SMART CAP

A mini-project report submitted for
Internet of Things(Semester V)

by

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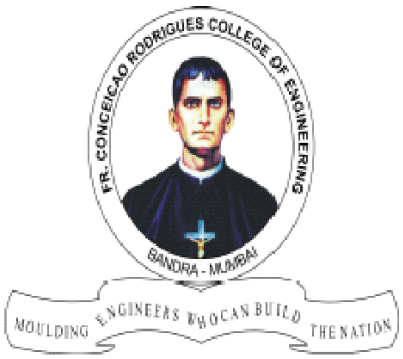
(sign with date)



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Approval Sheet

Project Report Approval

This project report entitled by **Smart Cap using** by **Nimisha Bhoir, Rincy Pereira and Sanil Rodrigues** is approved as mini project in Third year Engineering, Information Technology.

Examiners

1._____

2._____

Date:

Place:

Abstract

In today's era, where diseases like heart-attacks,cancer,TB etc are affecting human health in great proportion, new trend of heat-stroke has come up which is very harmful for human health. Due to pollution, global-warming various harmful UV rays are generated. As technology is upgrading day-by-day, man is also trying to upgrade his lifestyle,needs day-by-day.This leads to Competition. Due to this he has become busy in his daily routine and neglecting his health. To prevent human health and such dangerous situation the proposed device is designed with early notification ability. .In addition if any dangerous situation is detected the device is designed in such a way a buzzer that will activate alert function to remind or alert the user to respond adequately to avoid heat-stroke. The device is capable to send temperature data to cloud ad plot a graph based on temperature readings which will give graphical representation of rates in which heat-stroke is occuring.

Keywords :-heat-stroke,ThingSpeak,buzzer,notification ability,WHDD.

Table of Content

Lab Outcomes

LO1: Identify the requirements for the real world problems.

LO2: Conduct a survey of several available literatures in the preferred field of study.

LO3: Study and enhance software/hardware skills.

LO4: Demonstrate and build the project successfully by hardware requirements, coding, emulating and testing.

LO5: To report, present and demonstrate an ability to work in teams and manage the conduct of the research study.

Rubrics for the assessment (LO1):

Indicator	Very Poor	Poor	Average	Good	Excellent
Timeline (2)	More than a 3session late (0)	More than a 2session late (0.5)	More than a 2session late (1)	More than a 1session late (1.5)	Early or on time (2)
Identify real world problems(4)	NA (0)	Very poor identification of real world problems(1)	Poor identification of real world problems(2)	Good identification of real world problems.(3)	Accurate identification of the real world problems. (4)
Design the problem solution (4)	No requirement analysis is done(0)	Very poor requirement analysis is done(1)	Poor requirement analysis is done(2)	Good requirement analysis is done(3)	Requirement analysis done with best solution design(4)

Marks:

Rubrics for the assessment (LO2):

Indicator	Very Poor	Poor	Average	Good	Excellent
Timeline (2)	More than a 3session late (0)	More than a 2session late (0.5)	More than a 2session late (1)	More than a 1session late (1.5)	Early or on time (2)
Selection of Sources(8)	No information is gathered from a range of sources.(0)	Information is gathered from a limited number of sources.(2)	Sources rely heavily on a small number of sources and are not considered to be from authoritative sources(4)	Information is gathered from a range of sources but do not entirely reflect the breadth of the debate(6)	Information is gathered from a wide range of journals, books and related authoritative research materials.(8)

Formatting and Presentation of Assignment (4)	Document contains many errors in formatting, punctuation and writing was incoherent. (0)	Document contains many errors in punctuation and formatting. Referencing is not consistent with chosen style guide. Writing style lacks clarity.(1)	Document contains few errors in formatting and punctuation . Style of referencing is generally consistent with chosen style guide. Writing style is coherent(2)	Document contains few errors in formatting and punctuation . Style of referencing is generally consistent with chosen style guide. Writing style is coherent(3)	Document is professionally presented with virtually no errors in punctuation and is in the correct format. The style of referencing is consistent with chosen style guide. Writing style is clear and engaging(4)

Marks:

LO3: Study and enhance software/hardware skills.

