SRM UNIVERSITY

(Under Section 3 of UGC Act, 1956)

BONAFIDE CERTIFICATE

Certified that this project report titled "**SMART IOT ENABLED INTELLIGENT - HEALTH MEDICINE DEVICE**" is the bonafide work of " **ARPANA ARLAND [Reg No: RA1511004010706], SUSHANT KUMAR [Reg No: RA1511004010713], NITIN ASTHANA [Reg No: RA1511004010717], PRATEEK SRIVASTAVA [Reg No: RA151 1004010721],** ", who carried out the project work under my supervision along with his batch mates. Certified further, that to the best of my knowledge, the work reported herein does not form any other project report on the basis of which a degree or award was conferred on an earlier occasion for this or any other candidate.

SIGNATURE

Mrs. V Padmajothi
GUIDE
Assistant Professor (Sr.G)
Dept. of Electronics & Communication Engineering

SIGNATURE

HEAD OF THE DEPARTMENT
Dept. of Electronics & Communication Engineering

Signature of the Internal Examiner

Signature of the External Examiner

ABSTRACT

It is helpful to people who are forgetful about taking medicine in proper time, especially the elderly people. It can be used by nurses as well to avoid confusion in medication of patients. The time required to take medicine is not printed on medicine box or can not be read by people . Sometimes they forget to take pills. This project deals with particular time a patient needs to take pills which can be changed according to his requirement. It even ensures that right medicine at appropriate time is taken , moreover it monitors the number of pills left, if few , order of pill is sent by system to medical shop automatically through GSM.

ACKNOWLEDGEMENTS

I would like to express my deepest gratitude to HOD, Dr. T.Rama Rao, my project coordinator, Dr.J.Subhashini, panel members, Mr. Pinku Ranjan and Mrs. Showme and my guide, Mrs. V. Padmajothi , their valuable guidance, consistent encouragement, personal caring, timely help and providing me with an excellent atmosphere for doing research. All through the work, in spite of their busy schedule, they have extended cheerful and cordial support to us for completing this research work.

Arpana Arland

Sushant Kumar

Nitin Asthana

Prateek Srivastava

TABLE OF CONTENTS

LIST OF FIGURES

ABBREVIATIONS

DA	Data Aanalytics
GSM	Global System for Mobile communications
IoT	Internet of Things
RFID	Radio-frequency identification

CHAPTER 1

INTRODUCTION

Drugs, the most common medical intervention, are an important part of medical care for older people. Without drugs, many older people would function less well or die at an earlier age. Older people tend to take more drugs than younger people because they are more likely to have more than one chronic medical disorder, such as high blood pressure, diabetes, or arthritis. Most drugs used by older people for chronic disorders are taken for years. Other drugs may be taken for only a short time to treat such problems as infections, some kinds of pain, and constipation. This medicine box is helpful to people who are forgetful about taking medicine in proper time, especially the elderly people. It can be used by nurses as well to avoid confusion in medication of patients. The time required to take medicine is not printed on medicine box or can not be read by people. Sometimes they forget to take pills. This project deals with time a patient needs to take pills which can be changed according to his requirement. It even ensures that right medicine at appropriate time is taken, moreover it monitors the number of pills left, if few, order of pill is sent by system to medical shop automatically through GSM.

CHAPTER 2

LITERATURE SURVEY

The advancement of technology and day to day living is not only a boon but curse as well. Lifestyle of people has become hectic. This has given rise to medical disorders such as high blood pressure, diabetes, arthritis etc. Managing health along with busy schedule life is very difficult. So, we wanted to sort the medication procedure for people by combining some ideas. There existed projects to for people to segregate the medication to ease of use. Mobile reminders, applicatons etc were used for such cause. We finally took ideas from few paper and added some concept to provide an advanced manner of medication for any individual. [1] An IoT-Aware Architecture for Smart Healthcare Systems. Luca Catarinucci- Automatic monitoring and tracking of patients, personnel, and biomedical devices with a complex network infrastructure relying on a CoAP, 6LoWPAN, and REST paradigms has been implemented. [2] A Health-IoT Platform Based on the Integration of Intelligent Packaging- IoT-based intelligent home-centric healthcare platform connects smart sensors attached to human body for physiological monitoring and pharmaceutical packaging for daily medication. [3] An Electronic Pillbox for Continuous Monitoring of Medication Adherence- Magic Medicine Cabinet which used RFID to identify which medications were taken out of a cabinet, face recognition to identify who approached the device, and a broadband connection to be able to provide an integrated situation health portal. Thus, users were required to use the medicine cabinet and to store all medications in separate bottles that could be RFID tagged. [4] Reconfigurable Smart Factory for Drug Packing in Healthcare Industry 4.0.- Industry 4.0, which exploits CPS and represents digital transformation of manufacturing, is deeply affecting healthcare as well as other traditional production sector. To accommodate the increasing demand of agility, flexibility, and low cost in healthcare sector, a data-driven reconfigurable production mode of Smart Factory for pharmaceutical manufacturing is proposed in this paper. The architecture of the Smart Factory is consisted of three primary layers, namely perception layer, deployment layer and executing layer. [5] Effective ways to use Internet of Things in the

