.append([0.4, 0.88, 1.12, 1.36, 1.6, 1.84, 2.08, 2.32,
            2.56, 2.8, 3.04, 3.28, 3.52, 3.76, 4, 4.24, 4.48, 4.72,
            4.96, 5.2, 5.44, 5.68, 5.92, 6.16, 6.4, 6.64, 6.88, 7.12,
             7.36, 7.6, 7.84, 8.08, 8.36, 9.84])
945     keys.append([-0.128898, -0.186771, -0.186771, -0.186771,
            -0.186771, -0.186771, -0.186771, -0.186771, -0.186771,
            -0.186771, -0.186771, -0.186771, -0.186771, -0.186771,
            -0.186771, -0.186771, -0.186771, -0.186771, -0.186771,
            -0.186771, -0.186771, -0.186771, -0.186771, -0.186771,
            -0.186771, -0.186771, -0.186771, -0.186771, -0.186771,
            -0.186771, -0.186771, -0.186771, -0.186771, -0.0123138])
946
947     names.append("LAnklePitch")
948     times.append([0.4, 0.88, 1.12, 1.36, 1.6, 1.84, 2.08, 2.32,
            2.56, 2.8, 3.04, 3.28, 3.52, 3.76, 4, 4.48, 4.96, 5.2,
            5.44, 5.68, 5.92, 6.16, 6.4, 6.64, 6.88, 7.12, 7.36, 7.6,
             7.84, 8.08, 8.36, 9.16, 9.84])
949     keys.append([-0.128898, -0.331386, -0.365133, -0.331386,
            -0.365133, -0.331386, -0.365133, -0.331386, -0.365133,
            -0.331386, -0.365133, -0.331386, -0.365133, -0.331386,
            -0.365133, -0.145772, 0.400415, 0.276162, 0.400415,
            0.276162, 0.400415, 0.276162, 0.400415, 0.276162,
            0.400415, 0.276162, 0.400415, 0.276162, 0.400415,
            0.276162, 0.400415, -0.128898, 0.0996681])
950
951     names.append("LAnkleRoll")
952     times.append([0.4, 0.88, 1.12, 1.36, 1.6, 1.84, 2.08, 2.32,
            2.56, 2.8, 3.04, 3.28, 3.52, 3.76, 4, 4.48, 4.96, 5.2,
            5.44, 5.68, 5.92, 6.16, 6.4, 6.64, 6.88, 7.12, 7.36, 7.6,
             7.84, 8.08, 8.36, 9.16, 9.84])
953     keys.append([-0.0904641, 0.130432, 0.0261199, 0.130432,
            0.0261199, 0.130432, 0.0261199, 0.130432, 0.0261199,
            0.130432, 0.0261199, 0.130432, 0.0261199, 0.130432,
            0.0261199, -0.239262, -0.331386, -0.342125, -0.331386,
            -0.342125, -0.331386, -0.342125, -0.331386, -0.342125,
            -0.331386, -0.342125, -0.331386, -0.342125, -0.331386,
            -0.342125, -0.331386, -0.0904641, -0.128814])
954
955     names.append("LElbowRoll")
956     times.append([0.4, 0.88, 1.12, 1.36, 1.6, 1.84, 2.08, 2.32,
            2.56, 2.8, 3.04, 3.28, 3.52, 3.76, 4, 4.24, 4.48, 4.72,
            4.96, 5.2, 5.44, 5.68, 5.92, 6.16, 6.4, 6.64, 6.88, 7.12,
             7.36, 7.6, 7.84, 8.08, 8.36, 9.84])
957     keys.append([-1.17193, -1.2051, -1.2051, -1.2051, -1.2051,
            -1.2051, -1.2051, -1.2051, -1.2051, -1.2051, -1.2051,
            -1.2051, -1.2051, -1.2051, -1.2051, -1.2051, -1.2051,
            -1.2051, -1.2051, -1.2051, -1.2051, -1.2051, -1.2051,
```

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```
            -1.2051, -1.2051, -1.2051, -1.2051, -1.2051, -1.2051,
            -1.2051, -1.2051, -1.2051, -1.2051, -0.437147])
958
959         names.append("LElbowYaw")
960         times.append([0.4, 0.88, 1.12, 1.36, 1.6, 1.84, 2.08, 2.32,
                2.56, 2.8, 3.04, 3.28, 3.52, 3.76, 4, 4.24, 4.48, 4.72,
                4.96, 5.2, 5.44, 5.68, 5.92, 6.16, 6.4, 6.64, 6.88, 7.12,
                 7.36, 7.6, 7.84, 8.08, 8.36, 9.84])
961         keys.append([-1.15821, -0.46639, -0.265904, -0.46639,
                -0.265904, -0.46639, -0.265904, -0.46639, -0.265904,
                -0.46639, -0.265904, -0.46639, -0.265904, -0.46639,
                -0.265904, -0.46639, -0.265904, -0.46639, -0.265904,
                -0.46639, -0.265904, -0.46639, -0.265904, -0.46639,
                -0.265904, -0.46639, -0.265904, -0.46639, -0.265904,
                -0.46639, -0.265904, -0.46639, -0.265904, -1.15975])
962
963         names.append("LHand")
964         times.append([0.4, 0.88, 1.12, 1.36, 1.6, 1.84, 2.08, 2.32,
                2.56, 2.8, 3.04, 3.28, 3.52, 3.76, 4, 4.24, 4.48, 4.72,
                4.96, 5.2, 5.44, 5.68, 5.92, 6.16, 6.4, 6.64, 6.88, 7.12,
                 7.36, 7.6, 7.84, 8.08, 8.36, 9.84])
965         keys.append([0.8, 0.41, 0.2, 0.41, 0.2, 0.41, 0.2, 0.41,
                0.2, 0.41, 0.2, 0.41, 0.2, 0.41, 0.2, 0.41, 0.2, 0.41,
                0.2, 0.41, 0.2, 0.41, 0.2, 0.41, 0.2, 0.41, 0.2, 0.41,
                0.2, 0.41, 0.2, 0.41, 0.2, 0.3136])
966
967         names.append("LHipPitch")
968         times.append([0.4, 0.88, 1.12, 1.36, 1.6, 1.84, 2.08, 2.32,
                2.56, 2.8, 3.04, 3.28, 3.52, 3.76, 4, 4.48, 4.96, 5.2,
                5.44, 5.68, 5.92, 6.16, 6.4, 6.64, 6.88, 7.12, 7.36, 7.6,
                 7.84, 8.08, 8.36, 9.16, 9.84])
969         keys.append([-0.473963, 0.06447, 0.153442, 0.06447,
                0.153442, 0.06447, 0.153442, 0.06447, 0.153442, 0.06447,
                0.153442, 0.06447, 0.153442, 0.06447, 0.153442,
                -0.562937, 0.0199001, 0.230057, 0.0199001, 0.230057,
                0.0199001, 0.230057, 0.0199001, 0.230057, 0.0199001,
                0.230057, 0.0199001, 0.230057, 0.0199001, 0.230057,
                0.0199001, -0.473963, 0.139636])
970
971         names.append("LHipRoll")
972         times.append([0.4, 0.88, 1.12, 1.36, 1.6, 1.84, 2.08, 2.32,
                2.56, 2.8, 3.04, 3.28, 3.52, 3.76, 4, 4.48, 4.96, 5.2,
                5.44, 5.68, 5.92, 6.16, 6.4, 6.64, 6.88, 7.12, 7.36, 7.6,
                 7.84, 8.08, 8.36, 9.16, 9.84])
973         keys.append([0.0706061, -0.182504, -0.0183661, -0.182504,
                -0.0183661, -0.182504, -0.0183661, -0.182504, -0.0183661,
                 -0.182504, -0.0183661, -0.182504, -0.0183661, -0.182504,
                 -0.0183661, 0.25622, 0.449421, 0.449421, 0.449421,
                0.449421, 0.449421, 0.449421, 0.449421, 0.449421,
```