Rubrics for the assessment:

Indicator	Very Poor	Poor	Average	Good	Excellent
Timeline (2)	More than a 3session late (0)	More than a 2session late (0.5)	More than a 2session late (1)	More than a 1session late (1.5)	Early or on time (2)
Installation of Arduino IDE/Raspbian OS(4) Programming	NA(0)	Installation not done(1)	Installation With some drivers(2)	Installation without drivers(3)	Installation with drivers done(4)
Interfacing of sensors to Arduino/Raspberry board	NA(0)	Unable to do connection and but required output not obtained.(1)	Able to do connection and but required output not obtained(2)	Able to do connection and required output is obtained and no libraries are installed(3)	Able to do connection and required output is obtained and libraries are installed(4)
Sending data on ThingSpeak ,Analysis of Data	NA(0)	No data sent onthingspeak(1)	Data sent on thingspeak and no analysis done(2)	Data sent onthingspeak and some analysis notdone(3)	Data sent on thingspeak and analysis done(4)

Marks:

LO4: Demonstrate and build the project successfully by hardware requirements, coding, emulating and testing.

Rubrics for the assessment (LO4):

Indicator	Very Poor	Poor	Average	Good	Excellent
Timeline (2)	More than a 3session late (0)	More than a 2session late (0.5)	More than a 2session late (1)	More than a 1session late (1.5)	Early or on time (2)
Code design(4)	NA (0)	Very poor code design with no comments and indentation(1)	Poor code design with very comments and indentation (2)	Design with good coding standards (3)	Accurate design with better coding standards (4)
Demo	No system set up was shown(0)	Incomplete System set up was shown.(1)	Partially Complete set up shown with working(2)	Almost Complete set up shown with working(3)	Complete set up shown with working(4)

Marks :

LO5: To report, present and demonstrate an ability to work in teams and manage the conduct of the research study.

Rubrics for the assessment (L04):

Indicator	Very Poor	Poor	Average	Good	Excellent
Timeline (2)	More than a 3session late (0)	More than a 2session late (0.5)	More than a 2session late (1)	More than a 1session late (1.5)	Early or on time (2)
Teamwork and cooperation(4)	The project appears to have been carried out by only minimal (1-2) members for different tasks. (0)	) The project appears to have been carried out by only by 2) members	. The project was carried out by most (3-4) members	The project was carried out by most (3-4) members	The project was carried out by all members.
Formatting andPresentation of Report (4)	Document contains man y errors in formatting, punctuation and writing was incoherent. (0)	Document contains many errors in punctuation and formatting. Referencing is not consistent with chosen style guide.	Document contains few errors in formatting and punctuati on . Style of referencing is generally consistent with chosen	Document contains few errors in formatting and punctuati on . Style of referencing is generally consistent with chosen	Document is professionally presented with virtually no errors in punctuation and is in the correct format. The

		Writing style lacks clarity.(1)	style guide. Writing style is coherent(2)	style guide. Writing style is coherent(3)	style of referencing is consistent with chosen style guide. Writing style is clear and engaging(4)

Marks**:**

Chapter 1

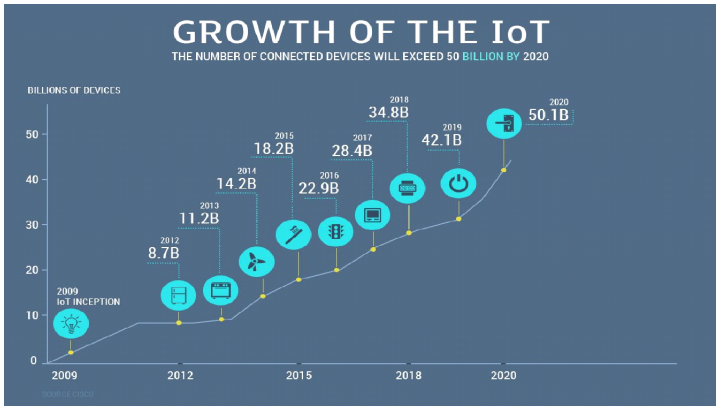
Introduction

In today's era of technology,Internet application Technology development demand is very high.These applications and technologies have made everything available for our humans at the tip of our hands.In one click we can buy various useful things we want ,we can control even our home through various technologies.Such major technology is IoT i.e(Internet of Things).

Internet of Things is basically a network that connects all the physical objects to the internet through network devices or router and exchange data.IoT is a very good and smart technique that reduces human effort as well as easy access to physical devices."Things" in IoT sense, is a combination of hardware software and services.