field of medical and smart health care.The Internet of Things (IoT) is a new concept that allows users to connect various sensors and smart devices to collect real-time data from the environment. However, it has been observed that a comprehensive platform is still missing in the e-Health and mHealth architectures to use smartphone sensors to sense and transmit important data related to a patients health.In this paper contribution is made twofold. Firstly, the existing literature has been critically evaluated, which discusses the effective ways to deploy IoT in the field of medical and smart health care. Secondly, we propose a new semantic model for patients e-Health. The proposed model is named as k-Healthcare makes use of 4 layers; the sensor layer, the network layer, the Internet layer and the services layer. All layers cooperate with each other effectively and efficiently to provide a platform for accessing patients health data using smart phones.

CHAPTER 3

THEORY METHODOLOGY AND ALGORITHM

3.1 Theory

The Networking and Communications area focuses on the design and performance evaluation of communication systems and data networks of all kinds, including wireless/cellular, optical, ultra-low power, vehicular, mobile, wearable, data center networks, cyber physical systems, and the Internet. Methods range from analyzing and refining existing approaches to the development of new and evolving networking techniques and systems.

3.2 Methodology

The design process of our project started with the decision making of the project title. The group members brainstormed together to come up with a suitable project. After deciding on one specific title, consultation with the lecturer was done, and the lecturer approved our title. We proceed to the proposal part of the project. The literature review was done, and all requirements for the proposal was analyzed. After completing the literature review, the proposal was complete. Therefore, after completing the proposal, we make an analysis on the system that we are going to use; software and hardware designing process can take place. We then test the prototype for any problem and the presentation will take place with a full report to submit.The hardware setup is first made with coding simulation. The code is run after which the Radio-frequency identification (RFID) tag is scanned. This leads to rotation of the servo motor which opens the box.Now when we place our hand inside the box the sensors (IR, Ultrasonic)start taking reading.Each time the hand is put it is considered that a pill has been taken out which the sensors simulation measures. At the same time this information of leftover pills is

sent to cloud.The box also incorporats an emergency button which on being pressed, sends an emergency message to the concerned authorities.

3.3 Algorithm

1. Coding for the setup is run.
2. Servomotor rotates hence box opens.
3. Hand is put inside box.
4. It is assumed that only one pill is taken out each time hand is placed inside box.
5. Sensors(PIR,Ultrasonic) measures reading and updates it.
6. This information of sensors is sent to cloud through NodeMCU.
7. In case of emergency, patient presses emergency button which sends message to concerned person through GSM.