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```
        0.449421, 0.449421, 0.449421, 0.449421, 0.449421,
        0.449421, 0.449421, 0.0706061, 0.116626])
974
975     names.append("LHipYawPitch")
976     times.append([0.4, 0.88, 1.12, 1.36, 1.6, 1.84, 2.08, 2.32,
        2.56, 2.8, 3.04, 3.28, 3.52, 3.76, 4, 4.48, 4.96, 5.2,
        5.44, 5.68, 5.92, 6.16, 6.4, 6.64, 6.88, 7.12, 7.36, 7.6,
         7.84, 8.08, 8.36, 9.16, 9.84])
977     keys.append([-0.223922, -0.516916, -0.472429, -0.516916,
        -0.472429, -0.516916, -0.472429, -0.516916, -0.472429,
        -0.516916, -0.472429, -0.516916, -0.472429, -0.516916,
        -0.472429, -0.239262, -0.516916, -0.472429, -0.516916,
        -0.472429, -0.516916, -0.472429, -0.516916, -0.472429,
        -0.516916, -0.472429, -0.516916, -0.472429, -0.516916,
        -0.472429, -0.516916, -0.223922, -0.168698])
978
979     names.append("LKneePitch")
980     times.append([0.4, 0.88, 1.12, 1.36, 1.6, 1.84, 2.08, 2.32,
        2.56, 2.8, 3.04, 3.28, 3.52, 3.76, 4, 4.48, 4.96, 5.2,
        5.44, 5.68, 5.92, 6.16, 6.4, 6.64, 6.88, 7.12, 7.36, 7.6,
         7.84, 8.08, 8.36, 9.16, 9.84])
981     keys.append([0.582879, 0.638103, 0.635035, 0.638103,
        0.635035, 0.638103, 0.635035, 0.638103, 0.635035,
        0.638103, 0.635035, 0.638103, 0.635035, 0.638103,
        0.635035, 0.659577, -0.0904641, -0.0904641, -0.0904641,
        -0.0904641, -0.0904641, -0.0904641, -0.0904641,
        -0.0904641, -0.0904641, -0.0904641, -0.0904641,
        -0.0904641, -0.0904641, -0.0904641, -0.0904641, 0.582879,
         -0.0874801])
982
983     names.append("LShoulderPitch")
984     times.append([0.4, 0.88, 1.12, 1.36, 1.6, 1.84, 2.08, 2.32,
        2.56, 2.8, 3.04, 3.28, 3.52, 3.76, 4, 4.24, 4.48, 4.72,
        4.96, 5.2, 5.44, 5.68, 5.92, 6.16, 6.4, 6.64, 6.88, 7.12,
         7.36, 7.6, 7.84, 8.08, 8.36, 9.84])
985     keys.append([0.458624, -0.0182518, 0.268927, -0.0182518,
        0.268927, -0.0182518, 0.268927, -0.0182518, 0.268927,
        -0.0182518, 0.268927, -0.0182518, 0.268927, -0.0182518,
        0.268927, -0.0182518, 0.268927, -0.0182518, 0.268927,
        -0.0182518, 0.268927, -0.0182518, 0.268927, -0.0182518,
        0.268927, -0.0182518, 0.268927, -0.0182518, 0.268927,
        -0.0182518, 0.268927, -0.0182518, 0.268927, 1.44192])
986
987     names.append("LShoulderRoll")
988     times.append([0.4, 0.88, 1.12, 1.36, 1.6, 1.84, 2.08, 2.32,
        2.56, 2.8, 3.04, 3.28, 3.52, 3.76, 4, 4.24, 4.48, 4.72,
        4.96, 5.2, 5.44, 5.68, 5.92, 6.16, 6.4, 6.64, 6.88, 7.12,
         7.36, 7.6, 7.84, 8.08, 8.36, 9.84])
989     keys.append([0.291418, -0.0940347, -0.0940347, -0.0940347,
```

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```
            -0.0940347, -0.0940347, -0.0940347, -0.0940347,
            -0.0940347, -0.0940347, -0.0940347, -0.0940347,
            -0.0940347, -0.0940347, -0.0940347, -0.0940347,
            -0.0940347, -0.0940347, -0.0940347, -0.0940347,
            -0.0940347, -0.0940347, -0.0940347, -0.0940347,
            -0.0940347, -0.0940347, -0.0940347, -0.0940347,
            -0.0940347, -0.0940347, -0.0940347, -0.0940347,
            -0.0940347, 0.0996681])

        names.append("LWristYaw")
        times.append([0.4, 0.88, 1.12, 1.36, 1.6, 1.84, 2.08, 2.32,
            2.56, 2.8, 3.04, 3.28, 3.52, 3.76, 4, 4.24, 4.48, 4.72,
            4.96, 5.2, 5.44, 5.68, 5.92, 6.16, 6.4, 6.64, 6.88, 7.12,
             7.36, 7.6, 7.84, 8.08, 8.36, 9.84])
        keys.append([-1.22571, -1.15957, -1.15957, -1.15957,
            -1.15957, -1.15957, -1.15957, -1.15957, -1.15957,
            -1.15957, -1.15957, -1.15957, -1.15957, -1.15957,
            -1.15957, -1.15957, -1.15957, -1.15957, -1.15957,
            -1.15957, -1.15957, -1.15957, -1.15957, -1.15957,
            -1.15957, -1.15957, -1.15957, -1.15957, -1.15957,
            -1.15957, -1.15957, -1.15957, -1.15957, 0.061318])

        names.append("RAnklePitch")
        times.append([0.4, 0.88, 1.12, 1.36, 1.6, 1.84, 2.08, 2.32,
            2.56, 2.8, 3.04, 3.28, 3.52, 3.76, 4, 4.48, 4.96, 5.2,
            5.44, 5.68, 5.92, 6.16, 6.4, 6.64, 6.88, 7.12, 7.36, 7.6,
             7.84, 8.08, 8.36, 9.16, 9.84])
        keys.append([-0.0966001, 0.400415, 0.276162, 0.400415,
            0.276162, 0.400415, 0.276162, 0.400415, 0.276162,
            0.400415, 0.276162, 0.400415, 0.276162, 0.400415,
            0.276162, -0.141086, -0.331386, -0.365133, -0.331386,
            -0.365133, -0.331386, -0.365133, -0.331386, -0.365133,
            -0.331386, -0.365133, -0.331386, -0.365133, -0.331386,
            -0.365133, -0.331386, -0.0966001, 0.104354])

        names.append("RAnkleRoll")
        times.append([0.4, 0.88, 1.12, 1.36, 1.6, 1.84, 2.08, 2.32,
            2.56, 2.8, 3.04, 3.28, 3.52, 3.76, 4, 4.48, 4.96, 5.2,
            5.44, 5.68, 5.92, 6.16, 6.4, 6.64, 6.88, 7.12, 7.36, 7.6,
             7.84, 8.08, 8.36, 9.16, 9.84])
        keys.append([0.108956, 0.331386, 0.342125, 0.331386,
            0.342125, 0.331386, 0.342125, 0.331386, 0.342125,
            0.331386, 0.342125, 0.331386, 0.342125, 0.331386,
            0.342125, 0.188724, -0.130432, -0.0261199, -0.130432,
            -0.0261199, -0.130432, -0.0261199, -0.130432, -0.0261199,
             -0.130432, -0.0261199, -0.130432, -0.0261199, -0.130432,
             -0.0261199, -0.130432, 0.108956, 0.122762])

        names.append("RElbowRoll")
```

