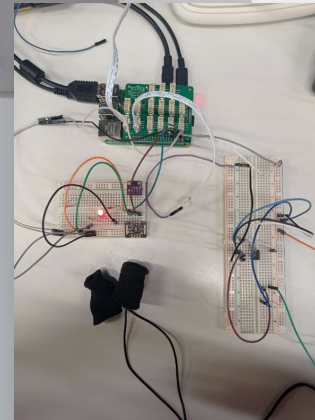
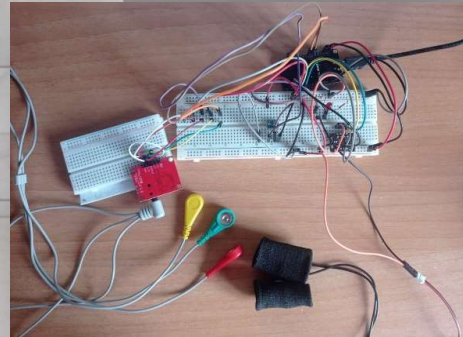


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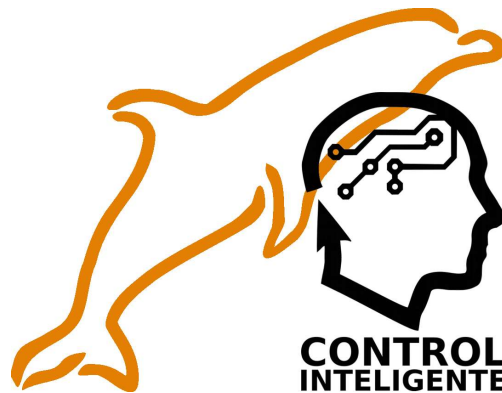
**Proposing *High Technology developments*
in *Low Cost solutions***

E. Irigoyen



- 1. Context**
- 2. Objective**
- 3. Study**
- 4. Results**
- 5. Final conclusions**

Department of Systems Engineering and Automatic Control



Motivation:

Create technologically advanced solutions
in order to facilitate the style of life
of people with disabilities.



Colaborating in projects coming from county and national calls

- ❑ Karmele López de Ipiña (2004):
 - Developments of Intelligent Tutoring Systems

Laguntxo

- ❑ Manuel Graña (2007):
 - Part of the Research Group **GIC**

A type – Research Group

Main objective:

To apply techniques developed in the Intelligent Control field into assistive solutions focused on users and responsables (medicians, relatives, etc.)

Artificial Neural Networks

Fuzzy Logic

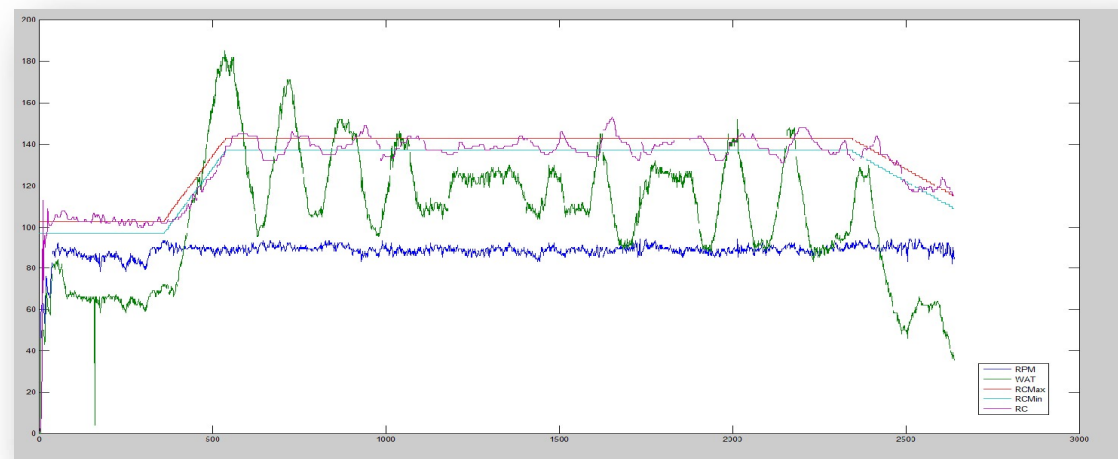
Finite-states Machines

Reinforcement Learning



Cardiovascular Rehabilitation

- **Proposal:**
 - Modeling of the bicycle-person binomial to obtain an advanced control to prevent and treat cardiovascular problems.