3.4 Flowchart

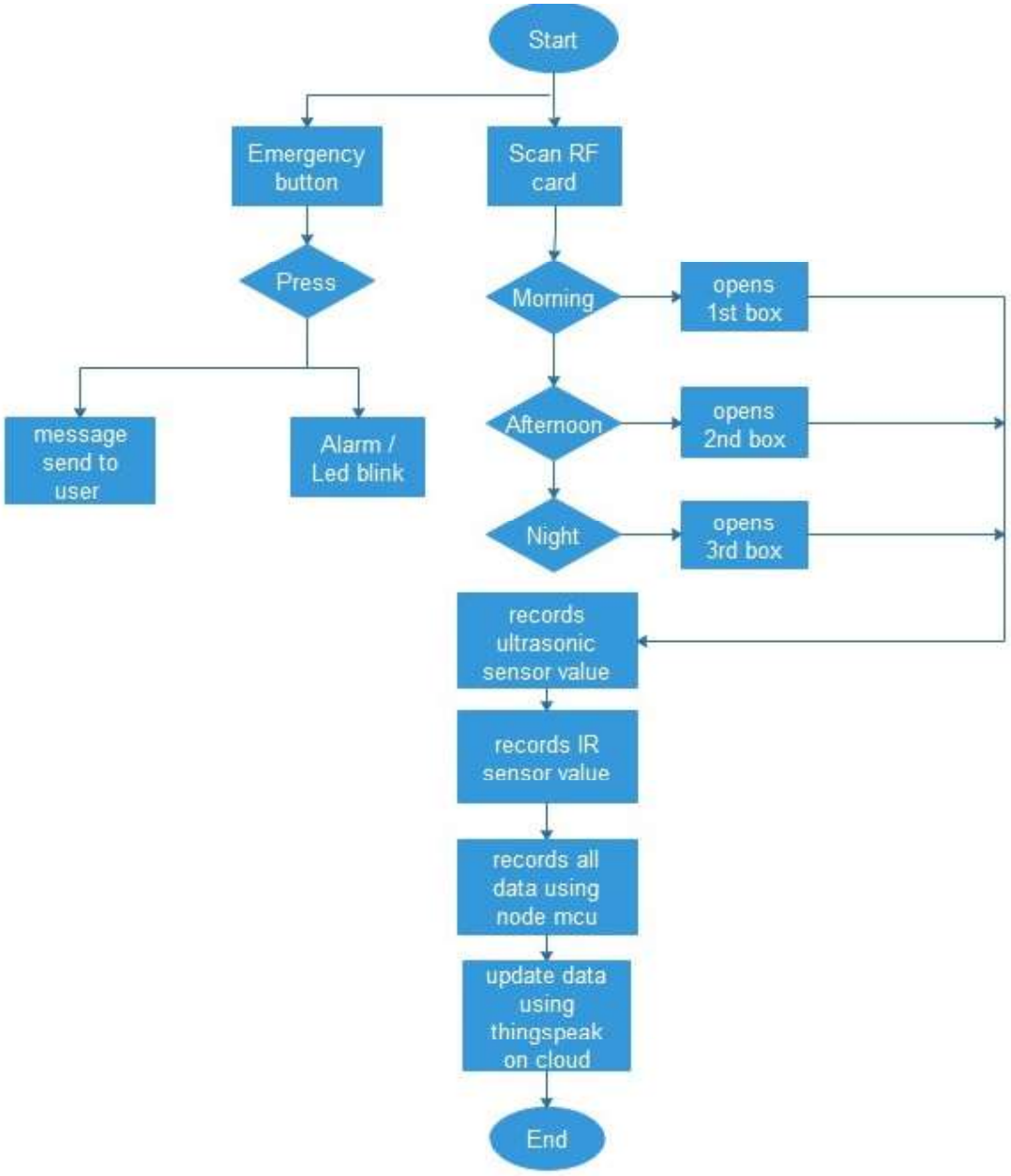

Figure 3.1: Flowchart

3.5 Flowchart Description

3.5.1 Arduino AT MEGA 2560

The Arduino Mega 2560 is a microcontroller board. It has 54 digital input/output pins (of which 15 can be used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller.The simulation of sensors,Global System for Mobile communications (GSM),RFID,servomotor is done on this microcontroller.

3.5.2 Ultrasonic Sensor

Ultrasonic sensors measure distance by using ultrasonic waves. The sensor head emits an ultrasonic wave and receives the wave reflected back from the target. Ultrasonic Sensors measure the distance to the target by measuring the time between the emission and reception.It senses whenever a hand is put in box to calculate the number of pills left over.

3.5.3 IR Sensor

An infrared sensor is an electronic device, that emits in order to sense some aspects of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion. The emitter is simply an IR LED (Light Emitting Diode) and the detector is simply an IR photodiode which is sensitive to IR light of the same wavelength as that emitted by the IR LED. When IR light falls on the photodiode, The resistances and these output voltages, change in proportion to the magnitude of the IR light received.It also caliberates number of pills left in box on sensing the presence of hand.It is used to provide accuracy.

3.5.4 NodeMCU

NodeMCU is an open source LUA based firmware developed for ESP8266 wifi chip. By exploring functionality with ESP8266 chip, NodeMCU firmware comes with ESP8266 Development board/kit i.e. NodeMCU Development board.It is used to take readings from sensors and upload the value of pills left in the cloud.

3.5.5 GSM

Global System for Mobile communication (GSM) is a digital cellular system used for mobile devices. It is an international standard for mobile which is widely used for long distance communication. There are various GSM modules available in the market like SIM900, SIM700, SIM800, SIM808, SIM5320 etc.SIM900A module allows users to send/receive data over GPRS, send/receive SMS and make/receive voice calls.It communicates serially with the devices like a microcontroller, PC using AT commands.On pressing the emergency button,LED glows andGSM sends message to the concerned.