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```
    times.append([0.4, 0.88, 1.12, 1.36, 1.6, 1.84, 2.08, 2.32,
        2.56, 2.8, 3.04, 3.28, 3.52, 3.76, 4, 4.24, 4.48, 4.72,
        4.96, 5.2, 5.44, 5.68, 5.92, 6.16, 6.4, 6.64, 6.88, 7.12,
         7.36, 7.6, 7.84, 8.08, 8.36, 9.84])
    keys.append([1.24718, 1.36621, 1.17461, 1.36621, 1.17461,
        1.36621, 1.17461, 1.36621, 1.17461, 1.36621, 1.17461,
        1.36621, 1.17461, 1.36621, 1.17461, 1.36621, 1.17461,
        1.36621, 1.17461, 1.36621, 1.17461, 1.36621, 1.17461,
        1.36621, 1.17461, 1.36621, 1.17461, 1.36621, 1.17461,
        1.36621, 1.17461, 1.36621, 1.17461, 0.444902])

    names.append("RElbowYaw")
    times.append([0.4, 0.88, 1.12, 1.36, 1.6, 1.84, 2.08, 2.32,
        2.56, 2.8, 3.04, 3.28, 3.52, 3.76, 4, 4.24, 4.48, 4.72,
        4.96, 5.2, 5.44, 5.68, 5.92, 6.16, 6.4, 6.64, 6.88, 7.12,
         7.36, 7.6, 7.84, 8.08, 8.36, 9.84])
    keys.append([1.19801, 1.24397, 1.24397, 1.24397, 1.24397,
        1.24397, 1.24397, 1.24397, 1.24397, 1.24397, 1.24397,
        1.24397, 1.24397, 1.24397, 1.24397, 1.24397, 1.24397,
        1.24397, 1.24397, 1.24397, 1.24397, 1.24397, 1.24397,
        1.24397, 1.24397, 1.24397, 1.24397, 1.24397, 1.24397,
        1.24397, 1.24397, 1.24397, 1.24397, 1.20261])

    names.append("RHand")
    times.append([0.4, 0.88, 1.12, 1.36, 1.6, 1.84, 2.08, 2.32,
        2.56, 2.8, 3.04, 3.28, 3.52, 3.76, 4, 4.24, 4.48, 4.72,
        4.96, 5.2, 5.44, 5.68, 5.92, 6.16, 6.4, 6.64, 6.88, 7.12,
         7.36, 7.6, 7.84, 8.08, 8.36, 9.84])
    keys.append([0.8, 0.54, 0.66, 0.54, 0.66, 0.54, 0.66, 0.54,
        0.66, 0.54, 0.66, 0.54, 0.66, 0.54, 0.66, 0.54, 0.66,
        0.54, 0.66, 0.54, 0.66, 0.54, 0.66, 0.54, 0.66, 0.54,
        0.66, 0.54, 0.66, 0.54, 0.66, 0.3096])

    names.append("RHipPitch")
    times.append([0.4, 0.88, 1.12, 1.36, 1.6, 1.84, 2.08, 2.32,
        2.56, 2.8, 3.04, 3.28, 3.52, 3.76, 4, 4.48, 4.96, 5.2,
        5.44, 5.68, 5.92, 6.16, 6.4, 6.64, 6.88, 7.12, 7.36, 7.6,
         7.84, 8.08, 8.36, 9.16, 9.84])
    keys.append([-0.490923, 0.0199001, 0.230057, 0.0199001,
        0.230057, 0.0199001, 0.230057, 0.0199001, 0.230057,
        0.0199001, 0.230057, 0.0199001, 0.230057, 0.0199001,
        0.230057, -0.521602, 0.06447, 0.153442, 0.06447,
        0.153442, 0.06447, 0.153442, 0.06447, 0.153442, 0.06447,
        0.153442, 0.06447, 0.153442, 0.06447, 0.153442, 0.06447,
        -0.490923, 0.13495])

    names.append("RHipRoll")
    times.append([0.4, 0.88, 1.12, 1.36, 1.6, 1.84, 2.08, 2.32,
        2.56, 2.8, 3.04, 3.28, 3.52, 3.76, 4, 4.48, 4.96, 5.2,
```

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```
        5.44, 5.68, 5.92, 6.16, 6.4, 6.64, 6.88, 7.12, 7.36, 7.6,
         7.84, 8.08, 8.36, 9.16, 9.84])
    keys.append([-0.0674542, -0.449421, -0.449421, -0.449421,
        -0.449421, -0.449421, -0.449421, -0.449421, -0.449421,
        -0.449421, -0.449421, -0.449421, -0.449421, -0.449421,
        -0.449421, -0.139552, 0.182504, 0.0183661, 0.182504,
        0.0183661, 0.182504, 0.0183661, 0.182504, 0.0183661,
        0.182504, 0.0183661, 0.182504, 0.0183661, 0.182504,
        0.0183661, 0.182504, -0.0674542, -0.101202])

    names.append("RHipYawPitch")
    times.append([0.4, 0.88, 1.12, 1.36, 1.6, 1.84, 2.08, 2.32,
        2.56, 2.8, 3.04, 3.28, 3.52, 3.76, 4, 4.48, 4.96, 5.2,
        5.44, 5.68, 5.92, 6.16, 6.4, 6.64, 6.88, 7.12, 7.36, 7.6,
         7.84, 8.08, 8.36, 9.16, 9.84])
    keys.append([-0.223922, -0.516916, -0.472429, -0.516916,
        -0.472429, -0.516916, -0.472429, -0.516916, -0.472429,
        -0.516916, -0.472429, -0.516916, -0.472429, -0.516916,
        -0.472429, -0.239262, -0.516916, -0.472429, -0.516916,
        -0.472429, -0.516916, -0.472429, -0.516916, -0.472429,
        -0.516916, -0.472429, -0.516916, -0.472429, -0.516916,
        -0.472429, -0.516916, -0.223922, -0.168698])

    names.append("RKneePitch")
    times.append([0.4, 0.88, 1.12, 1.36, 1.6, 1.84, 2.08, 2.32,
        2.56, 2.8, 3.04, 3.28, 3.52, 3.76, 4, 4.48, 4.96, 5.2,
        5.44, 5.68, 5.92, 6.16, 6.4, 6.64, 6.88, 7.12, 7.36, 7.6,
         7.84, 8.08, 8.36, 9.16, 9.84])
    keys.append([0.536942, -0.0904641, -0.0904641, -0.0904641,
        -0.0904641, -0.0904641, -0.0904641, -0.0904641,
        -0.0904641, -0.0904641, -0.0904641, -0.0904641,
        -0.0904641, -0.0904641, -0.0904641, 0.628982, 0.638103,
        0.635035, 0.638103, 0.635035, 0.638103, 0.635035,
        0.638103, 0.635035, 0.638103, 0.635035, 0.638103,
        0.635035, 0.638103, 0.635035, 0.638103, 0.536942,
        -0.091998])

    names.append("RShoulderPitch")
    times.append([0.4, 0.88, 1.12, 1.36, 1.6, 1.84, 2.08, 2.32,
        2.56, 2.8, 3.04, 3.28, 3.52, 3.76, 4, 4.24, 4.48, 4.72,
        4.96, 5.2, 5.44, 5.68, 5.92, 6.16, 6.4, 6.64, 6.88, 7.12,
         7.36, 7.6, 7.84, 8.08, 8.36, 9.84])
    keys.append([1.1352, 1.16093, 1.36032, 1.16093, 1.36032,
        1.16093, 1.36032, 1.16093, 1.36032, 1.16093, 1.36032,
        1.16093, 1.36032, 1.16093, 1.36032, 1.16093, 1.36032,
        1.16093, 1.36032, 1.16093, 1.36032, 1.16093, 1.36032,
        1.16093, 1.36032, 1.16093, 1.36032, 1.16093, 1.36032,
        1.16093, 1.36032, 1.16093, 1.36032, 1.47422])
```

