Iot Based Medication Monitoring System for Independently Living Patient

S. Kiruthiga, B. Arunthadhi, R. Deepthyvarma, V. R. Divya Shree

Abstract: ***Medicines are synthesized to cure, cease, prevent diseases or help in the diagnosis of illnesses. Lots of aged people live unaccompanied; few of them are endure from disorder, making it difficult to take care by oneself. Delay of taking their tablets or even taking it at the incorrect interval may raise health consequences. The design of an IoT based medication system is established and it can be used by patients as well as caretakers in sequence to monitor and ensure that the correct amount of each medicine is being taken at the exact time. This provides audio communication to aware the user when a confirmed medicine is to be taken. Furthermore, a software application is used to send messages and email alerts to the patient and the caretaker.***

Keywords: medicine box, Android app, IoT, Sensors, Cooling system.

I. INTRODUCTION

Technology has become a part of our daily life and implementation in a medical field leads to numerous solution for healthcare. People who are taking medicines on periodic basis represent a compelling ratio of the community all over the world. With such abundant of prescribed medicine, the possibility of forgetting to take medications in the meantime is a high. The Health System of America found that, about one third of aged peoples are prescribed to take eight or further medications each day. With such a generous prescription, the result of forgetting to take medicines at a particular time or unintentionally taking the same medicines twice are considerably high. The British Pharmacological Society noticed that greater than 80% are hospitalized due to injurious drug reactions. While prescription bottles have illiberal instructions covering their top, all of these indications are useless for patients striving with memory pathologies, like Alzheimer. It can be used by either aged people or even by the patients or caretaker. It contains segregate compartments
that can be organized for different user's needs. This helps the patient or caretaker by specifying the indispensable pill quantity, the mean time to take the medicine each day, and the need to fill certain pills. An application has been designed to support various categories of users such as independently living people who have scheduled medications, or for those people who take care of their patients.

Revised Manuscript Received on February 15, 2020.

S. Kiruthiga, Assistant Professor of Electronics And Communication Engineering in Sri Krishna College of Technology, Coimbatore.

B. Arunthadhi, Students of Electronics And Communication Engineering in Sri Krishna College of Technology, Coimbatore.

R. Deepthyvarma, Students of Electronics And Communication Engineering in Sri Krishna College of Technology, Coimbatore.

V. R. Divya Shree, Students of Electronics And Communication Engineering in Sri Krishna College of Technology, Coimbatore.

II. LITERATURE SURVEY

The proposed system of IoT is making powerful incursion in the medical field with the development of applicable sensors and devices**.** It is to make a convenient design that the sufferers can aware to take their regular medicines on time. The system includes chip, buzzer, and power supply. The connection contains sensors with the essential hardware components. All these modules are incorporate with the controller and implement using protocol such as I2C and SPI. The system is linked to the Wi-Fi and it will post all the information to cloud technology. The information stored in the memory card will transmit to the mobile application which acts as an approval for addressing through the internet [1]. Design of IoT structure is to establish medicine intake adherence where medicine intake action is allowed to protect adherence. Moving signals are obtained from the wristwatch, using the acceleration sensor in the watch. The obtained information are send to the wireless system pouring water into the glass and take the medicine from the blister package can be performed by swapping their order. After identifying medicine intake, which type of medicine is taken will be find using RFID tags rested on the blister package. This system can be commercialized as a mobile application along with particular use of hardware [2]. It shows a device that is collected by various components that are direct by Arduino. There are various types of communication in each section. It might be one or two ways. The Arduino transmits instruction to the different section but also obtain information from them. When the alarm is set in the correct time and controller acquires the hour from the RTC. The alert will be informed to the doctor or the caretaker. Through all this operation the accurate hour will be displayed on the LCD and when the alarm is fixed it shows the details about the right dosage [3]. This system uses proposed module of Raspberry Pi. It is given to 5 V and 2 A power adapter if handled with coaxial cable. When the system is connected to the mobile, the cable will be changed by a USB Wi-Fi dongle suited with the Raspberry Pi. The internet link is initially required to renovate, enrich and download vital collections for the Raspberry Pi. The GPO of Raspberry Pi is attached to the LED's that is required to light up the correct dosage that is to be taken at the time and buzzer is further linked to the GPO of Raspberry Pi. It acts as audio alert to tell the patient to take up the right dosage. Although the patient takes a specific tablet, it is necessary to confirm their activity. The email alerting is conveyed to the patient and caretakers by default. Therefore, it is essential for the cellular phone to have gateway to the internet [4]. The proposed module can be divided into hardware and software.