3.5.6 RTC

The DS1307 real time clock (RTC) IC is an 8 pin device. The clock/calendar provides seconds, minutes, hours, day, date, month and year qualified data.

3.6 Hardware and Software Description

3.6.1 Arduino AT MEGA 2560

The Arduino MEGA 2560 has 54 digital I/O pins, 16 analog inputs and a larger space for your sketch it is the recommended board for 3D printers and robotics projects.

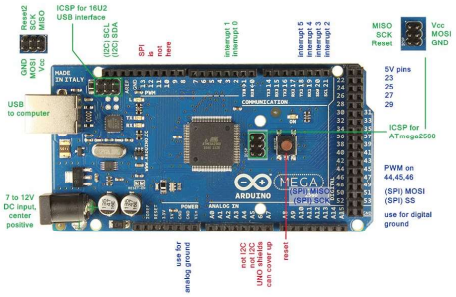

Figure 3.2: Arduino AT MEGA

3.6.2 Ultrasonic Sensor

Ultrasonic transducers are used in systems which evaluate targets by interpreting the reflected signals.

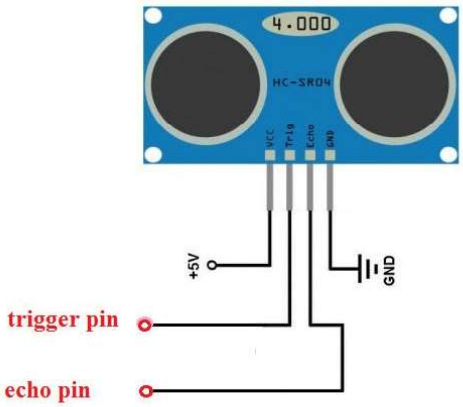

Figure 3.3: Ultrasonic Sensor

3.6.3 IR Sensor

An IR sensor can measure the heat of an object as well as detects the motion.

Figure 3.4: IR Sensor

3.6.4 Real Time Clock (RTC)

The DS1307 real time clock (RTC) IC is an 8 pin device. The clock/calendar provides seconds, minutes, hours, day, date, month and year qualified data.

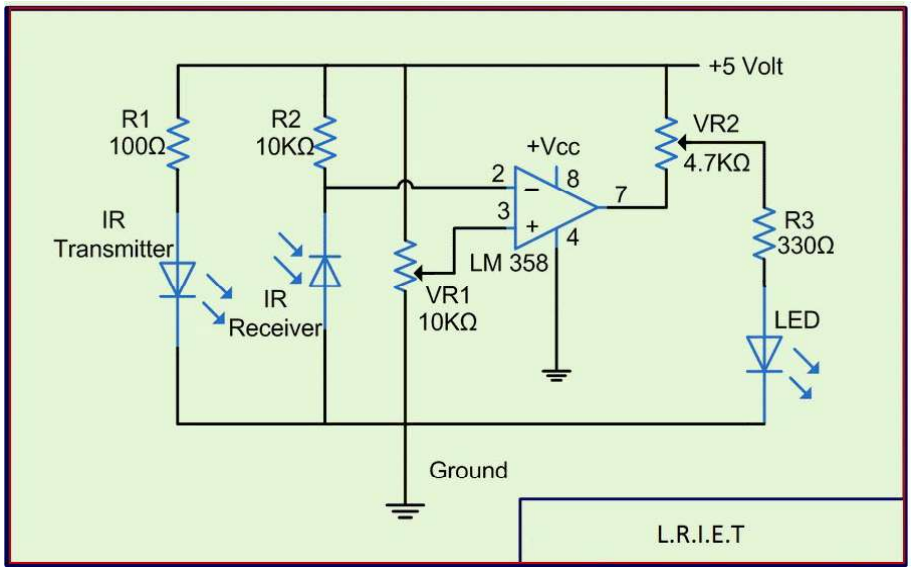

Figure 3.5: RTC

3.6.5 NodeMCU

NodeMCU is an open source IoT platform. It includes firmware which runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which is based on the ESP-12 module.

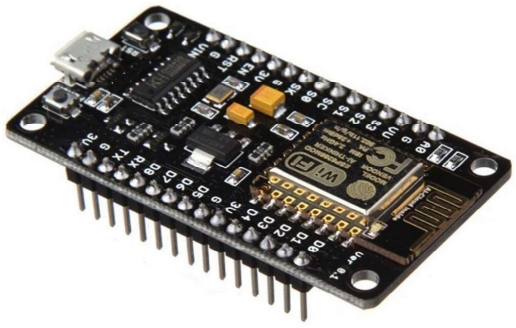

Figure 3.6: NodeMCU

3.6.6 Ubidots

Ubidots: IoT platform | Internet of Things - Connect, Develop, and Deploy IoT Applications with Ubidots Intuiative IoT Development Platform.