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```
1035        names.append("RShoulderRoll")
1036        times.append([0.4, 0.88, 1.12, 1.36, 1.6, 1.84, 2.08, 2.32,
                2.56, 2.8, 3.04, 3.28, 3.52, 3.76, 4, 4.24, 4.48, 4.72,
                4.96, 5.2, 5.44, 5.68, 5.92, 6.16, 6.4, 6.64, 6.88, 7.12,
                 7.36, 7.6, 7.84, 8.08, 8.36, 9.84])
1037        keys.append([-0.196393, 0.0915661, 0.0915661, 0.0915661,
                0.0915661, 0.0915661, 0.0915661, 0.0915661, 0.0915661,
                0.0915661, 0.0915661, 0.0915661, 0.0915661, 0.0915661,
                0.0915661, 0.0915661, 0.0915661, 0.0915661, 0.0915661,
                0.0915661, 0.0915661, 0.0915661, 0.0915661, 0.0915661,
                0.0915661, 0.0915661, 0.0915661, 0.0915661, 0.0915661,
                0.0915661, 0.0915661, 0.0915661, 0.0915661, -0.115092])
1038
1039        names.append("RWristYaw")
1040        times.append([0.4, 0.88, 1.12, 1.36, 1.6, 1.84, 2.08, 2.32,
                2.56, 2.8, 3.04, 3.28, 3.52, 3.76, 4, 4.24, 4.48, 4.72,
                4.96, 5.2, 5.44, 5.68, 5.92, 6.16, 6.4, 6.64, 6.88, 7.12,
                 7.36, 7.6, 7.84, 8.08, 8.36, 9.84])
1041        keys.append([0.720938, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
                0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
                0, 0.0889301])
1042
1043        return names, keys, times
1044
1045    """*********************************
1046    Name: guitar
1047    Function: It simulates that it plays a
1048              guitar.
1049    *********************************"""
1050    def guitar():
1051        names = list()
1052        times = list()
1053        keys = list()
1054
1055        names.append("HeadPitch")
1056        times.append([0.96, 1.48, 1.92, 2.92, 3.36, 3.6, 4, 4.32,
                4.72, 5, 5.52, 5.96, 6.32, 6.76, 7.04, 8.4, 8.72, 9.24,
                9.64, 10.4, 10.72, 11.12])
1057        keys.append([0.131882, -0.00924597, 0.266875, -0.261302,
                0.164096, -0.201476, 0.208583, 0.0551821, -0.235939,
                0.0959881, 0.241821, -0.164114, -0.227008, 0.0745118,
                0.18496, -0.276198, 0.11818, -0.113492, 0.150393, 0,
                -0.125678, -0.169665])
1058
1059        names.append("HeadYaw")
1060        times.append([0.96, 1.48, 2.6, 2.92, 3.6, 4.32, 4.72, 5,
                5.52, 5.96, 6.32, 6.76, 7.44, 8.72, 9.64, 10.72, 11.12])
1061        keys.append([0.256136, 0.237728, 0.130348, 0.010696,
                0.033706, 0.309826, 0.300622, 0.374254, 0.355168,
```

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```
        0.230059, 0.226991, 0.266875, 0.260738, -0.114583,
        -0.00310997, 0, 0.000342193])

    names.append("LAnklePitch")
    times.append([0.84, 2.08, 2.8, 3.48, 4.2, 4.88, 5.4, 6.2,
        6.92, 7.84, 8.6, 9.52, 11.12])
    keys.append([0.15796, 0.184038, 0.208583, 0.191709,
        0.230059, 0.20398, 0.148756, 0.148756, 0.131882,
        0.030638, 0.024502, 0.1733, 0.0994511])

    names.append("LAnkleRoll")
    times.append([0.84, 2.08, 2.8, 3.48, 4.2, 4.88, 5.4, 6.2,
        6.92, 7.84, 8.6, 9.52, 11.12])
    keys.append([-0.285283, -0.231591, -0.276078, -0.289883,
        -0.338973, -0.397761, -0.397761, -0.397761, -0.397761,
        -0.187106, 0.122762, 0.0261199, -0.12954])

    names.append("LElbowRoll")
    times.append([0.44, 0.88, 1.4, 1.84, 2.52, 3.28, 3.52, 3.92,
         4.24, 4.64, 4.92, 5.44, 5.88, 6.24, 6.68, 6.96, 7.36,
        7.88, 8.32, 8.64, 9.16, 9.56, 9.92, 10.72, 11.12])
    keys.append([-0.645772, -1.20261, -1.19341, -1.25477,
        -1.45879, -1.34681, -1.34834, -1.34221, -1.33454,
        -1.23483, -1.4051, -1.45879, -1.44038, -1.36215,
        -1.46033, -1.4005, -1.4051, -1.28392, -1.30999, -1.31306,
         -1.25017, -1.2379, -1.21182, -0.469324, -0.416334])

    names.append("LElbowYaw")
    times.append([0.44, 0.88, 1.4, 1.84, 2.52, 3.28, 3.52, 3.92,
         4.24, 4.64, 4.92, 5.44, 5.88, 6.24, 6.68, 6.96, 7.36,
        7.88, 8.32, 8.64, 9.16, 9.56, 9.92, 10.4, 10.72, 11.12])
    keys.append([-1.58825, -2.0372, -1.91986, -1.94822,
        -1.61381, -1.79636, -1.81476, -1.60307, -1.63529,
        -1.78561, -1.63835, -1.61841, -1.52791, -1.57239,
        -1.33002, -1.38524, -1.23645, -1.37757, -1.49416,
        -1.51257, -1.34076, -1.47422, -1.48802, -1.18857,
        -1.19865, -1.18985])

    names.append("LHand")
    times.append([0.44, 0.88, 1.4, 1.84, 3.52, 3.92, 4.24, 4.92,
         5.44, 5.88, 6.24, 6.68, 6.96, 7.88, 8.32, 8.64, 9.16,
        9.56, 10.72, 11.12])
    keys.append([0.636364, 0.345455, 0.254545, 0.381818,
        0.366571, 0.0909091, 0.127273, 0.218182, 0.343298,
        0.254545, 0.332753, 0.127273, 0.127273, 0.254545,
        0.127273, 0.0909091, 0.176364, 0.0909091, 0.299693,
        0.299693])

    names.append("LHipPitch")
```