The software section will do the residue portion of the task, and that is to mention patients to take their medication along with how many tablets are expected to have. The alert can be set by using web app. The software need users to login, therefore the medicine can be connected with the calendar. Additionally, it will allocate a color to each medicine and when it's time for the alert, an LED of that color will be shifted on indicating that the correct time to take the tablets. The features are under no circumstances and can be easily accessible by the user. It is also useful for the working people with a hectic schedule by sending alert on the system [5].

III. PROPOSED METHOD

The main reason behind the proposed design is to provide a user friendly interface for independently living people to use this gadget as a reminder alert for taking their medicines daily on mean time. The proposed design comprises of four main parts: circuitry, cooling system, battery and pulse sensor and the various components used are shown in Fig 1. The circuitry is incorporated with simple sensors in the hardware modules. The Peltier cooling system comprises of cooling module along with heat dissipation units. The rechargeable battery is used for power supply to all the components in the gadget. The pulse sensor and a Wi-Fi module are used to calculate pulse and store for future uses.

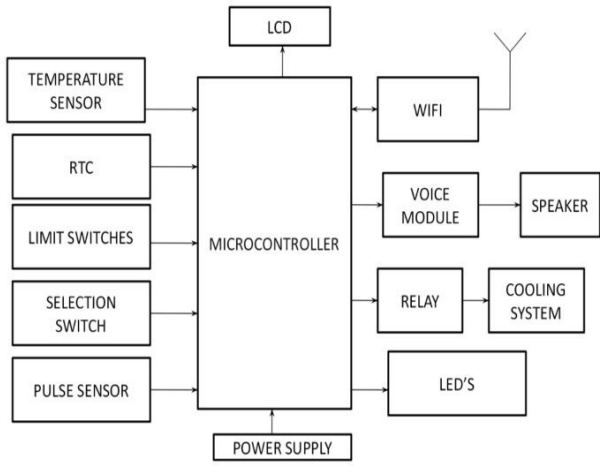

Fig 1.Block Diagram Of medication system

IV. COMPONENTS USED IN MEDCATION SYSTEM

A. ARDUINO UNO:

Arduino is open-source where, hardware and software can be accessed easily. It consists of a circuit board, that is programmed (referred to as a microcontroller) by Arduino IDE software. It is based on ATMEGA328 microcontroller which operates at 5V with programming interface with USB via ATMega16U2.

B. DS3231 RTC:

It is Precise Real-Time Clock Module with 32Kbit EEPROM. It comprises of a battery input that maintains accurate timekeeping when main power to the device is interrupted and it is an configurable I2C device Address for AT24C32 using SMD jumpers on PCB.

C. DS18B20 TEMPERATURE SENSOR:

It is a 1-wire programmable temperature sensor from maxim integrated. The sensor is prevented from moisture environment as it is incorporated inside a metal case. It can measure temperature ranges from -55°C to +125°. The temperature is measured at multiple points without compromising much of the digital pins on the microcontroller.

D. RELAY:

It is an electrical switch that controls an output circuit of higher power than the input circuit, so it also considered as electrical amplifier and because of this principle, Peltier system gets switched on.