In early 1982, the concept of network of smart devices was introduced by a modified coke machine.This machine was modified at"Carnegie Mellon University" and became the first Internet-connected appliances.In 1994 the idea of IoT was highlighted by Reza Raji as small packets of data to a large set of nodes, to integrate and automate everything from home appliances to entire factories.The thought of IoT first became popular in 1999.The term Internet of Things was first used by a British entrepreneur Kevin Ashton during he worked at Auto-ID labs. In the present scenario, near field communication,barcode scanners, QR code scanners, and digital watermarking are the various devices that are working on IoT. [6]

The picture given below depicts the growth of IoT in recent years.



Various practical applications of IoT are as follows:-

1.Wemo Switch Smart Device:

It is the most useful devices which connected home devices in a Switch smart plug.It accepts the power cable from any device and can be used to turn it on and off on a hit button on the smartphone.

2. Enterprise:

In the enterprise field many applications are there like environmental monitoring system,smart environment etc.

3.Utilities:

Smart metering,smart grid and water monitoring are the most helpful applications in utility area.

4.Transportation:

Electronic Toll Collection is best example in this field.Another examples of this field includes 2-Way Intersection with Pedistrian walk cycle,Bluetooth Enabled Bicycle Turn Signal,Voice Controlled car etc.[6]

5. Medical and Healthcare:

Remote health monitoring system with emergency notiifcation ability is an example of IoT in medical field. Health patch Health Monitor machine can be used for the patient who cannot go to doctors,letting them get ECG,heartrate body posture, temperature avd activity readings remotely.IoT can be used for patients, Physicians, Hospitals etc.

IoT for Patients - Devices in the form of wearables like fitness bands and other wirelessly connected devices like blood pressure and heart rate monitoring cuffs, glucometer etc. give patients access to personalized attention. These devices can be tuned to remind calorie count, exercise check, appointments, blood pressure variations and much more.IoT has changed people's lives, especially elderly patients, by enabling constant tracking of health conditions. This has a major impact on people living alone and their families. On any disturbance or changes in the routine activities of a person, alert mechanism sends signals to family members and concerned health providers.

IoT for Physicians - By using wearables and other home monitoring equipment embedded with IoT, physicians can keep track of patients' health more effectively. They can track patients' adherence to treatment plans or any need for immediate medical attention. IoT enables healthcare professionals to be more watchful and connect with the patients proactively. Data collected from IoT devices can help physicians identify the best treatment process for patients and reach the expected outcomes.

IoT for Hospitals - Apart from monitoring patients' health, there are many other areas where IoT devices are very useful in hospitals. IoT devices tagged with sensors are used for tracking real time location of medical equipment like wheelchairs, defibrillators, nebulizers, oxygen pumps and other monitoring equipment. Deployment of medical staff at different locations can also be analyzed real time.The spread of infections is a major concern for patients in hospitals. IoT-enabled hygiene monitoring devices help in preventing patients from getting infected. IoT devices also help in asset management like pharmacy inventory control, and environmental monitoring, for instance, checking refrigerator temperature, and humidity and temperature control.[9]

Chapter2

Problem Definition

Construct a Smart Cap that prevents heat stroke with early notification ability.The device is able to give graphical view regarding amount of time the user has been in heat or hot area and also store previous years database of users who suffered from heat stroke.Blynk app notifies user about the Heat Stroke Alert.A buzzer beeps for 15 seconds if the temperature of user matches with temperature at which heat stroke occurs.

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Chapter3

Literature Survey

Workers in many fields – construction, landscaping, oil and gas extraction, emergency response, firefighters among others – toil in high heat stress conditions. These tasks can lead to rapid increases in body temperature that raise the risk of heat related illnesses. Wearable technology advances have made it possible to monitor one or more physiological factors of heat strain. R&D trials and pilots come from sports performance, the military, NASA, and start-up companies. After all, many workers are considered industrial athletes, and many wear heavy personal protective equipment (PPE) akin to soldiers.One technological example: a wearable heat-stroke-detection-device has early notification capability. Physical sensors, such as galvanic skin response, heart beat, and body temperature, collect medical data from working individuals. A risk evaluation functional component detects the signals of heat stroke for users. If a dangerous situation is detected, the device activates an alert function to remind the user to respond appropriated – add safely – to avoid heat stroke. Technology developers are also focusing on resolving the trade-off between sensor accuracy and user comfort. The goal is to have an accurate sensor that is still comfortable to wear for long periods of intensive use. Much trial and testing is ongoing to tackle this challenge.[1]