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```
1084        times.append([0.84, 2.08, 2.8, 3.48, 4.2, 4.88, 5.4, 6.2,
                6.92, 7.84, 8.6, 9.52, 11.12])
1085        keys.append([0.197927, 0.147306, 0.090548, 0.0245859,
                0.00157596, 0.00617796, 0.16418, 0.165714, 0.151908,
                0.31758, 0.300706, 0.04913, 0.122859])
1086
1087        names.append("LHipRoll")
1088        times.append([0.84, 2.08, 2.8, 3.48, 4.2, 4.88, 5.4, 6.2,
                6.92, 7.84, 8.6, 9.52, 11.12])
1089        keys.append([0.382007, 0.29457, 0.35593, 0.306841, 0.395814,
                 0.675003, 0.483252, 0.483252, 0.546147, 0.214801,
                -0.253067, -0.085862, 0.0993253])
1090
1091        names.append("LHipYawPitch")
1092        times.append([0.84, 2.08, 2.8, 3.48, 4.2, 4.88, 5.4, 6.2,
                6.92, 7.84, 8.6, 9.52, 11.12])
1093        keys.append([-0.328234, -0.342041, -0.363515, -0.332836,
                -0.323633, -0.184038, -0.177901, -0.1733, -0.153358,
                -0.214717, -0.223922, -0.248467, -0.17012])
1094
1095        names.append("LKneePitch")
1096        times.append([0.84, 2.08, 2.8, 3.48, 4.2, 4.88, 5.4, 6.2,
                6.92, 7.84, 8.6, 9.52, 11.12])
1097        keys.append([-0.0923279, -0.092082, -0.0923279, -0.0923279,
                -0.0923279, -0.090548, -0.0923279, -0.092082, -0.0923279,
                 -0.0874799, -0.0245859, -0.021518, -0.0898759])
1098
1099        names.append("LShoulderPitch")
1100        times.append([0.88, 1.4, 1.84, 2.52, 3.28, 3.52, 3.92, 4.24,
                 4.64, 4.92, 5.44, 5.88, 6.24, 6.68, 6.96, 7.36, 7.88,
                8.32, 8.64, 9.16, 9.56, 9.92, 10.72, 11.12])
1101        keys.append([1.29619, 1.25017, 1.15659, 1.22256, 1.23943,
                1.21489, 1.18421, 1.17347, 1.30079, 1.32073, 1.34374,
                1.37135, 1.41124, 1.38209, 1.37749, 1.39283, 1.29465,
                1.35141, 1.3284, 1.23483, 1.27164, 1.25937, 1.4416,
                1.47183])
1102
1103        names.append("LShoulderRoll")
1104        times.append([0.88, 1.4, 1.84, 2.52, 3.28, 3.52, 3.92, 4.24,
                 4.64, 4.92, 5.44, 5.88, 6.24, 6.68, 6.96, 7.36, 7.88,
                8.32, 8.64, 9.16, 9.56, 9.92, 10.72, 11.12])
1105        keys.append([0.519984, 0.513848, 0.483168, 0.461692,
                0.845191, 0.901949, 0.564471, 0.567537, 1.02927, 0.97865,
                 0.984786, 0.760822, 0.897349, 0.826783, 0.828318,
                0.638103, 0.639635, 0.891212, 0.803775, 0.395731,
                0.44175, 0.455555, 0.229996, 0.178631])
1106
1107        names.append("LWristYaw")
1108        times.append([0.44, 0.88, 1.4, 1.84, 2.52, 3.28, 3.52, 4.24,
```

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```
        4.64, 4.92, 5.44, 6.24, 6.96, 7.88, 8.64, 9.56, 10.72,
        11.12])
1109    keys.append([-1.25664, -1.39626, -1.51844, -1.44862,
        -1.50098, -1.74533, -1.81514, -1.42206, -1.81514,
        -1.81629, -1.8238, -1.8238, -1.75495, -1.71966, -1.81937,
         -1.53711, 0.0509231, 0.0975074])
1110
1111    names.append("RAnklePitch")
1112    times.append([0.84, 2.08, 2.8, 3.48, 4.2, 4.88, 5.4, 6.2,
        6.92, 7.84, 8.6, 9.52, 11.12])
1113    keys.append([0.00617796, 0.021518, 0.00310997, -0.06592,
        -0.15029, -0.363515, -0.317496, -0.315962, -0.052114,
        0.090548, 0.038392, 0.184122, 0.0914011])
1114
1115    names.append("RAnkleRoll")
1116    times.append([0.84, 2.08, 2.8, 3.48, 4.2, 4.88, 5.4, 6.2,
        6.92, 7.84, 8.6, 9.52, 11.12])
1117    keys.append([0.00924597, 0.04913, 0.00157596, 0.0598679,
        -0.016832, -0.030638, -0.0459781, -0.0459781, 0.0598679,
        0.112024, 0.392746, 0.247016, 0.130506])
1118
1119    names.append("RElbowRoll")
1120    times.append([0.8, 1.32, 1.76, 2.04, 2.44, 2.76, 3.2, 3.44,
        3.84, 4.16, 4.56, 4.84, 5.36, 5.8, 6.16, 6.4, 6.6, 6.88,
        7.28, 7.8, 8.24, 8.56, 8.84, 9.08, 9.48, 9.88, 10.72,
        11.12])
1121    keys.append([1.46194, 1.53097, 1.14594, 1.39752, 1.24565,
        1.09685, 0.954191, 0.954191, 1.29781, 1.15975, 1.40979,
        0.929646, 0.779314, 1.46501, 1.12907, 1.54462, 1.18276,
        1.48189, 1.03703, 0.848343, 1.48342, 1.15208, 1.45581,
        1.04316, 1.48649, 0.862151, 0.429827, 0.413425])
1122
1123    names.append("RElbowYaw")
1124    times.append([0.8, 1.32, 1.76, 2.04, 2.44, 2.76, 3.2, 3.44,
        3.84, 4.16, 4.56, 4.84, 5.36, 5.8, 6.16, 6.4, 6.6, 6.88,
        7.28, 7.8, 8.24, 8.56, 8.84, 9.08, 9.48, 9.88, 10.4,
        10.72, 11.12])
1125    keys.append([0.742414, 0.895815, 0.122678, 0.477032,
        0.418739, 0.0996681, -0.0614019, -0.06447, 0.449421,
        0.0199001, 0.860533, 0.00609404, 0.138018, 0.627364,
        0.154892, 0.71787, 0.153358, 0.58748, 0.236194, 0.233125,
         0.613558, 0.249999, 0.694859, -0.013848, 0.46476,
        0.0827941, 1.18857, 1.19191, 1.18392])
1126
1127    names.append("RHand")
1128    times.append([0.8, 1.32, 1.76, 2.04, 2.44, 3.2, 3.44, 3.84,
        4.16, 4.56, 4.84, 5.36, 6.16, 6.4, 6.6, 6.88, 7.28, 7.8,
        8.24, 8.56, 8.84, 9.08, 9.48, 9.88, 10.72, 11.12])
1129    keys.append([0.454545, 0.45348, 0.672727, 0.287273,
```