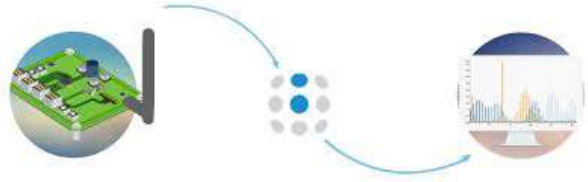

Figure 3.7: Ubidots

CHAPTER 4

SMART IOT ENABLED INTELLIGENT - HEALTH MEDICINE DEVICE

4.1 Introduction

Elderly people are forgetful of their medications and nurses get confused about medication of different patients. The appropriate time of dosage of medicine is not stated on the medicine box hence should be careful regarding that. Therefore to maintain the schedule of taking medicine, to help old person who have weak memory and nurses who get confused in giving medicine to her number of patient.It maintains the regularity of taking medicine and due to this patient can complete course of medicine easily.Single device can handle number of patient that is why it is cheap and best.

4.2 Internet of Things

The Internet of Things (IoT) refers to the concept of extending Internet connectivity beyond conventional computing platforms such as personal computers and mobile devices, and into any range of traditionally "dumb" or non-internet-enabled physical devices and everyday objects. Embedded with electronics, Internet connectivity, and other forms of hardware (such as sensors), these devices can communicate and interact with others over the Internet, and they can be remotely monitored and controlled.

4.2.1 Ubidots

Ubidots is an Internet of Things (IoT) Data Aanalytics (DA) and visualization company. We turn sensor data into information that matters for business-decisions, machine-to-machine interactions, educational research, and increase economization of global resources. Ubi exists as an easy and affordable means to integrate the power of the IoT

into your business or research.Ubidots technology and engineering stack was developed to deliver a secure, white-glove experience for our users. Device friendly APIs (accessed over HTTP/MQTT/TCP/UDP protocols) provide a simple and secure connection for sending and retrieving data to and from our cloud service in real-time. Ubidots time-series backend services are performance optimized for IoT data storage, computation, and retrieval. Our application enablement platform supports interactive, real-time data visualization (widgets), and an IoT App Builder that allows developers to extend the platform with their own HTML/JS code for private customization when desired. Ubidots exists to empower your data from device to visualization.

4.3 Explanation

The Smart Medicine Box incorporates components as; Arduino AT Mega,Ultrasonic sensor,PIR sensor ,RFID(tag and reader), Wifi module, RTC, Emergency button. Arduino AT Mega is the hub for all other components. This microcontroller co-ordinates all components working and it is the power source for them. The Ultrasonic sensor indirectly counts number of times hand has been put inside box. Similarly the PIR sensor too counts the number of times hand has been inserted. The use of two sensors is just to increase accuracy of the count. RFID (Radio Frequency Identification) tag and reader provides encryption to the box, such that patient unknowingly doesnot take wrong pills and doesnot put the bought pills into wrong box. Wifi module helps to update all information to cloud. RTC module alarms the time in which medication has to be taken while glowing its LED. Emergency button is connected with GSM to send emergency message to doctor or relatives. The project initiates its work RTC module alarms the time to take tablet. Patient then scans RFID tag to the reader, at the same time servo motor causes the respective box to open. Now when patient puts hand inside box, the sensors count the number of times hand has been put and simultaneously update the number of medicine left to the cloud. If patient needs urgent help, he can press the emergency button which sends message to the concerned people through GSM. Every prescription and medical history of patient can be stored and updated in cloud.

4.4 Simulations

4.4.1 Simulation of counts

1. The first 3 COUNT boxes, indicate how many pills are taken out from each box

2. The next 3 boxes, measures the depth of each box so as to indicate how much the box is filled(with threshold given in coding). Once the depth drops below threshold, an email is sent to care taker or relative through service@ubidots.com alerting the box is empty and requires refilling.