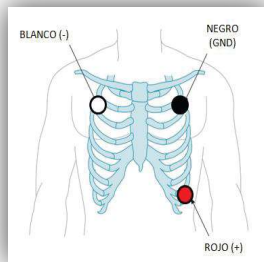


Identification of emotions & stress

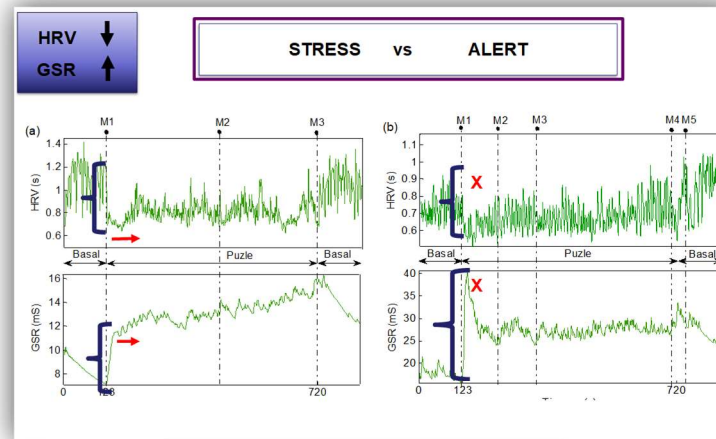
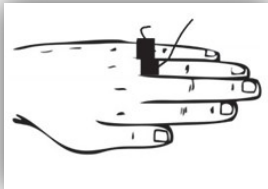
- **Proposal:**
 - To design a system for the detection and classification of emotional changes by analyzing non-intrusive physiological signals.



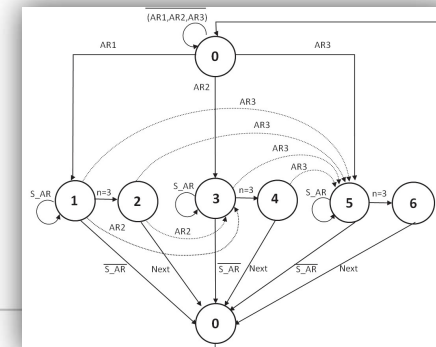
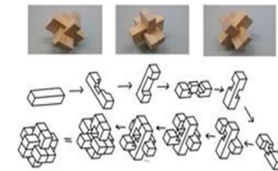
ECG



GSR

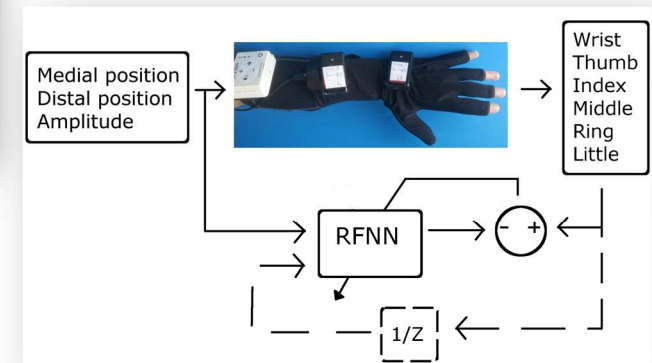
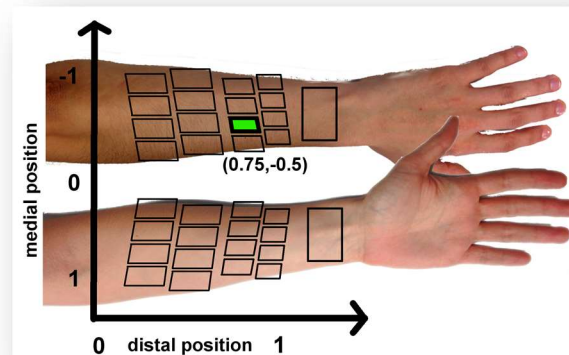
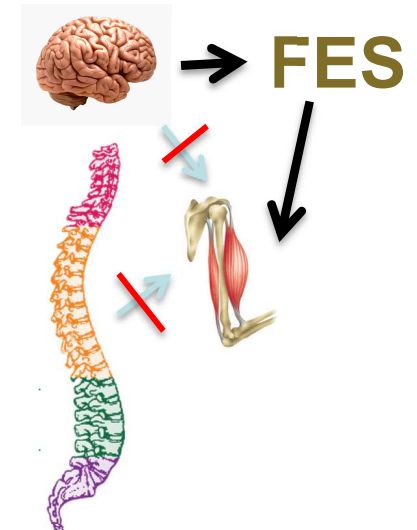