There are a few studies and research done on the development of a device to alert the parents of an unattended child left in a car in recent years. However, all the inventions are yet to provide an effective and comprehensive warning and feedback system for the unattended child in the car . There are also some products being sold in the market that parents can buy to prevent such a death-defying situation from occurring, but they are mostly unreliable and inconsistent . Types of product that are currently available in the market can be divided into three categories i.e. seat based reminder system, buckle based reminder system, and reminder system installed in car. The first kind of heatstroke detection system is through attaching the device to the car seat. The device is placed at the base of the seat which usually makes use of pressure sensor to determine the presence of a child. It comes with an alarm system that can be hooked as a keychain or installed on a phone. The alarm device is connected to the sensor on the seat via a communication medium such as radio frequency, Wi-Fi or Bluetooth. The alarm device alerts the driver when the device is set apart and a weight is detected on the seat. A study that reported the problem with pressure sensing products was due to positioning of the pressure sensors .There are also products that are attached to a baby seatbelt buckle to determine the presence of the child. It uses a sensor to sense if the seatbelt tongue is connected to the buckle. The alarm system functions similarly to the pressure type detection system where the alarm system will go off if the child is left buckled to the seat and the parents has gone off to a certain distance away from

the car. There are also some problems with this type of system as it works with the condition that the child is buckled up to the seat. The weakness of this type of detection system is that if the child is unbuckled or the child unbuckles by himself from the seat, it will fail to trigger.There is also a type of heatstroke detection system that is installed within the car. This kind of device usually uses a human presence sensor to determine if a child is being left unattended in the car. The examples of sensors that can sense the presence of a human being are thermal sensor, carbon dioxide sensor, motion sensor, facial recognition.[2]

The paper presented a novel application, HeatWatch, which predicts heatstroke and prevents heatstroke by ensuring users breaking and water intake. The application estimates user's core temperature based on human thermal mode land vital sensors equipped with smart watches. The device tracks user's water intake by assuming to apply existing activity recognition technique to acceleration sensors inside a smart watch. Application is used to detect heatstroke sign and evaluated its performance through a real data set over100 hours. Finally, the result showed that our method is able to instantly notify high temperature states with more than 0.9recall and 0.53 precision by allowing early/late notification within 6 minutes.[3]

Chapter 4

Hardware and Software Components used in Project

Hardware Components

1. LM35 Temperature Sensor
2. DHT11 Temperature and Humidity Sensor
3. Jumper Wires
4. Buzzer
5. LED
6. Arduino
7. ESP-8266
8. Breadboard