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```
            0.381818, 0.690909, 0.654545, 0.305455, 0.418182,
            0.345455, 0.654545, 0.749091, 0.469091, 0.327273,
            0.436364, 0.318182, 0.545455, 0.727273, 0.436364,
            0.729115, 0.490909, 0.618182, 0.490909, 0.745455,
            0.331235, 0.300722])

        names.append("RHipPitch")
        times.append([0.84, 2.08, 2.8, 3.48, 4.2, 4.88, 5.4, 6.2,
            6.92, 7.84, 8.6, 9.52, 11.12])
        keys.append([0.184038, 0.102736, 0.0643861, -0.18719,
            -0.168782, -0.22554, -0.105888, -0.105888, 0.076658,
            0.276078, 0.282215, 0.0996681, 0.12793])

        names.append("RHipRoll")
        times.append([0.84, 2.08, 2.8, 3.48, 4.2, 4.88, 5.4, 6.2,
            6.92, 7.84, 8.6, 9.52, 11.12])
        keys.append([0.046062, -0.021434, 0.067538, -0.00762803,
            0.092082, 0.174919, 0.093616, 0.093616, 0.0798099,
            -0.115008, -0.569072, -0.309826, -0.100832])

        names.append("RKneePitch")
        times.append([0.84, 2.08, 2.8, 3.48, 4.2, 4.88, 5.4, 6.2,
            6.92, 7.84, 8.6, 9.52, 11.12])
        keys.append([0.092082, 0.1335, 0.170316, 0.37127, 0.467912,
            0.725624, 0.642787, 0.644321, 0.176453, -0.0923279,
            -0.0628521, -0.0923279, -0.0885215])

        names.append("RShoulderPitch")
        times.append([0.8, 1.32, 1.76, 2.04, 2.44, 2.76, 3.2, 3.44,
            3.84, 4.16, 4.56, 4.84, 5.36, 5.8, 6.16, 6.4, 6.6, 6.88,
            7.28, 7.8, 8.24, 8.56, 8.84, 9.08, 9.48, 9.88, 10.72,
            11.12])
        keys.append([0.650458, 0.658129, 0.767043, 0.675003, 0.6704,
             0.737896, 0.779314, 0.79312, 0.60904, 0.690342, 0.42496,
             0.925044, 1.06157, 0.94652, 0.987938, 0.820732,
            0.879025, 0.828401, 1.10759, 1.20577, 0.768577, 0.894364,
             0.564555, 0.802324, 0.673468, 0.833004, 1.41297,
            1.46544])

        names.append("RShoulderRoll")
        times.append([0.8, 1.32, 1.76, 2.04, 2.44, 2.76, 3.2, 3.44,
            3.84, 4.16, 4.56, 4.84, 5.36, 5.8, 6.16, 6.4, 6.6, 6.88,
            7.28, 7.8, 8.24, 8.56, 8.84, 9.08, 9.48, 9.88, 10.72,
            11.12])
        keys.append([-0.0951499, -0.019984, -0.144238, -0.122762,
            -0.093616, -0.127364, -0.127364, -0.130432, -0.0261199,
            -0.0706059, -0.027654, -0.29457, -0.314512, -0.251617,
            -0.248551, -0.22554, -0.207132, -0.168782, -0.199461,
            -0.207132, -0.220938, -0.316046, -0.219404, -0.247016,
```

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```
            -0.219404, -0.119694, -0.217714, -0.191641])
1150
1151        names.append("RWristYaw")
1152        times.append([0.8, 1.32, 2.04, 2.44, 3.44, 3.84, 4.84, 5.36,
                 6.16, 6.6, 7.28, 8.24, 8.56, 8.84, 9.08, 9.48, 9.88,
                10.72, 11.12])
1153        keys.append([1.01229, 1.00626, 0.989389, 0.987855, 1.00473,
                1.02314, 1.03541, 1.0216, 1.02927, 1.02314, 1.00013,
                1.18682, 0.820305, 1.09956, 0.925025, 1.02974, 0.855211,
                0.13945, 0.102771])
1154
1155        return names, keys, times
1156
1157    """*********************************
1158    Name: wave
1159    Function: Say hello to with its hand.
1160    *********************************"""
1161
1162    def wave():
1163        names = list()
1164        times = list()
1165        keys = list()
1166
1167        names.append("HeadPitch")
1168        times.append([0.8, 1.56, 2.24, 2.8, 3.48, 4.6])
1169        keys.append([0.29602, -0.170316, -0.340591, -0.0598679,
                -0.193327, -0.01078])
1170
1171        names.append("HeadYaw")
1172        times.append([0.8, 1.56, 2.24, 2.8, 3.48, 4.6])
1173        keys.append([-0.135034, -0.351328, -0.415757, -0.418823,
                -0.520068, -0.375872])
1174
1175        names.append("LElbowRoll")
1176        times.append([0.72, 1.48, 2.16, 2.72, 3.4, 4.52])
1177        keys.append([-1.37902, -1.29005, -1.18267, -1.24863,
                -1.3192, -1.18421])
1178
1179        names.append("LElbowYaw")
1180        times.append([0.72, 1.48, 2.16, 2.72, 3.4, 4.52])
1181        keys.append([-0.803859, -0.691876, -0.679603, -0.610574,
                -0.753235, -0.6704])
1182
1183        names.append("LHand")
1184        times.append([1.48, 4.52])
1185        keys.append([0.238207, 0.240025])
1186
1187        names.append("LShoulderPitch")
1188        times.append([0.72, 1.48, 2.16, 2.72, 3.4, 4.52])
```

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```
1189        keys.append([1.11824, 0.928028, 0.9403, 0.862065, 0.897349,
                0.842125])
1190
1191        names.append("LShoulderRoll")
1192        times.append([0.72, 1.48, 2.16, 2.72, 3.4, 4.52])
1193        keys.append([0.363515, 0.226991, 0.20398, 0.217786,
                0.248467, 0.226991])
1194
1195        names.append("LWristYaw")
1196        times.append([1.48, 4.52])
1197        keys.append([0.147222, 0.11961])
1198
1199        names.append("RElbowRoll")
1200        times.append([0.64, 1.4, 1.68, 2.08, 2.4, 2.64, 3.04, 3.32,
                3.72, 4.44])
1201        keys.append([1.38524, 0.242414, 0.349066, 0.934249,
                0.680678, 0.191986, 0.261799, 0.707216, 1.01927,
                1.26559])
1202
1203        names.append("RElbowYaw")
1204        times.append([0.64, 1.4, 2.08, 2.64, 3.32, 3.72, 4.44])
1205        keys.append([-0.312978, 0.564471, 0.391128, 0.348176,
                0.381923, 0.977384, 0.826783])
1206
1207        names.append("RHand")
1208        times.append([1.4, 3.32, 4.44])
1209        keys.append([0.853478, 0.854933, 0.425116])
1210
1211        names.append("RShoulderPitch")
1212        times.append([0.64, 1.4, 2.08, 2.64, 3.32, 4.44])
1213        keys.append([0.247016, -1.17193, -1.0891, -1.26091,
                -1.14892, 1.02015])
1214
1215        names.append("RShoulderRoll")
1216        times.append([0.64, 1.4, 2.08, 2.64, 3.32, 4.44])
1217        keys.append([-0.242414, -0.954191, -0.460242, -0.960325,
                -0.328317, -0.250085])
1218
1219        names.append("RWristYaw")
1220        times.append([1.4, 3.32, 4.44])
1221        keys.append([-0.312978, -0.303775, 0.182504])
1222
1223        return names, keys, times
1224
1225    """*************************************
1226    Name: sambaU4
1227    Function: Dances like U4 calls it samba.
1228    *************************************"""
1229    def sambaU4():
```

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```
    names = list()
    times = list()
    keys = list()

    names.append("HeadPitch")
    times.append([1.72, 2.6, 3.56, 4.44, 5.4, 6.32, 7.28, 8.24,
        9.2, 10.16, 11.12, 11.96])
    keys.append([0, 0.303687, 0.293807, 0.283731, 0.269342,
        0.252707, 0.229721, 0.199202, 0.157101, 0.0969999,
        0.0177092, 0])

    names.append("HeadYaw")
    times.append([1.72, 2.6, 3.56, 4.44, 5.4, 6.32, 7.28, 8.24,
        9.2, 10.16, 11.12, 11.96])
    keys.append([0, 0.877901, -0.925025, 0.92677, -0.925025,
        0.925025, -0.925025, 0.925025, -0.925025, 0.925025,
        -0.925025, 0])

    names.append("LElbowRoll")
    times.append([1.72, 2.6, 4.44, 6.32, 8.24, 10.16])
    keys.append([-0.181514, -0.221657, -0.221657, -0.221657,
        -0.221657, -0.221657])

    names.append("LElbowYaw")
    times.append([1.72, 2.6, 3.56, 4.44, 5.4, 6.32, 7.28, 8.24,
        9.2, 10.16, 11.12])
    keys.append([-1.45211, 0.589921, -1.50971, 0.589921,
        -1.50971, 0.589921, -1.50971, 0.589921, -1.50971,
        0.589921, -1.50971])

    names.append("LShoulderRoll")
    times.append([1.72, 2.6, 3.56, 4.44, 5.4, 6.32, 7.28, 8.24,
        9.2, 10.16, 11.12])
    keys.append([1.56207, 1.56207, 1.56207, 1.56207, 1.56207,
        1.56207, 1.56207, 1.56207, 1.56207, 1.56207, 1.56207])

    names.append("LWristYaw")
    times.append([1.72])
    keys.append([-0.642281])

    names.append("RElbowRoll")
    times.append([1.72])
    keys.append([0.46331])

    names.append("RElbowYaw")
    times.append([1.72, 2.6, 3.56, 4.44, 5.4, 6.32, 7.28, 8.24,
        9.2, 10.16, 11.12])
    keys.append([0.984366, 0.984366, -1.01404, 0.984366,
```