- The resolution of a **3D-wooden puzzle** within a limited time.
- Different puzzles to provoke different levels of stress.



Upper limb motor functions

- **Proposal:**
 - Neuro-fuzzy multi-surface electrode models for hand grasping.

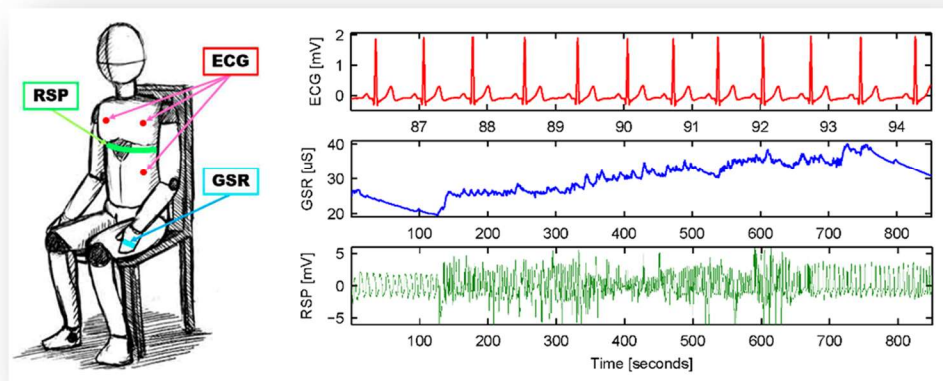


Reinforcement Learning



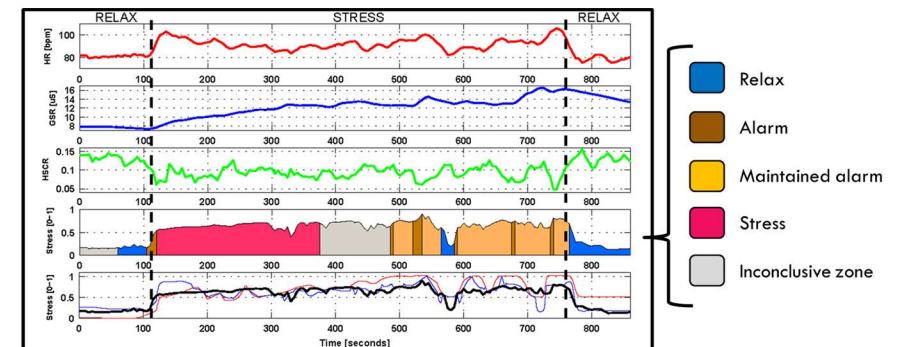
Robust classification of stress

- **Proposal:**
 - Improve and strengthen stress classification algorithms, together with their implementation in Low Cost platforms.