Software Components

1. Arduino IDE
2. ThingSpeak
3. Ifttt

Chapter 5

Project Implementation

The interfacing diagram, explanation and connections-

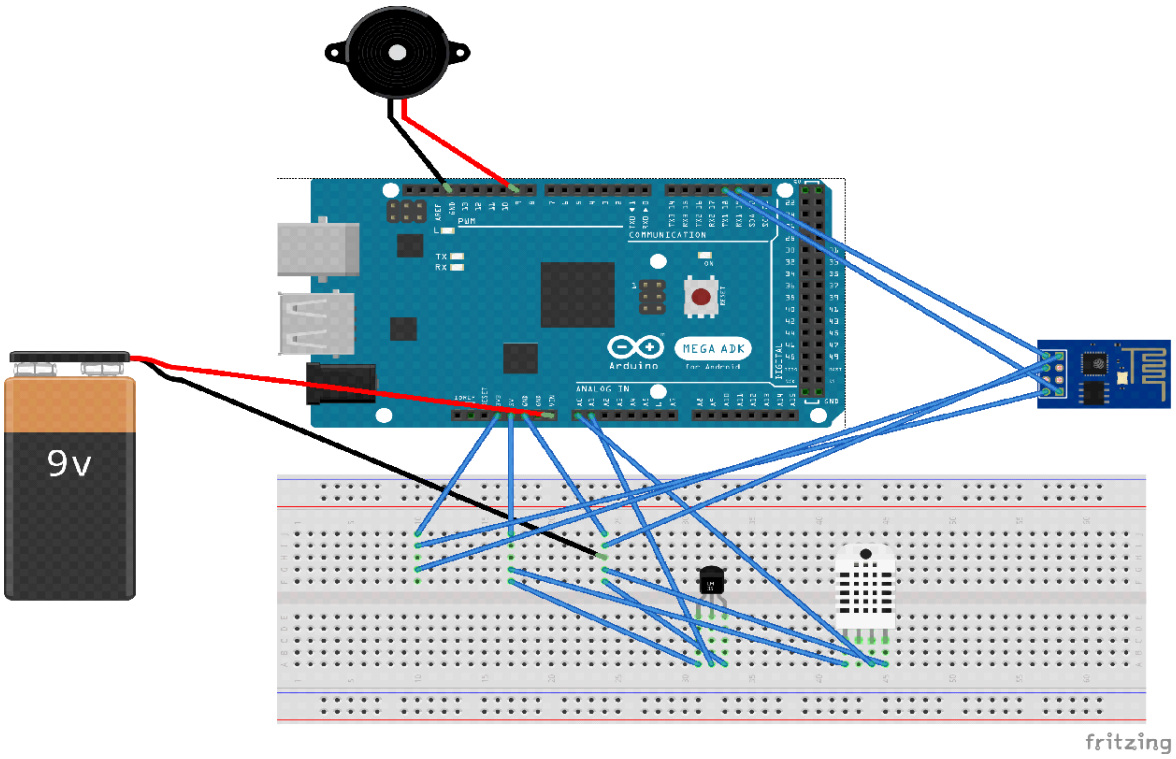


Fig.5.1

Flowchart Diagram

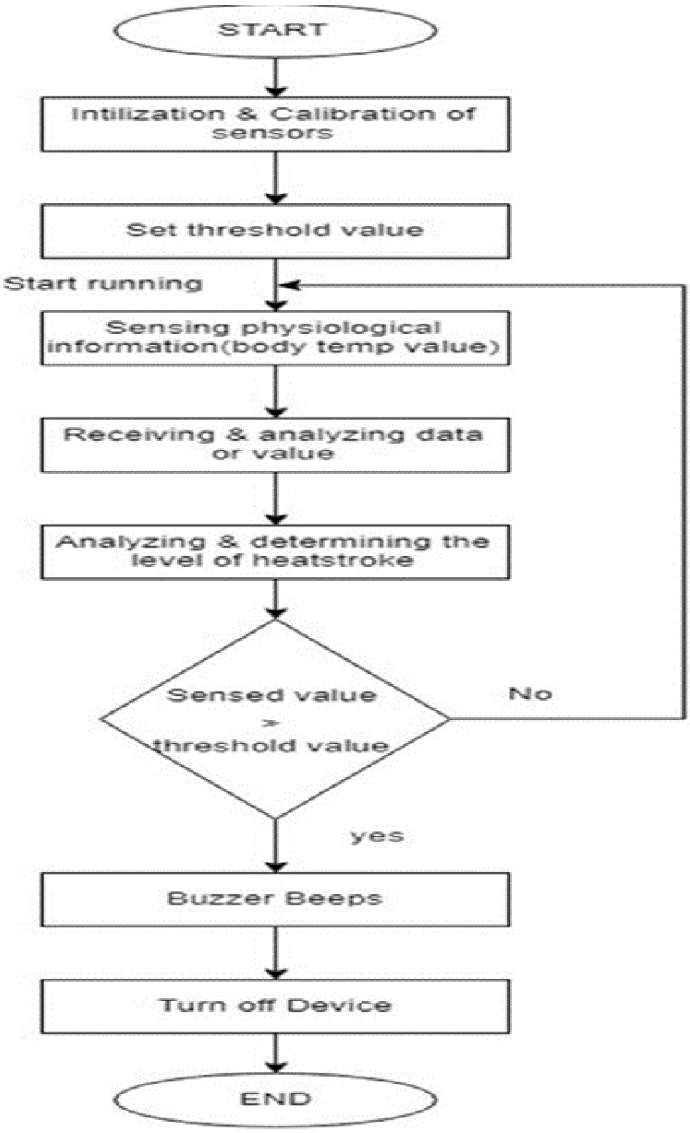


Fig.5.2

Connections:-

Arduino Mega -> LM35 (Analog Temp Sensor):-

5v -> Vcc (Left Pin - Flat side facing towards you)

A1 -> Analog Out (Middle Pin) (10mV / degree Celcious)

Gnd -> Gnd (Right Pin - Flat side facing towards you)

Arduino Mega -> DHT-11 (Temp and Humidity Sensor):-

5v -> Vcc (Left Pin)

A0 -> Analog Out (Middle Pin)

Gnd -> Gnd (Right Pin)

ESP01 -> Arduino:-

Vcc -> 3.3V

GND -> GND

TxD -> Rx1 (Pin 19)

RxD -> Tx1 (Pin 18)

CH_PD -> 3.3V

Arduino -> Buzzer:-

Pin 9 -> Buzzer +

Gnd -> Buzzer -

Working of smart cap:-

When the system is switched on the lm35 sensor will sense the body temperature and dht11 will sense the external temperature then the temperatures will be matched.before that a threshold value will be set in program for eg:-here we are keeping it above 20.so if the temperature rises above the value the buzzer will beep and user will get a notification on his mobile via

IFTTT,When the user clicks on notification he will get the graph of the data uploaded to thingspeak the data goes through the wifi module esp-8266 connected to the internet.