E. THERMOELECTRIC COOLER (PELTIER MODULE) - TEC1-12706 :

It is the cooling system used in this design. The cooler has 2 heat sinks: the bigger one is for the hotter side and the smaller one is for the cooler side used to keep the medications under temperature. The fan included in this kit acts as a radiator.

F. LIQUID CRYSTAL DISPLAY:

The CMOS LCD of 2×8 is used to display time, temperature, medicine name etc. programmed and it is used because of its low power consumption feature. These LCD modules can be interfaced with a 4-bit or 8-bit microprocessor or Micro controller are shown in Fig 5.

G. LIGHT EMITTING DIODE (LED):

It is a semiconductor light source used as an indicator lamp in the mean time for specifying the appropriate medicine. It is used because of low power consumption feature.

H. LIMIT SWITCH:

It is operated by the motion of a machine part or by the presence of an object. They are used as safety interlocks, or to count objects passing a point. It is installed on gate lock, and it indicates the position of a gate to the control system.

V. MEDICATION SYSTEM FRAMEWORK AND WORKING METHODOLOGY

The proposed system is designed to compact with the adaptation of cooling system and it is portable in nature. When the device gets connected to the Wi-Fi sends all data to the cloud storage. The information regarding the medications intake can be send through the mobile app, so that the caretaker can track the patient condition from anywhere are shown in Fig 3.

A. FEATURES OF MEDICATION SYSTEM:

The design of medication system contains features like medication storage, reminder, data storage.

1) MEDICATION STORAGE:

The condition in which the medication to be stored is maintained under surveillance as temperature sensor is fixed to monitor.

The container temperature in which the medications like insulin should be stored under temperature for usage. So, the separate container is fixed with cooling system consisting of a heat sink and an exhaust fan for the storage purposes and container in which the normal medicines to be stored is placed for usage and a separate pulse module is fixed for patients usage.

2) MEDICATION REMINDER:

As it is especially designed for independently living patients it has some important reminder systems like playback voice module system which plays back the stored voice at the mean time as specified in programs along with LED notification and LED display. The information about the medications status gets notified in caretaker smartphone by connecting the device to Wi-Fi. The RTC in the proposed design keeps track of the current time and date for the system to function properly as programmed.

3) DATA STORAGE:

The storage of medical records are so important as it is used doctors usage for taking care of patient under any circumstance. The patient intake time of medications along with pulse readings are stored in open source storage called as MySQL where the information from the medication system is stored in website where a special id created for individual persons for usage. The caretaker and doctor can refer the details of medication intake timing and pulse readings with time notification which can be used for future references.

B. ESSENTIAL FEATURES OF COOLING SYSTEM:

The proposed design consists of peltier cooling system which works with a power supply. It is used for cooling the container. The cooling system gets switched on by the usage of relay control system. The relay system gets on when temperature in container gets above 20 degree celsius and remains off when it is 20 and below, which helps in controlling the usage of power. It consists of heat sink and exhaust fan which helps in the air circulation are shown in Fig 3.

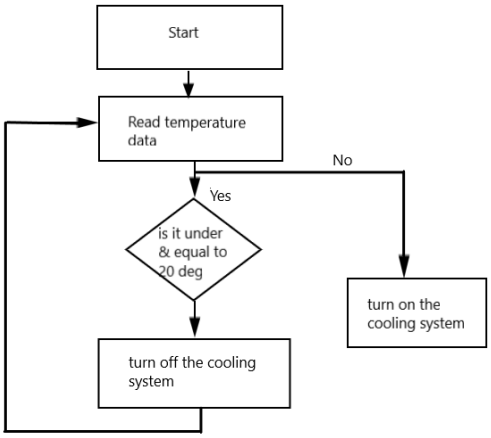

Fig 2. Flow chart of cooling system

Fig 3. Cooling system

C. REAL TIME DATA GENERATION AND ACTUATION STEPS:

First the system displays in the mean time and checks for the temperature. If the time for intake of the medicine gets the playback module along with the LED and LCD notification turns on with an notification in caretakers smartphone. If the patient takes their medication with these alerts, the taken time of the medicine gets updated in the My SQL website where the server is designed by using HTML and PHP technologies. If any delay occur in the intake of the medicine it updates in the mobile app think speak as the proposed design of the gadget has Wi-Fi module.