Relevant physiological signals in the study of stress

Electrocardiogram (ECG) Galvanic Skin Response (GSR) Breathing (RSP)

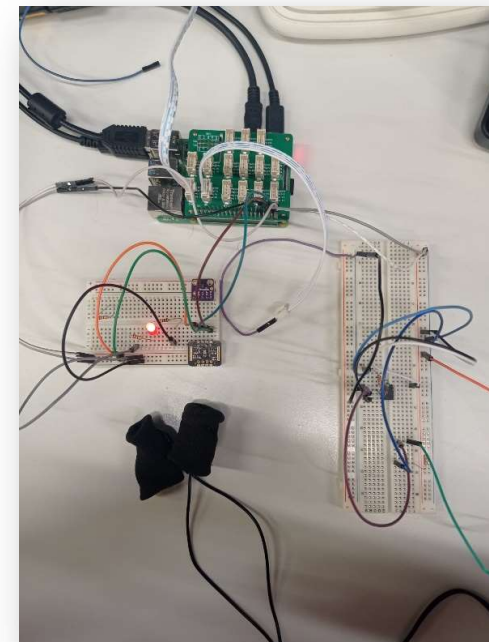
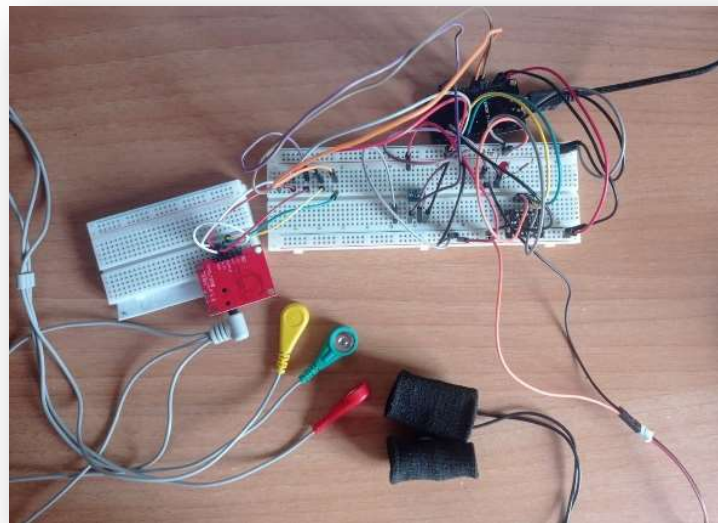


Detection of heart disease - BP



Development of a first prototype based on a low-cost platform.

- **Proposal:**
 - **Design and development of a system to support the diagnosis and identification of pathologies implemented with low-cost devices.**