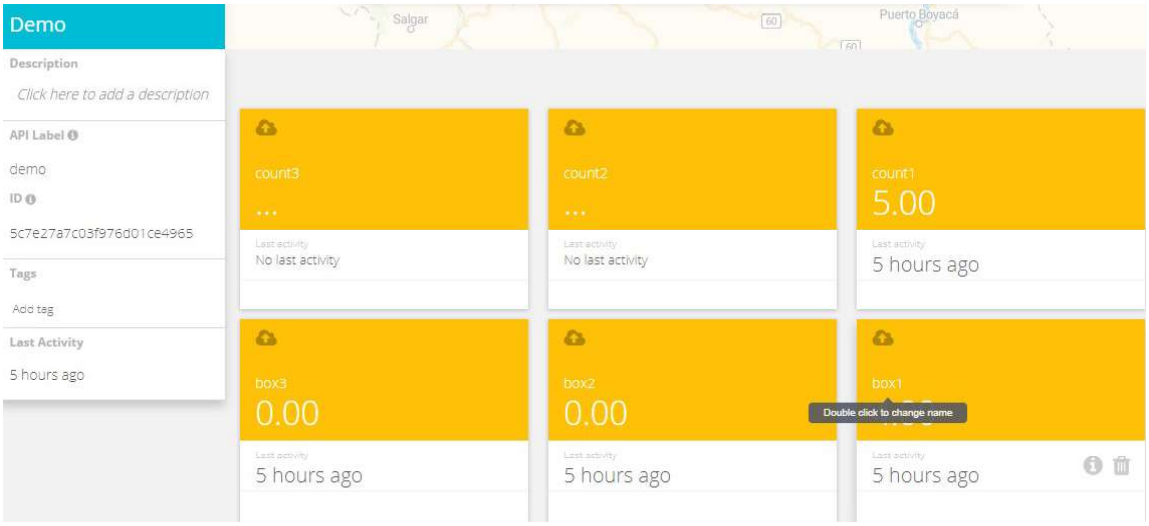

Figure 4.1: Simulation of counts

4.4.2 Record of individual box

Simulation of Depth

X axis : Time in hrs

Y axis : Depth of box

Initially when the box is empty having greater depth, it shows a peak. On being completely filled with pills, there is no peak. Again on removal of pills, the peak increases.

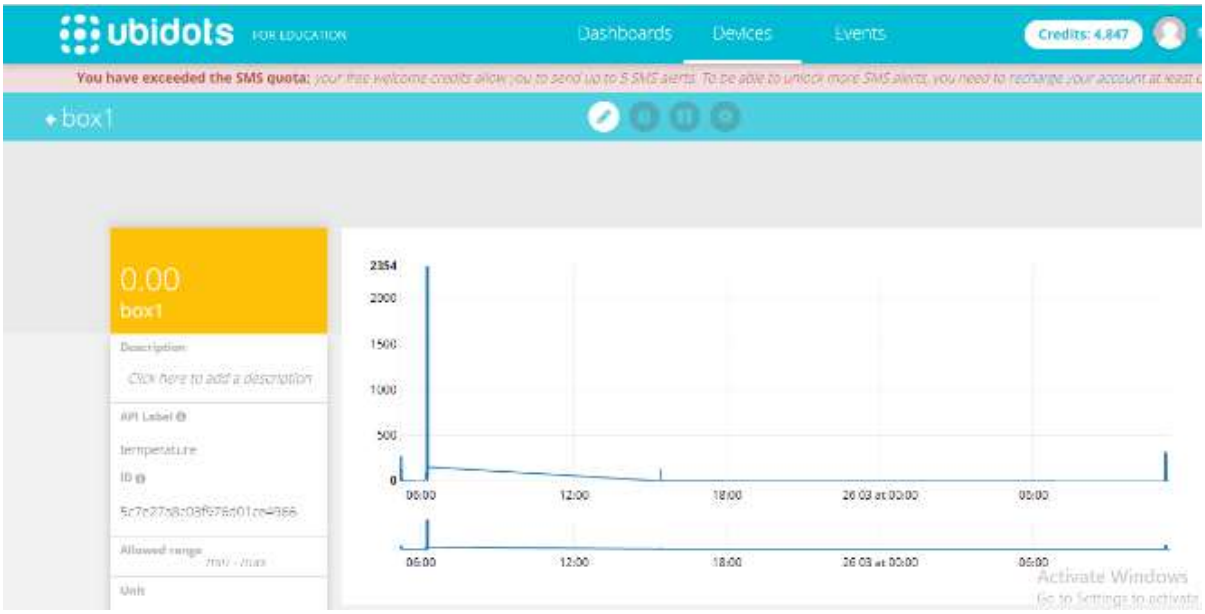

Figure 4.2: Simulation of depth

4.5 Realistic Constraints

1)Since the ultrasonic sensor on opening the box measures inaccurate reading because of its position, we're trying to correct it's reading in coding simulation such that it takes reading only when the box is closed.
2)It is assumed that whenever a hand is placed inside the box, only 1 pill has been taken out for sure.
3)Lifespan of sensors is less and hence may require replacement In case, wrong timing is updated in code, it will indicate to take medication at wrong time.
4)It needs constant power supply to work.