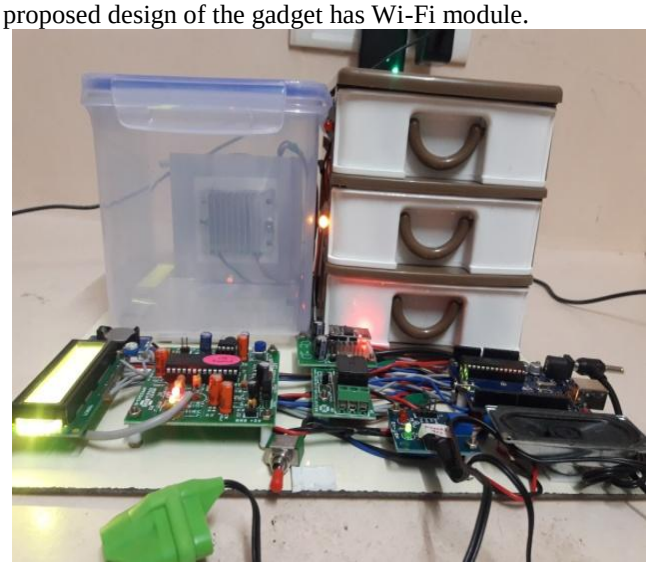

Fig 4. Medication system

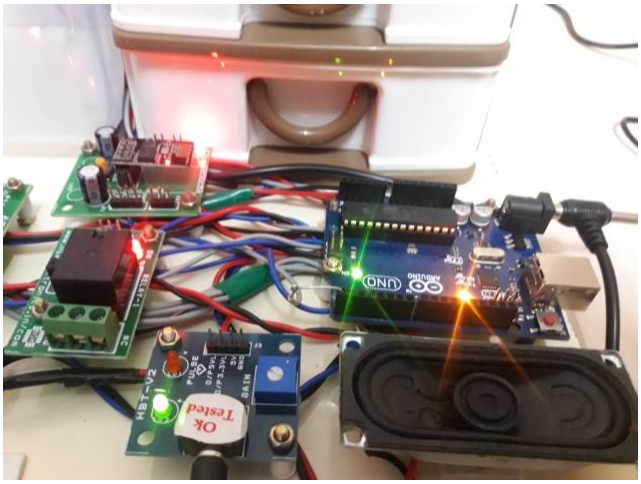

Fig 5.Voice module

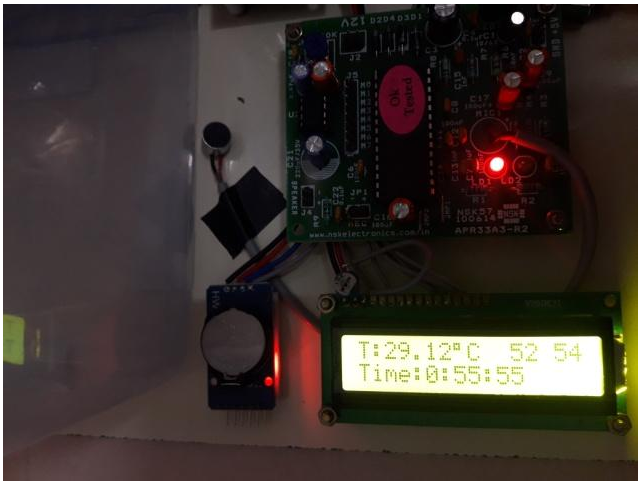

Fig 6. LCD display

VI. RESULTS

The proposed design of medicine box consists of separate draw box to store regular tablets like sugar and pressure tablets in separate draws and an separate container to store medication like insulin, eyedrop which is shown in Fig 4. The cooling system gets switched on whenever the temperature gets above the fixed reading as shown in Fig . At the mean time to take medication, the LCD, LED and voice module gets switch on without any manual interruption by arduino UNO as shown in Fig 9,10,11,12&13and we also get message notifications in mobile by the use of ThingSpeak(an open source application) shown in Fig 8, where the alert timings an be changed according to the caretakers conviences as shown in Fig 7 and it also shows whether the medicine is taken by the patient as represented in Fig 15.The information regarding intake of medication gets updated automatically along with time in the website which can be viewed by creating an separate id for the patient future use as shown in Fig 17&18 to represent separately the intake timings of sugar, pressure. It also has separate pulse sensor module to calculate patient pulse readings as shown in Fig 14 and gets stored in website for future use as shown in Fig 19.