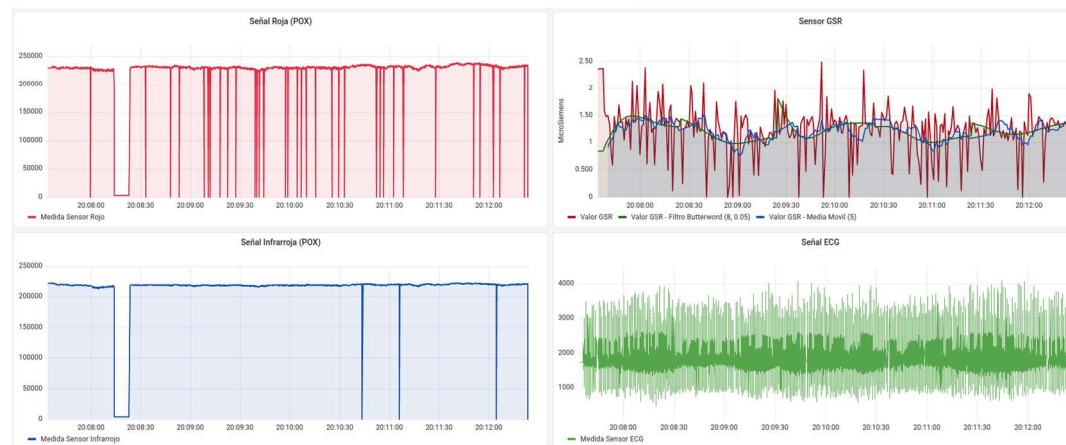




Contacto seco

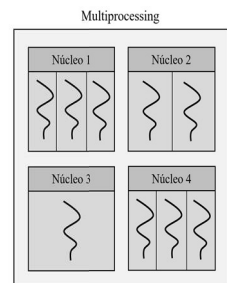
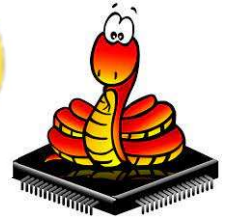
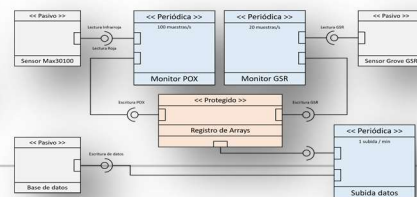
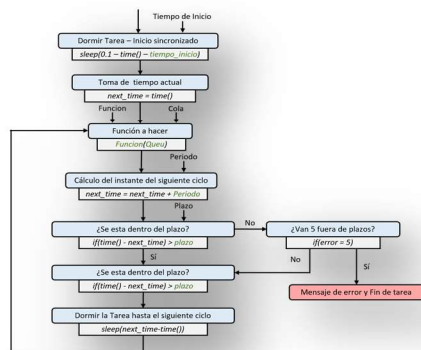