4.6 Multidisciplinary Tasks

1) Electronics and Communication Engineering for IoT and Node-McU.
2) Electrical Engineering for wires and Arduino Mega.
3) Instrumentation and Control Engineering for Ultrasonic and IR sensor.
4) Mechanical Engineering for servo motors.
5) Desktop publication for report.

CHAPTER 5

RESULTS AND DISCUSSION

5.1 Results

The Smart medicine box is used to maintain the regularity of taking medicine and due to this patient can complete course of medicine easily.
The project consists of three smart boxes.
After the time for taking the medicine is set, the box opens on that particular time and the indication for taking the medicine is given using LED.
We design the box in such a way that continuous monitoring on the count of the pills is done and a message is send to the user before the box gets emptied.
The algorithm was translated to arduino c code, and we optimized our implementation to reduce computation time.
The whole data of the medicine box is stored on ubidocs website and can be access by the user or care taker.
For the future use, it would be nice to have one central medicine box website and the numbers of pins of NodeMCU should be increase so that more boxes can be connected to it.

5.2 Discussion

This project was given to 5 elderly people. 3 out of 5 found it to be useful and convenient. The medicine box kept reminding individual to take medicine at correct time. They could complete their medication course without fail.
Whereas 2 out of 5 found it difficult to use. The box was not portable for every site. Sometimes they could not hear the buzzing of sensor to take medicine. They were unable to get constant power supply for the box.

CHAPTER 6

CONCLUSION

Older people experience several practical problems using their medicines, and their strategies to manage these problems are sometimes suboptimal. These problems can lead to incorrect medication use with clinically relevant consequences. The findings pose a challenge for healthcare professionals, drug developers, and regulators to diminish these problems. The correct and timely use of medication determines its therapeutic effect, yet several steps are involved in taking medicines as recommended, such as reading and understanding the user information, opening and removing the medicine from the outer and inner packaging, any preparation before use, and taking the medicine. This project aimed to resolve the practical problems that older people experience with the daily use of their medicines and their management strategies to address these problems and to determine the potential clinical relevance thereof.

6.1 Future Enhancement

1. In the future, we hope that this smart medicine box can be to link to the online med karts, if in case the tablets are empty it directly sends a prescription message to the med kart in which they can help us delivering the prescribed tablets to our door step.

2. We can also try connecting our smart phones and smart devices to the medicine box so it can keep a track of the patient's routine like his daily movement, heartbeat, blood pressure etc.

CHAPTER 7

REFERENCES

[1] , [2], [3], [4] and [5] .

REFERENCES

[1] Amato, A. and Coronato, A. (2017). "An iot-aware architecture for smart healthcare coaching systems." *2017 IEEE 31st International Conference on Advanced Information Networking and Applications (AINA)*, 1027–1034 (March).

[2] Hayes, T. L., Hunt, J. M., Adami, A., and Kaye, J. A. (2006). "An electronic pillbox for continuous monitoring of medication adherence." *2006 International Conference of the IEEE Engineering in Medicine and Biology Society*, 6400–6403 (Aug).

[3] Ullah, K., Shah, M. A., and Zhang, S. (2016). "Effective ways to use internet of things in the field of medical and smart health care." *2016 International Conference on Intelligent Systems Engineering (ICISE)*, 372–379 (Jan).

[4] Wan, J., Tang, S., Li, D., Imran, M., Zhang, C., Liu, C., and Pang, Z. (2019). "Reconfigurable smart factory for drug packing in healthcare industry 4.0." *IEEE Transactions on Industrial Informatics*, 15(1), 507–516.

[5] Yang, G., Xie, L., MÃd'ntysalo, M., Zhou, X., Pang, Z., Xu, L. D., Kao-Walter, S., Chen, Q., and Zheng, L. (2014). "A health-iot platform based on the integration of intelligent packaging, unobtrusive bio-sensor, and intelligent medicine box." *IEEE Transactions on Industrial Informatics*, 10(4), 2180–2191.