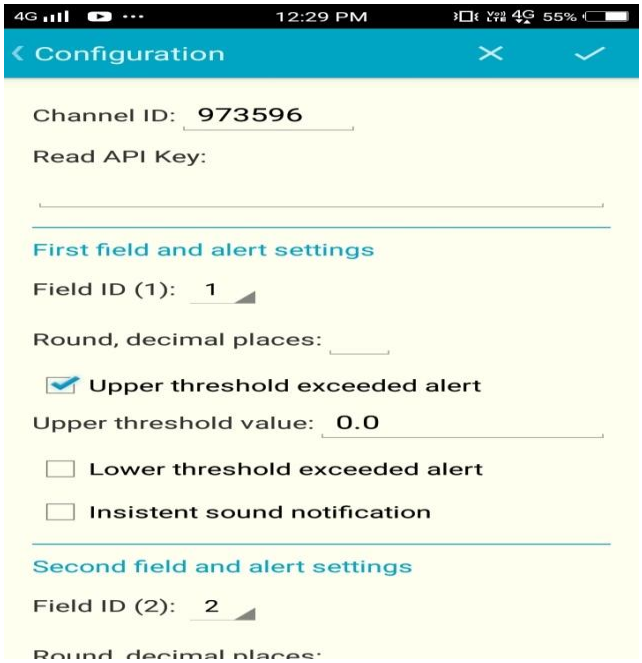

Fig 7. Unique id and remainder settings

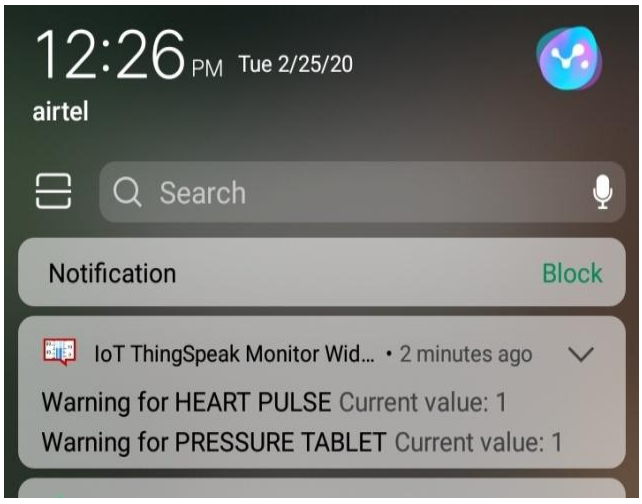

Fig 8. Remainder messages from ThingSpeak application

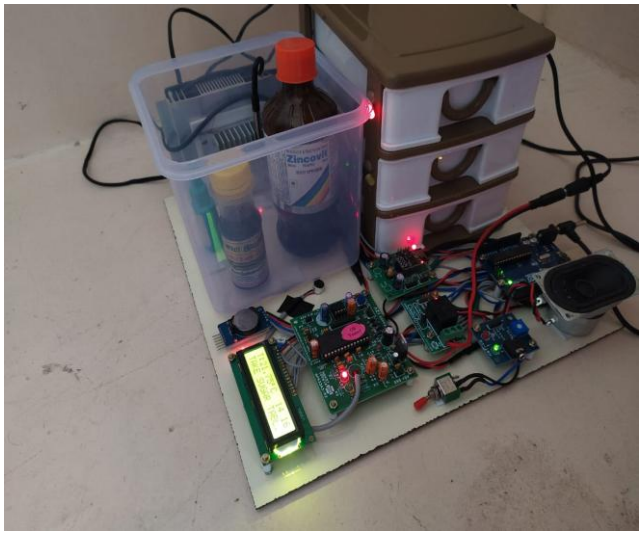

Fig 9. Hardware indication to take the 1st tablet

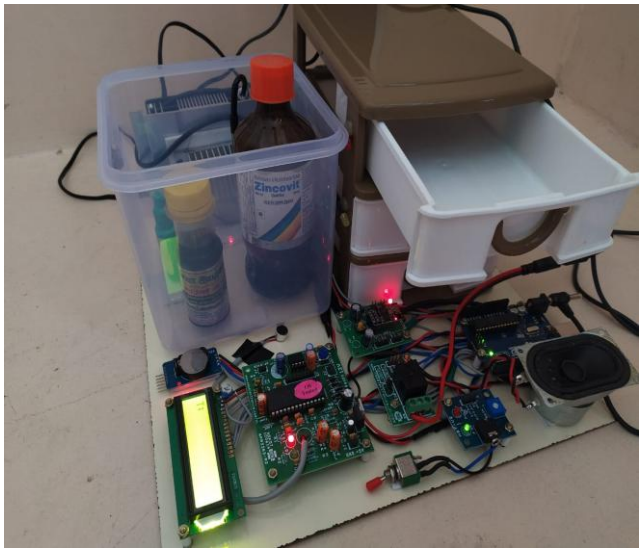

Fig 10. 1st tablet is taken

Fig 13. Status about 2nd tablet gets displayed on LCD

Fig 11. LCD displays the status of data sent for storage purpose