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```
        -1.01404, 0.984366, -1.01404, 0.984366, -1.01404,
        0.984366, -1.01404])

    names.append("RShoulderRoll")
    times.append([1.72, 3.56, 5.4, 7.28, 9.2, 11.12])
    keys.append([-1.32645, -1.56207, -1.56207, -1.56207,
        -1.56207, -1.56207])

    names.append("RWristYaw")
    times.append([1.72])
    keys.append([0.110406])

    return names, keys, times


"""************************************
Name: initialMoveInteraction
Function: Moves the hip roll to its left
************************************"""
def initialMoveInteraction():

    names = list()
    times = list()
    keys = list()

    names.append("HeadPitch")
    times.append([1.56, 4.76])
    keys.append([0.333358, 0.015708])


    names.append("HeadYaw")
    times.append([1.56, 4.76])
    keys.append([-0.263545, -0.0226893])

    return names, keys, times
```

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1.2 Sensors

File 11: __init__.py

```
1 from . import *
```

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File 12: nao_head_tactile_gestures.py

```
#! /usr/bin/env python
# -*- encoding: UTF-8 -*-
"""
    ////////////////////////////////////////////////////////////////////////////

Name: nao_head_tactile_gestures.py
Function: File with the class to get information from the head
    sensors of robot nao
          See ALTactileGesture:
          https://developer.softbankrobotics.com/nao6/naoqi-
              developer-guide/naoqi-apis/naoqi-sensors-leds/
              altactilegesture#altactilegesture

COMMENT: It does not work!!

Creation date: 15/08/2022
Last modified: 15/08/2022
Created by: SCV
////////////////////////////////////////////////////////////////////////////
    """


"""++++++++++++++++++++++++++++++++++++++
Libraries
++++++++++++++++++++++++++++++++++++++"""
import qi

"""++++++++++++++++++++++++++++++++++++++
Constants Classes
++++++++++++++++++++++++++++++++++++++"""

"""**********************************
Name: HEAD_TACTILE_GESTURES
Function: class that contains the head gestures. See: https://
    developer.softbankrobotics.com/nao6/naoqi-developer-guide/
    naoqi-apis/naoqi-sensors-leds/altactilegesture#default-
    tactile-gesture
**********************************"""
class HEAD_TACTILE_GESTURES():
    SINGLE_FRONT = 'SingleFront'
    SINGLE_MIDDLE = 'SingleMiddle'
    SINGLE_REAR =  'SingleRear'
    DOUBLE_FRONT = 'DoubleFront'
    DOUBLE_MIDDLE = 'DoubleMiddle'
    DOUBLE_REAR = 'DoubleRear'
    SINGLE_TAP = 'SingleTap'
    DOUBLE_TAP = 'DoubleTap'
```

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```
39      CARESS_FRONT_TO_REAR = 'CaressFtoR'
40      CARESS_REAR_TO_FRONT = 'CaressRtoF'
41      ZOOM_IN = 'ZoomIn'
42      ZOOM_OUT = 'ZoomOut'
43      THE_CLAW = 'TheClaw'
44      SINGLE_FRONT_HOLD = 'SingleFrontHold'
45      SINGLE_MIDDLE_HOLD = 'SingleMiddleHold'
46      SINGLE_REAR_HOLD = 'SingleRearHold'
47      SINGLE_TAP_HOLD = 'SingleTapHold'
48      THE_CLAW_HOLD = 'TheClawHold'
49
50  """++++++++++++++++++++++++++++++++++++++
51  Class
52  ++++++++++++++++++++++++++++++++++++++"""
53  class Nao_HeadTactileGestures():
54      """--------------------------------------
55      Name: __init__
56      Function: init of the class
57      Parameters: session: nao session
58                  controller: controller to advise when an event
                        happens
59      Return: -
60      --------------------------------------"""
61      def __init__(self, session):
62
63          self.session = session
64
65          #Init tactile_gestures_service
66          self.tactile_gestures_service = self.session.service("
                ALTactileGesture")
67
68          #Init react to touch
69          self.react_to_touch = ReactToTouch(self.session, self)
70
71          #HEAD inits
72          #----------
73          #Init list of other gestures
74          self.head_new_gestures = []
75
76          #Init list of gestures to check
77          self.head_check_gestures = []
78
79          # Connect tactile gesture handler to onGesture signal
80          self.s1 = self.tactile_gestures_service.onGesture.
                connect(self.head_tactile_gesture_handler)
81
82          # Connect tactile gesture release handler to onRelease
                signal
83          self.s2 = self.tactile_gestures_service.onRelease.
```

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```
            connect(self.head_tactile_gesture_release_handler)
84
85          # Boolean 'lock' useful for responding to 'hold'
                gestures in a more controlled manner
86          self.head_gesture_hold_lock = False
87
88      ##############################################
89      ##                HEAD FUNCTIONS              ##
90      ##############################################
91      """-------------------------------------
92      Name: head_add_new_gestures
93      Function: adds new head tactile gestures
94      Parameters: session: nao session
95      Return: -
96      -------------------------------------"""
97      def head_add_new_gestures(self, gesture):
98          # Create a new gesture
99          try:
100             self.head_new_gestures.append(self.
                    tactile_gestures_service.createGesture(gesture))
101         except RuntimeError as e:
102             print e
103
104     """-------------------------------------
105     Name: head_add_gestures_to_check
106     Function: creates a list with the gestures to check
107     Parameters: add_new_gestures: boolean. True if the list of
                new gestures has
108                                 to be added.
109                 list_existing_gestures: list of gestures that
                        exist and want to
110                                         check (see class
                                                HEAD_TACTILE_GESTURES
                                                )
111     Return: -
112     -------------------------------------"""
113     def head_add_gestures_to_check(self, add_new_gestures,
                list_existing_gestures):
114         if add_new_gestures:
115             for gesture in self.head_new_gestures:
116                 self.head_check_gestures.append(gesture)
117         for gesture in list_existing_gestures:
118             self.head_check_gestures.append(gesture)
119
120     """-------------------------------------
121     Name: head_tactile_gesture_handler
122     Function: handler of head gestures
123     Parameters: value: gesture detected
124     Return: -
```

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```
125         ------------------------------------"""
126     def head_tactile_gesture_handler(self, value):
127         for gesture in self.head_new_gestures:
128             if value == gesture:
129                 self.controller.head_gesture_happened(gesture)
130 
131     """------------------------------------
132     Name: head_tactile_gesture_handler
133     Function: Enables 'locking out' of multiple 'hold gesture'
            signal responses
134     Parameters: -
135     Return: -
136     ------------------------------------"""
137     def head_tactile_gesture_release_handler(self):
138         self.gesture_hold_lock = False
139 
140     """------------------------------------
141     Name: head_clean_up
142     Function: cleans up the handlers
143     Parameters: -
144     Return: -
145     ------------------------------------"""
146     def head_clean_up(self):
147         """
148         Disconnect tactile gesture handler from signal
149         """
150         self.tg.onGesture.disconnect(self.s1)
151         self.tg.onRelease.disconnect(self.s2)
```