APPENDIX A

CODING

```
#include <swRTC.h>
swRTC rtc; //create a new istance of the lib
void setup()
{
rtc.stopRTC(); //stop the RTC
rtc.setTime(12,23,0); //set the time here rtc.setDate(7,3,2019);
//set the date here
rtc.startRTC(); //start the RTC
Serial.begin(19200); //choose the serial speed here delay(2000);
//delay to let the user opens the serial monitor
}
void loop()
{
Serial.print(rtc.getHours(), DEC);
Serial.print(":");
Serial.print(rtc.getMinutes(), DEC);
Serial.print(":");
Serial.print(rtc.getSeconds(), DEC);
Serial.print(" âĂŞ ");
Serial.print("Timestamp: ");
Serial.println(rtc.getTimestamp(), DEC);
if(rtc.getHours() == 12 && rtc.getMinutes() ==23 )
{
if(Serial.available() > 0)
{
String c;
c = Serial.readString(); // if data available from reader
```

```
Serial.print(c);
if(c == "$0001630441")
{
Serial.println("ID1");
14
}
}
}
if(rtc.getHours() == 12 && rtc.getMinutes() == 25)
{
if(Serial.available() > 0)
{
String c;
c = Serial.readString();// if data available from reader
Serial.print(c);
if(c == "$0001630441")
{
Serial.println("ID1");
}
}
}
if(rtc.getHours() == 12 && rtc.getMinutes() == 27 )
{
if(Serial.available() > 0)
{
String c;
c = Serial.readString();// if data available from reader
Serial.print(c);
if(c == "$0001630441")
{
Serial.println("ID1");
}
```

```
}
}
}
```

APPENDIX B

PAPER ACCEPTANCE PROOF

ICASISET19 Notification & Registration link for your paper ICASISET19-EMA-026-306 - Reg.
3 messages

ICASISET 2019 <icasiset@gmail.com> Tue 2 Apr, 2019 at 5:49 PM
To: nitin.asthana22@gmail.com, arpanaarland_rom@srmuniv.edu.in, prateek071996@gmail.com, sushant2981@gmaik.com

Dear **Arpana Arland, V Padmajothi, Nitin Asthana, Prateek Srivastava,Sushant Kumar,**

We are pleased to inform you that your paper, "**Smart IoT Enabled Intelligent Health Medicine Dispenser System**" has been accepted for presentation in **INTERNATIONAL CONFERENCE ON ADVANCED SCIENTIFIC INNOVATION IN SCIENCE, ENGINEERING AND TECHNOLOGY (ICASISET- 2019)**. Please remember to quote the paper id, "**ICASISET19-EMA-026-306**" whenever inquiring about your submission.

You can **pay your registration fee for Conference on or before 5th April 2019** by using the following links:

https://coredroidtech.com/payments.php (Link for Payment Gateway)

Note:

- **Ø Before making payment in the above link, calculate your amount including co-author certificate as per your category in the given table**
- Ø First Author Certificate cost is included with registration fee itself. **If Certificate(s) required for Co-authors, Need to pay Rs. 300/- per certificate additionally. (From second author onwards).**
- Ø Journal payment and Conference payment can be done as separate also.
- **Ø Your article is accepted to publish in Scopus / UGC Journals with additional payment.**
- **Ø If you want to publish in Sci Journal kindly contact us through E-Mail/ Watsapp.**

Conference Fee Categories (*Category will be considered based on the First Author in the Article)	Indian	International
Student	INR 1500	USD 75
Research Scholar	INR 1750	USD 100
Academician/ Industrial Professionals	INR 2000	USD 125
Listener	INR 750	USD 25
Co -Author Additional Certificate	INR 300	USD 8

Journal Fee Categories (Processing Charges are applicable all Journals in the same categories) For journal details kindly visit: http://www.icasiset.com/	Amount
Scopus Indexed Journals	INR 8500
UGC Indexed Journals	INR 2500
Springer Book Chapter	INR 5500
Sci Indexed Journals	Payment details will be given later

Kindly send the following details along with final version of research paper (.doc / .docx format only) & Payment proof on or before 5/April/2019 to icasiset@gmail.com. (Including those who are already done payment through Chronicle Manager Login also kindly send the below details to icasiset@gmail.com without fail.)

1. Paper ID :
2. Paper Title:
3. Author(s) Name: (As given in the paper order)
4. First Author Category: (Student / Research Scholar / Academician/ Industrial Professionals)
5. Certificate Required Author(s): (It's Purpose of Printing Certificate. Type without spelling mistake as you required.)
   * Kindly mention the (First Author Name & Additional Amount paid Author(s) for Certificate) only
6. Total Amount Paid : Rs_____ For Conference :Rs._____ For Journal: Rs._____

Figure B.1: Paper acceptance proof

APPENDIX C

PLAIGARISM PROOF