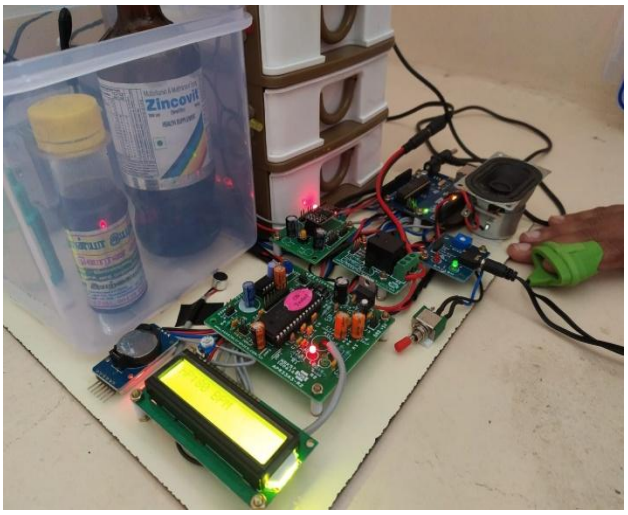

Fig 14. Lcd displays the pulse reading of the patient and gets stored

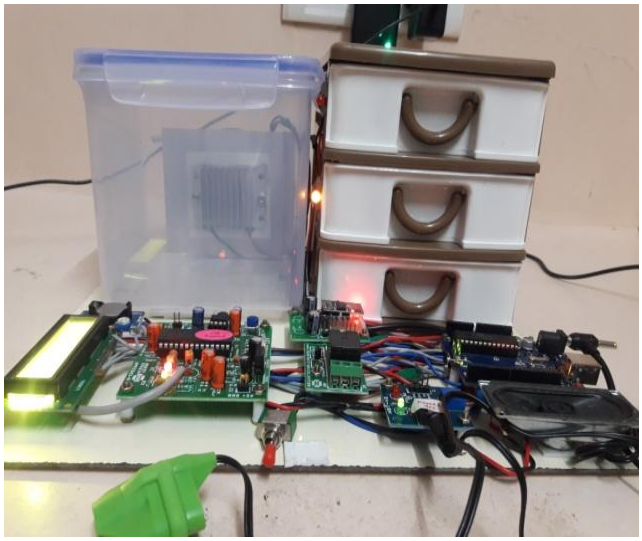

Fig 12. Hardware indication to take 2nd tablet

Fig 15. ThingSpeak displays updated status about medications and pulse reading

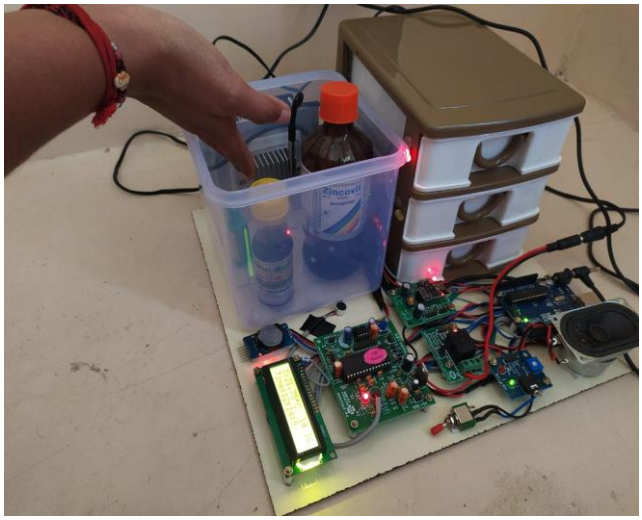

Fig 16. Cooling system gets switched on whe temperature gets above 20 degree celsius