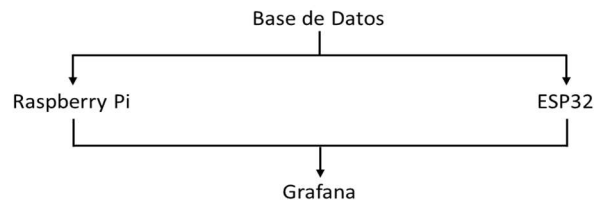
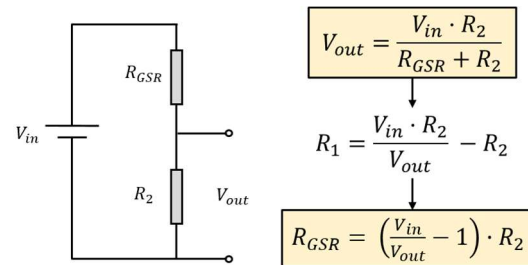


Contacto húmedo



Developments:

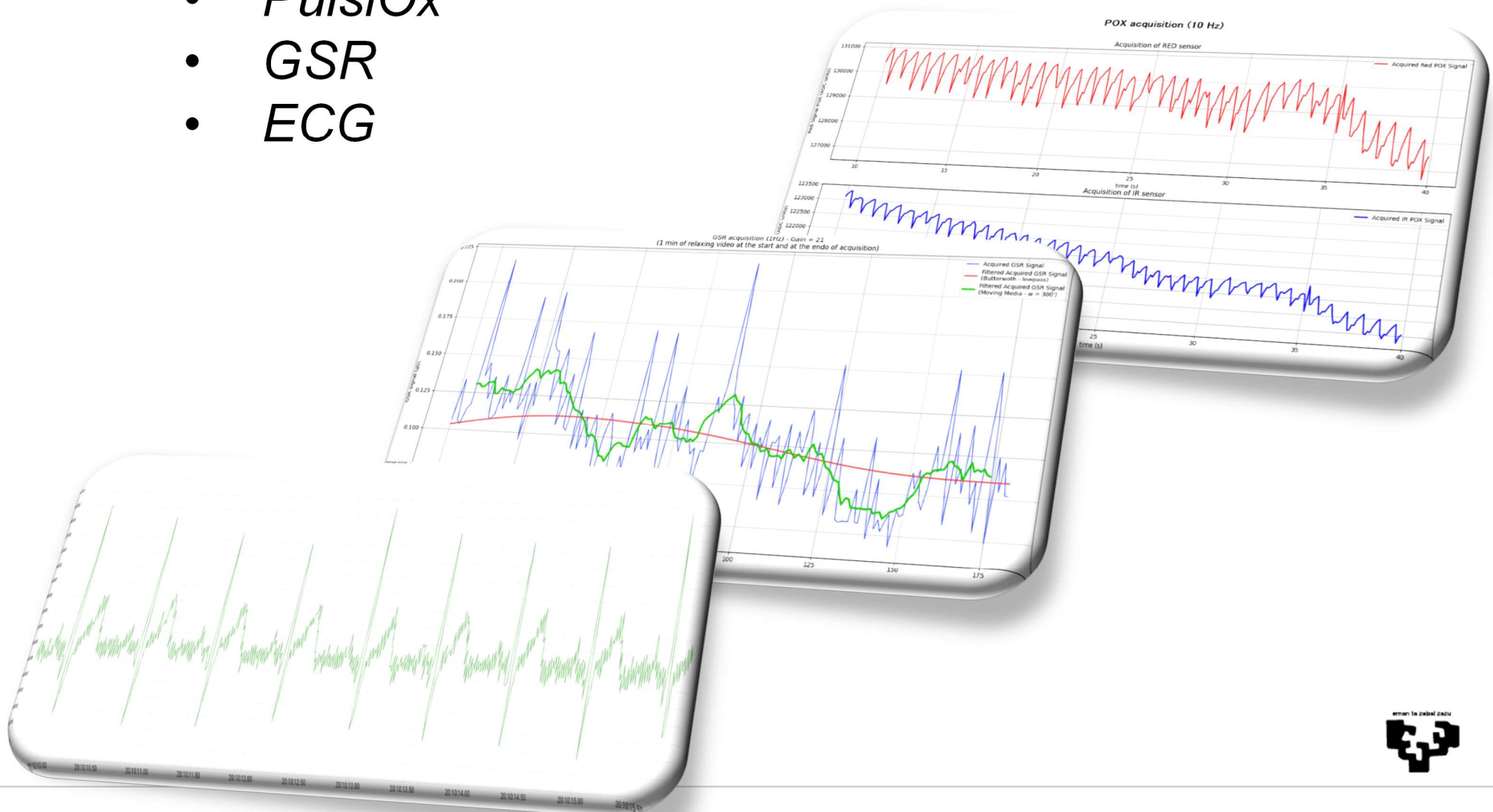
- Sensors
- Platforms
- Data Bases
- Communication
- Processing