Chapter 6

Testing & Debugging

Test Case ID	Test Scenario	Test Steps	Test Data	Expected Results	Actual Results	Pass/Fail
TU01	Check for the temperature readings	Open the code Compile and upload Open serial monitor	Temperature present around.	User should see the temperature on Serial Monitor.	As Expected	Pass
TU02	To check the data is uploaded on cloud	Open the code Compile and upload Open thingspeak and check	The data which is collected by sensor	The data should be updated on thingspeak.	As Expected	Pass
TU03	Check if notification arrives	Open the code Compile and upload Login into your ifttt account in mobile	Temperature exceeding threshold value	Notification should arrive on mobile..	As Expected	Pass

Problems that we faced:-

1. Our biggest problem was to Implement all the things in a small space and fit it on a cap.as the cap is small and the setup was too big .so fitting everything in a small space was a challenge.

Solution:-

To fit this setup in a cap firstly the breadboard has to be removed and for that reason we made use of digital pins on arduino to give the sensors +5 or ground.

2. Secondly we faced problem while dealing with the notification part,as we were not getting an appropriate platform to send notifications.

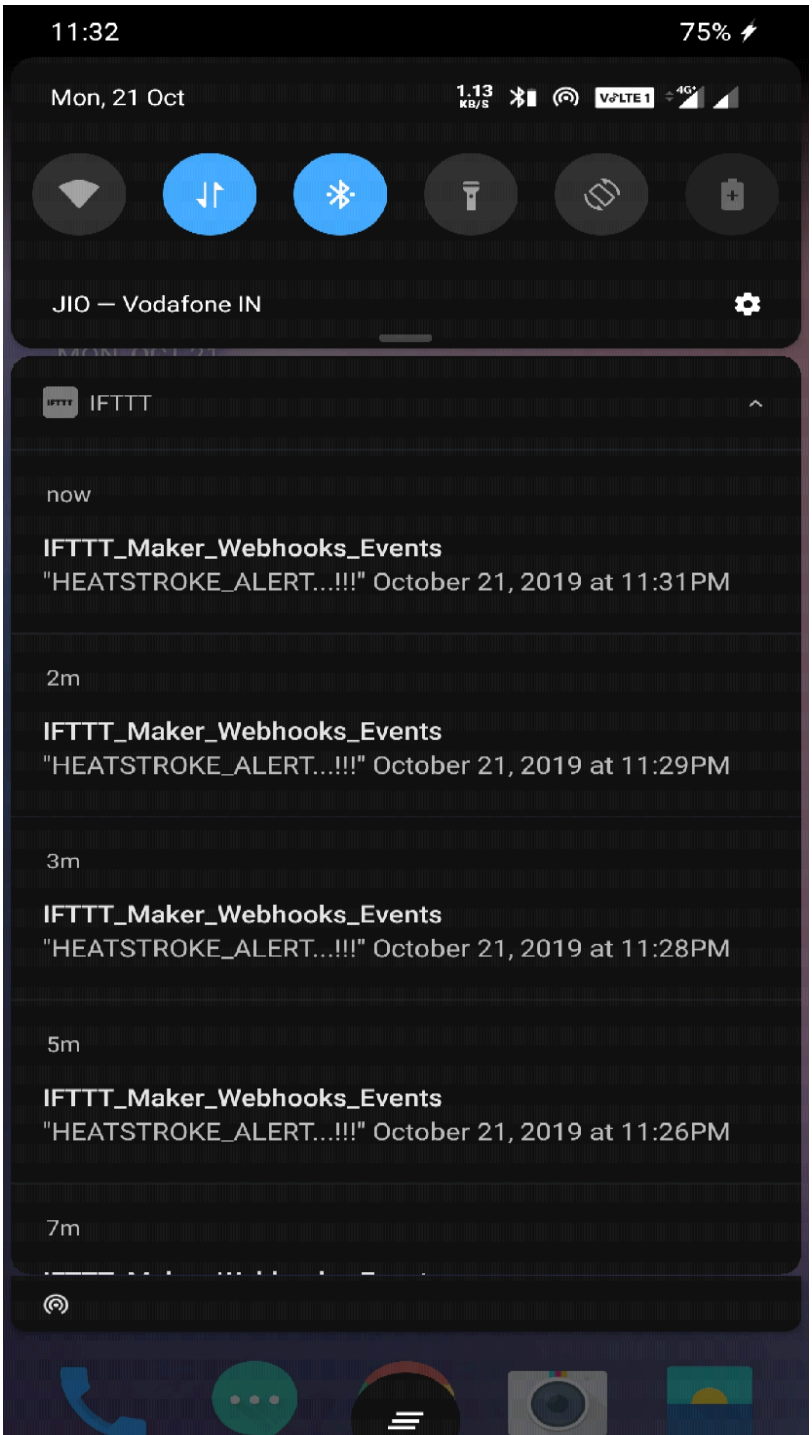
Solution:-

Instead of using lot of third party app we created the HTTPS trigger in Thingspeak itself and also the react using thingspeak.after that we used IFTTT platform to make sure that the react which is created in thingspeak is shown as a notification on a mobile phone.

Chapter 7

Results

Smart Cap Device



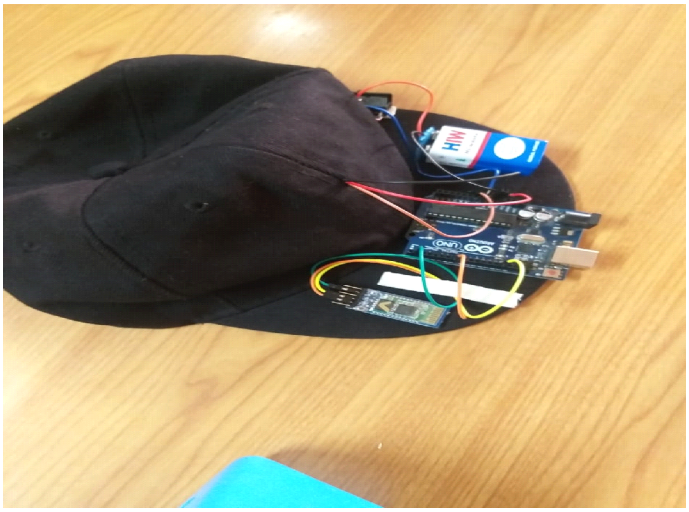


Fig.7.1

Heat-Stroke alert notification

Fig.7.2

Graphical Representation of data on Cloud

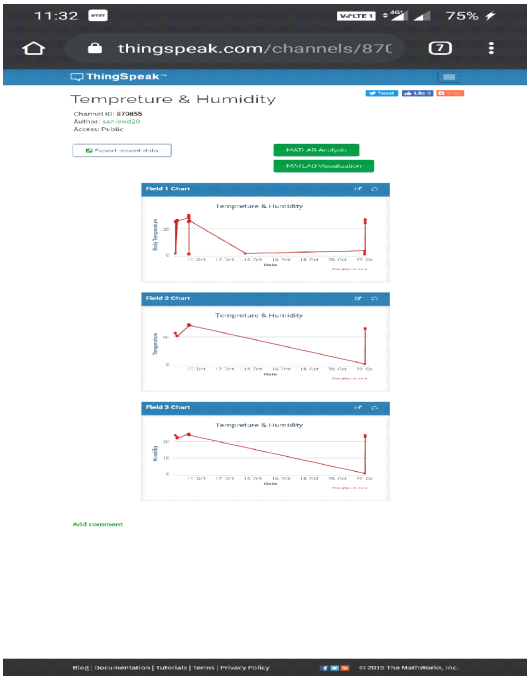


Fig.7.3

Database of previous heatstroke cases

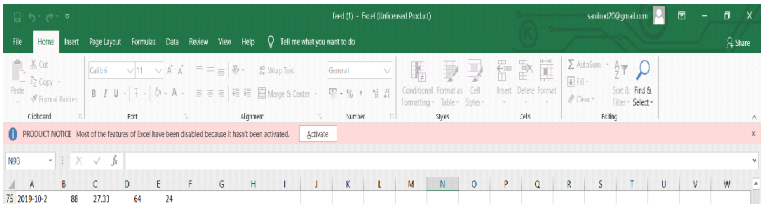


Fig.7.4

Chapter 8

Futurescope

Smart Cap device designed can be enhanced in future in following ways:-

• Various sensors can be used to make the device more useful detecting various things.

• Pulse sensor can also be added to the device for getting the accurate results for detecting a stroke.