Fig 17. Status about 1st tablet gets stored along with respective timings

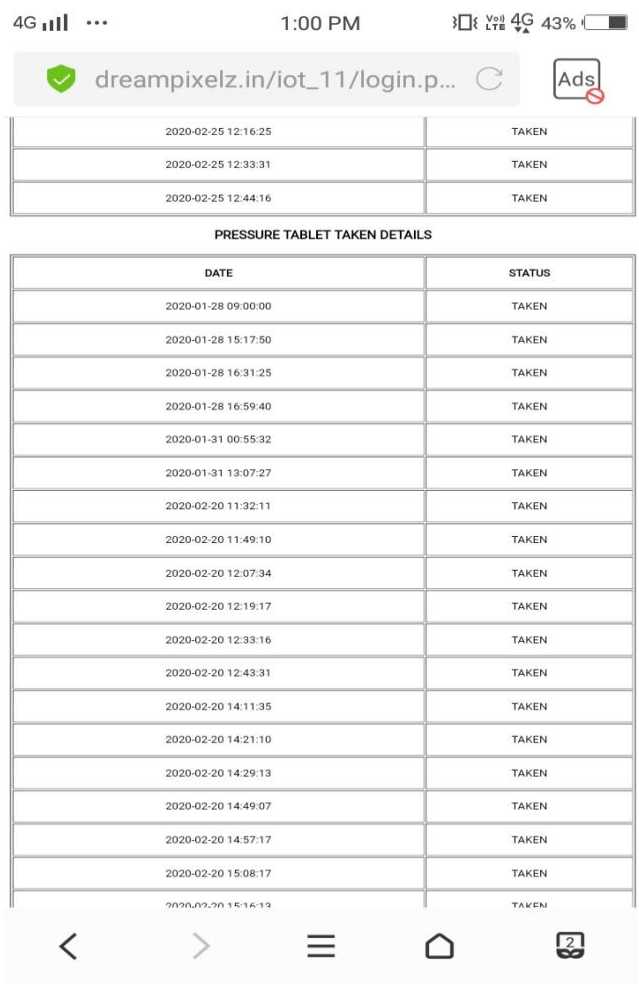

Fig 18. Status about 2nd tablet gets stored along with respective timings

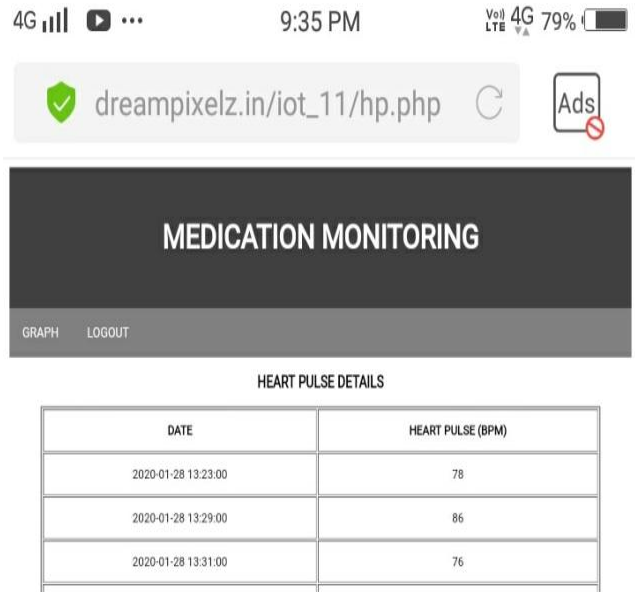

Fig 19. Pulse reading gets updated along with timing

VII. CONCLUSION AND FUTURE WORK

In this paper, a design of an IoT based medication system is proposed which was designed to serve aged peoples and independently living patients, to notify about the medications that to be taken at different intervals. The proposed design consist of different sections to store different sort of medications, within a compact zone. The system gets atomized by Arduino and can monitor the patients medication status by using open source software application. In future work, a high voltage battery can be used as a power supply for the system to get portable. In addition, it can be enhanced to network based systematization for directing the system from anyplace in the world.

REFERENCES

1. Saravanan, M., & Marks, A. M. (2018). MEDIBOX — IoT enabled patient assisting device. 2018 IEEE 4th World Forum on Internet of Things (WF-IoT).
2. Serdaroglu, K., Uslu, G., & Baydere, S. (2015). Medication intake adherence with real time activity recognition on IoT. 2015 IEEE 11th International Conference on Wireless and Mobile Computing, Networking and Communications (WiMob).