Sensors:

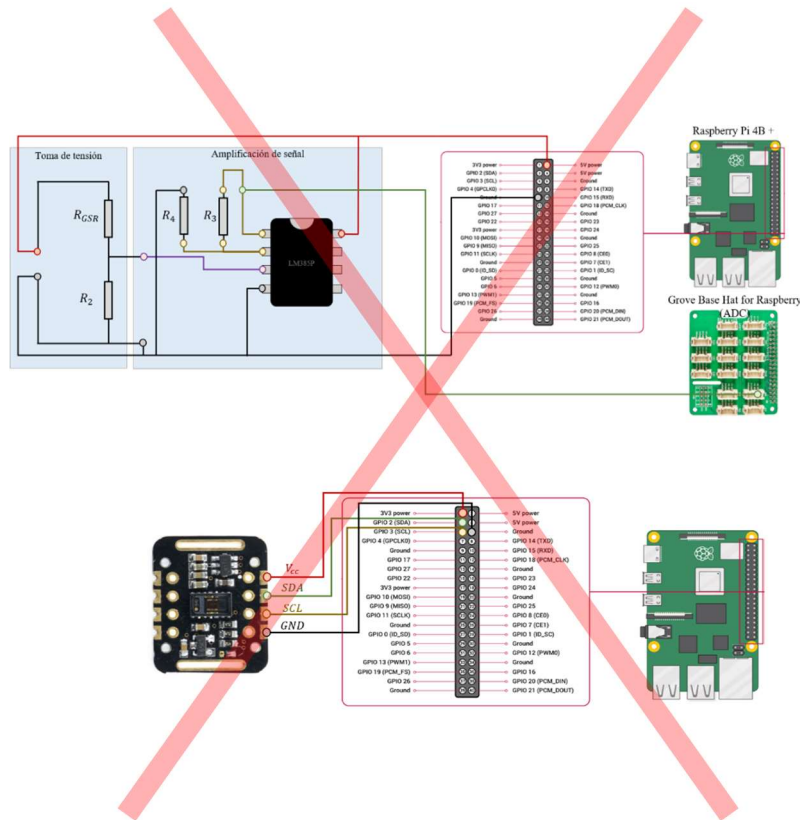
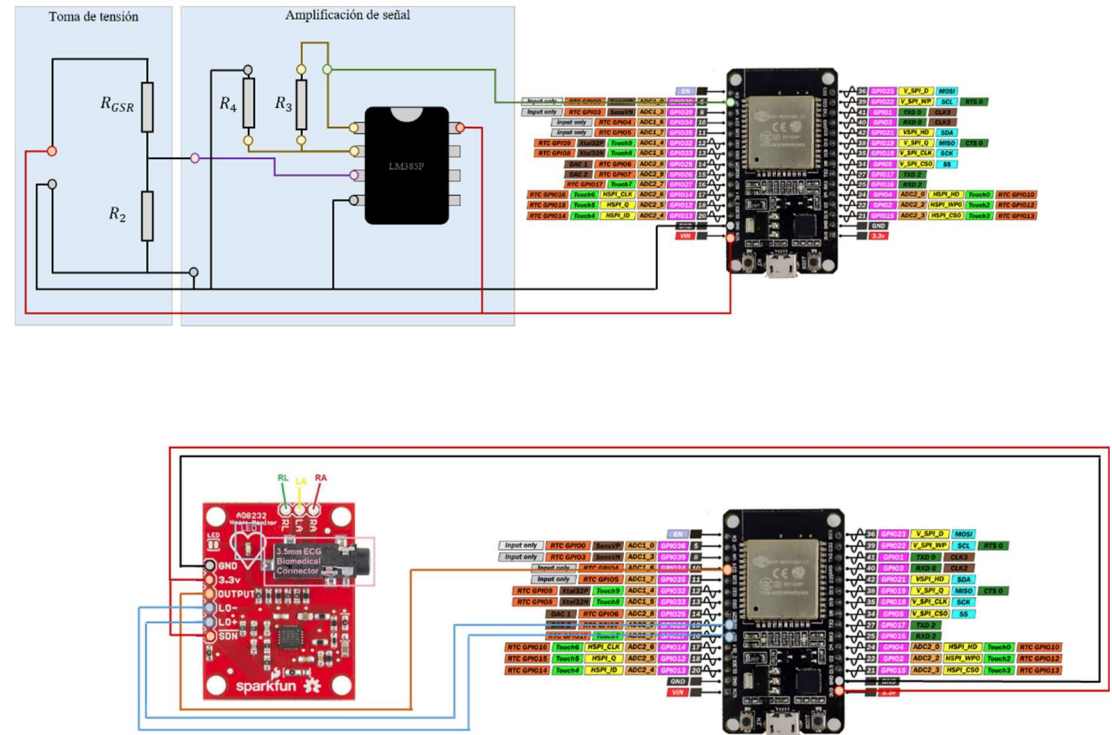
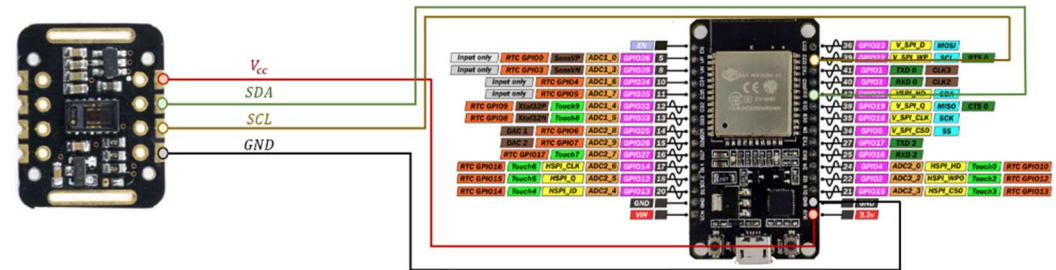
- *PulsiOx*
- *GSR*
- *ECG*

	Señal Pulsioxímetro	Señal GSR	Señal ECG
Frecuencia de muestreo	10 Hz	1 Hz	100 Hz



Platforms:

- ESP32
- R-Pi

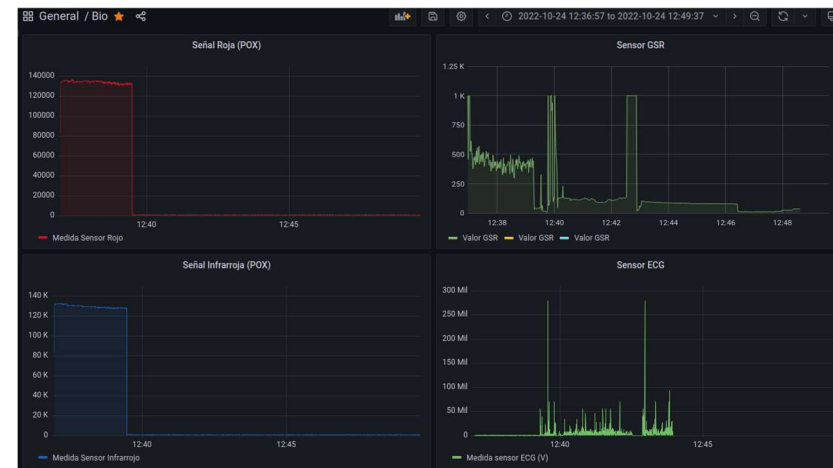
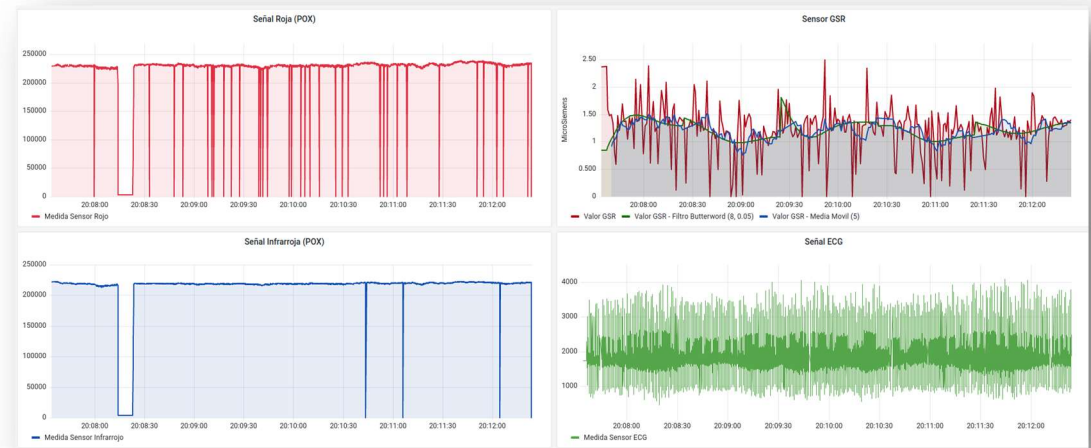


Signal processing:

- *Comunication*
- *Filtering*
- *Visualization*

2023-01-23 09:52:25.806	127208	128299
2023-01-23 09:52:25.906	127163	128317
2023-01-23 09:52:26.006	127210	128362
2023-01-23 09:52:26.106	127224	128341
2023-01-23 09:52:26.206	127348	128408
2023-01-23 09:52:26.306	127463	128477
2023-01-23 09:52:26.406	127529	128518
2023-01-23 09:52:26.506	127605	128414
2023-01-23 09:52:26.606	126886	128159
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2023-01-23 09:52:26.806	126871	128294
2023-01-23 09:52:26.906	126754	128261
2023-01-23 09:52:27.006	127046	128315
2023-01-23 09:52:27.106	127196	128383
2023-01-23 09:52:27.206	127424	128388
2023-01-23 09:52:27.306	127168	128102
2023-01-23 09:52:27.406	126723	127935
2023-01-23 09:52:27.506	126886	128097
2023-01-23 09:52:27.606	127323	128371
2023-01-23 09:52:27.706	127594	128430
2023-01-23 09:52:27.806	127334	128332
2023-01-23 09:52:27.906	127348	128335
2023-01-23 09:52:28.006	127362	128248

2023-01-23 08:25:58.006	151385	158548
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2023-01-23 08:25:58.506	150888	158081



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Thank you for your attention!

**Proposing *High Technology developments*
*in Low Cost solutions***

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