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File 13: nao_touch.py

```python
#! /usr/bin/env python
# -*- encoding: UTF-8 -*-
"""
    ////////////////////////////////////////////////////////////////////////////

Name: nao_touch.py
Function: File with the class to get information from the touch
    sensors of robot nao
            See ALTouch:
            https://developer.softbankrobotics.com/nao6/naoqi-
                developer-guide/naoqi-apis/naoqi-sensors-leds/
                altouch#altouch
            https://developer.softbankrobotics.com/nao6/naoqi-
                developer-guide/naoqi-apis/naoqi-sensors-leds/
                altouch/altouch-api
Creation date: 15/08/2022
Last modified: 15/08/2022
Created by: SCV
////////////////////////////////////////////////////////////////////////////
    """


"""++++++++++++++++++++++++++++++++++++++
Libraries
++++++++++++++++++++++++++++++++++++++"""
import qi
import functools

"""++++++++++++++++++++++++++++++++++++++
Constants Classes
++++++++++++++++++++++++++++++++++++++"""

"""**********************************
Name: TOUCH_SENSORS
Function: class that contains touch sensors.
**********************************"""
class TOUCH_SENSORS():
    HEAD_FRONT = "Head/Touch/Front"
    HEAD_MIDDLE = "Head/Touch/Middle"
    HEAD_REAR = "Head/Touch/Rear"
    LEFT_HAND_GREY_ZONE = "LHand/Touch/Back"
    LEFT_HAND_EXTERNAL_WHITE_ZONE = "LHand/Touch/Left"
    LEFT_HAND_INTERNAL_WHITE_ZONE = "LHand/Touch/Right"
    RIGHT_HAND_GREY_ZONE = "RHand/Touch/Back"
    RIGHT_HAND_EXTERNAL_WHITE_ZONE = "RHand/Touch/Right"
    RIGHT_HAND_INTERNAL_WHITE_ZONE = "RHand/Touch/Left"
    LEFT_FOOD_EXTERNAL_BUMPER = "LFoot/Bumper/Left"
```

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```
    LEFT_FOOD_INTERNAL_BUMPER = "LFoot/Bumper/Right"
    RIGHT_FOOD_EXTERNAL_BUMPER = "RFoot/Bumper/Right"
    RIGHT_FOOD_INTERNAL_BUMPER = "RFoot/Bumper/Left"

"""**********************************
Name: TOUCH_EVENTS
Function: class that contains touch events.
**********************************"""
class TOUCH_EVENTS():
    TOUCH_CHANGED = "TouchChanged"
    RIGHT_BUMPER_PRESSED = "RightBumperPressed"
    LEFT_BUMPER_PRESSED = "LeftBumperPressed"
    # BACK_BUMPER_PRESSED = "BackBumperPressed" #Pepper only
    FRONT_TACTIL_TOUCH = "FrontTactilTouched"
    MIDDLE_TACTIL_TOUCH = "MiddleTactilTouched"
    REAR_TACTIL_TOUCH = "RearTactilTouched"
    HAND_RIGHT_BACK_TOUCHED = "HandRightBackTouched"
    HAND_RIGHT_LEFT_TOUCHED = "HandRightLeftTouched"
    HAND_RIGHT_RIGHT_TOUCHED = "HandRightRightTouched"
    HAND_LEFT_BACK_TOUCHED = "HandLeftBackTouched"
    HAND_LEFT_LEFT_TOUCHED = "HandLeftLeftTouched"
    HAND_LEFT_RIGHT_TOUCHED = "HandLeftRightTouched"



"""++++++++++++++++++++++++++++++++++++++++
Class
++++++++++++++++++++++++++++++++++++++++"""
class Nao_Touch():
    """----------------------------------
    Name: __init__
    Function: init of the class
    Parameters: session: nao session
                need_callback: boolean to indicate if a callback
                    is needed
                controller: controller to advise when an event
                    happens
                memory_service: in case a handler is needed
    Return: -
    ----------------------------------"""
    def __init__(self, session, need_callback = False,
        controller = None, memory_service = None):

        if need_callback:
            self.controller = controller
            self.memory_service = memory_service
            # Connect to an Naoqi Event.
            self.touch = self.memory_service.subscriber(
                TOUCH_EVENTS.TOUCH_CHANGED)
```

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```
85              self.id = self.touch.signal.connect(functools.
                    partial(self.callbackOnTouched, TOUCH_EVENTS.
                    TOUCH_CHANGED))
86
87          else:
88              self.session = session
89
90              #Init touch_service
91              self.touch_service = self.session.service("ALTouch")
92
93              #Save status with no touched sensors
94              self.offStatus = self.touch_service.getStatus()
95              self.preStatus = self.offStatus
96
97
98      """_____________________________________
99      Name: callbackOnTouched
100     Function: callback to on touch event of ALMemory
101     Parameters: strVarName: event name
102                 value: a list of ALValue with a name and a
                        boolean for the touch status.
103     Return: -
104     _____________________________________"""
105     def callbackOnTouched(self, strVarName, value):
106         """ This will be called each time a touch
107         is detected.
108         """
109         # Disconnect to the event when talking,
110         # to avoid repetitions
111         self.touch.signal.disconnect(self.id)
112
113         touched_bodies = []
114         for p in value:
115             if p[1]:
116                 touched_bodies.append(p[0])
117
118         # Give to the controller the list of the names of the
                touched bodies
119         self.controller.handle_touch(touched_bodies)
120
121         # Reconnect again to the event
122         self.id = self.touch.signal.connect(functools.partial(
                self.onTouched, TOUCH_EVENTS.TOUCH_CHANGED))
123
124     """_____________________________________
125     Name: check_touch_sensors_status
126     Function: function that checks if the touch sensors status
            has changed
127     Parameters: strVarName: event name
```

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```
128                 offStatus_NOTpreStatus: boolean. If true,
                        compares with offStatues. If false, compares
                        with the status checked previously
129         Return: False if nothing changed, a list of the sensors
                changed otherwise
130         ----------------------------------------"""
131         def check_touch_sensors_status(self, offStatus_NOTpreStatus)
                :
132             if offStatus_NOTpreStatus:
133                 status_to_compare = self.offStatus
134             else:
135                 status_to_compare = self.preStatus
136             #Get the new status
137             nowStatus= self.touch_service.getStatus()
138             list_sensors_changed = []
139             #And compare it with the status_to_compare
140             if status_to_compare != nowStatus:
141                 #Search which one changed
142                 for i in range(len(nowStatus)):
143                     if status_to_compare[i][1] != nowStatus[i][0]:
144                         list_sensors_changed.append(nowStatus[0])
145                 self.preStatus = nowStatus
146                 return list_sensors_changed
147             else:
148                 return False
```

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