3. Parra, J. M., Valdez, W. F., Guevara, A. P., Cedillo, I. P., & Ortíz-Segarra, J. (2017). Intelligent PillBox: Automatic and Programmable Assistive Technology Device. Biomedical Engineering.
4. Jayanth, S., Poorvi, M. B., & Sunil, M. P. (2016). MED-Alert: An IoT device. 2016 International Conference on Inventive Computation Technologies (ICICT).
5. Mayuresh Waykole, Vatsalya Prakash, Himanshu Singh, Nalini N (2016). ArduMed - Smart Medicine Reminder for Old People international Journal of Scientific & Engineering Research.

AUTHORS PROFILE

S. Kiruthiga, ME, Assistant professor in Sri Krishna College of Technology, Coimbatore. She has completed Master of Engineering in VLSI design and Bachelor degree in Electronics and Communication Engineering. Published more than 8 research papers in reputed journals.

B. Arunthadhi, UG Scholar, Department of Electronics and Communication Engineering, Sri Krishna College of Technology, Coimbatore.

R.Deepthyvarma, UG Scholar, Department of Electronics and Communication Engineering, Sri Krishna College of Technology, Coimbatore.

V. R. Divya Shree, UG Scholar, Department of Electronics and Communication Engineering, Sri Krishna College of Technology, Coimbatore.