• A current location can also be sent to the user relative if the user wearing the device is about to have a stroke.

Applications:-

• Useful for children

• Helpful for patients

• Useful for animals

• Helpful for senior citizens

• Can be preferred for other alerting systems

Chapter 9

References

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Chapter 10

Appendix

```
#include "dht.h"
#define dht_apin A0
#include <dht.h>
dht DHT;
const int lm35_pin = A1;      //declare of output  pin of temp
String apiKey = "QC88N8MC44NNNVNE";  //API key
void setup() {
  Serial.begin(9600);      // PC Arduino Serial Monitor
  Serial1.begin(115200);// Arduino to ESP Communication
  connectWiFi();           // To connect to Wifi
 }
void loop() {
  DHT.read11(dht_apin);
    Serial.print("Current humidity = ");
    Serial.print(DHT.humidity);
    Serial.print("%  ");
    Serial.print("temperature = ");
    Serial.print(DHT.temperature);
    Serial.println("C  ");
```

```
  delay(1000);
int temp_adc_val;
float temp_val;
temp_adc_val = analogRead(lm35_pin); // Read Temperature
temp_val = (temp_adc_val * 4.88); // Convert adc value to equivalent voltage
temp_val = (temp_val/10); // LM35 gives output of 10mv/°C
Serial.print("Temperature = ");
Serial.print(temp_val);
Serial.print(" Degree Celsius\n");
delay(1000);
if (temp_val >= 20 && temp_val <= 30){    //logic
   delay (9000);
   digitalWrite(9,HIGH);
   delay(15000);
   digitalWrite(9,LOW);
}
Serial1.println("AT+CIPMUX=0\r\n");      // To Set MUX = 0
delay(2000);                            // Wait for 2 sec
// TCP connection
String cmd = "AT+CIPSTART=\"TCP\",\"";   // TCP connection with thingspeak server
cmd += "184.106.153.149";                // IP addr of api.thingspeak.com
cmd += "\",80\r\n\r\n";                  // Port No. = 80
Serial1.println(cmd);                    // Display above Command
Serial.println(cmd);                     // Send above command to Rx1, Tx1
```

```
delay(20000);                    // Wait for 20 Sec
if(Serial1.find("ERROR"))              // If returns error in TCP connection
{
  Serial.println("AT+CIPSTART error");   // Display error msg
  //return;
}
// prepare GET string
String getStr = "GET /update?api_key=";
getStr += apiKey;
getStr +="&field1=";
getStr += temp_val;
getStr +="&field2=";
getStr += DHT.humidity;
getStr +="&field3=";
getStr += DHT.temperature;
getStr += "\r\n\r\n";
Serial.println(getStr);               // Display GET String
cmd = "AT+CIPSEND=";                  // send data length
cmd += String(getStr.length());
cmd+="\r\n";
Serial.println(cmd);                  // Display Data length
Serial1.println(cmd);                 // Send Data length command to Tx1, Rx1
delay(20000);                        // wait for 20sec
if(Serial1.find(">"))                 // If prompt opens verify connection with cloud
```

```
  {
   Serial.println("connected to Cloud");  // Display confirmation msg
   Serial1.print(getStr);                // Send GET String to Rx1, Tx1
  }
  else
  {
   Serial1.println("AT+CIPCLOSE\r\n");    // Send Close Connection command to Rx1, Tx1
   Serial.println("AT+CIPCLOSE");         // Display Connection closed
  }
  delay(16000);                          // wait for 16sec
}
boolean connectWiFi() {                  // Connect to Wifi Function
  Serial1.println("AT+CWMODE=1\r\n"); // Setting Mode = 1
  delay(100);                        // wait for 100 mSec
  String cmd = "AT+CWJAP=\"";         // Connect to WiFi
  cmd += "Op";                       // ssid_name
  cmd += "\",\"";
  cmd += "12345678";                  // password
  cmd += "\"\r\n";
  Serial.println(cmd);                // Display Connect Wifi
  Serial1.println(cmd);               // send Connect WiFi command to Rx1, Tx1
  delay(10000);                      // wait for 10 sec
  Serial1.println("AT+CWJAP?");       // Verify Connected WiFi
  if(Serial1.find("+CWJAP"))
```

```
  {
    Serial.println("OK, Connected to WiFi.");         // Display Confirmation msg .....first time
    return true;
  }
  else
  {
    Serial.println("Can not connect to the WiFi.");   // Display Error msg
    return false;
  }
}
```