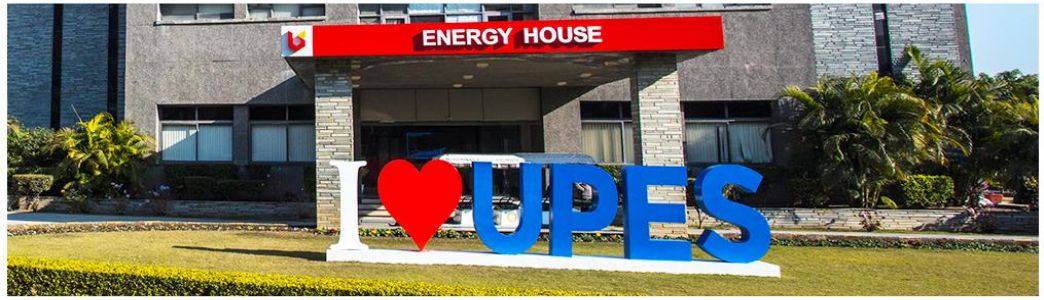

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School of Computer Science and Engineering
University of Petroleum And Energy Studies
Bidholi Campus, Energy Acres, Dehradun – 248007.

Minor-2

Project Title: IOT Based Alert Generator For Mining Workers

SUBMITTED BY:
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UNDER GUIDANCE OF :
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(Assistant Professor of Informatics)

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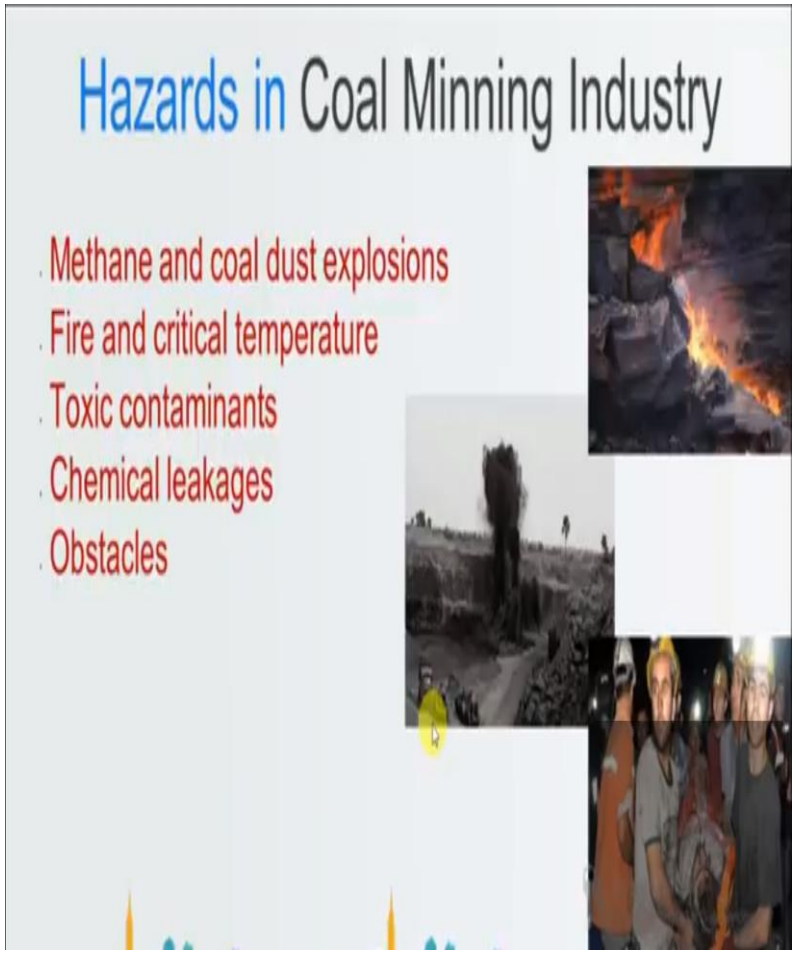
INTRODUCTION

- The most important part of any type of industry is safety.
- To avoid any types of unwanted conditions, every mining industry follows some basic precaution, Despite of several government regulations.
- Which keeps workers at high risk.



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PROBLEM STATEMENT

Our aim is to design a IOT Based Alert Generator Device for workers working in mining industries. Miners working at field are exposed to different hazardous gases. This is very harmful for their health. So There is a need to design a system to warn them when level of gases parameters are not good for their health.

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LITERATURE REVIEW

Author	Title	Contribution
Jagadeesh R, Dr. R. Nagaraja International Research Journal of Engineering and Technology (IRJET)	"IoT based Smart Helmet for unsafe event detection for mining industry"	The developed prototype is able to sense the quality of air, humidity, removing the helmet by miner, and crash of an object on head. The helmet module includes ARM7 microcontroller in conjunction with various sensors and ZigBee, while reporting module includes ZigBee at the receiving end and raspberry pi controller.
M. Naveen raj, P. Ashwin Kumar, R. Vignesh, K. Iniyan, M. Sri Krishna Prasanth International Journal of Pure and Applied Mathematics	"Internet of Things Based an Intelligent Helmet For Wireless Sensor Network"	The problem addressed in this paper was the improvement of a mining helmet in order to ensure more safety awareness between miners. When working with noisy equipment, being aware of one's surroundings can sometimes be challenging. In the mining trade miners tend to get rid of their safety gear because the gear is too significant, heat or uncomfortable to work with. So, this system is developed to intimate the authorities in critical conditions.
Shruti P. Borkar, V. B. Baru	"IoT Based Smart Helmet for Underground Mines"	A mining helmet is developed that is able to detect different types of hazardous events such as, humidity condition of mines, then temperature and existence of combustible gases, the helmet removing by miner, and light intensity inside the mines.

OBJECTIVE

IOT Based Alert Generator for Mining Workers

Sub Objective 1: Our project aims at developing real-time surveillance with early warning intelligence on harmful gases, temperature, humidity which Minimize Health Risks of Workers Within Mining Industry.

Sub Objective 2 : All these parameters are detected continuously by temperature sensor, carbon monoxide, gas sensor, humidity sensor and if they cross the pre-defined limit, then the user gets alert as the buzzer will automatically turn on with LED indications. Our project involves implementation of Wi-Fi module and add-on of heartbeat sensor to monitor the health of workers.

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METHODOLOGY

Hardware requirement

- 5v Power Supply
- Microcontrollers
- Humidity and Temperature Sensor
- Carbon Monoxide Sensor
- LCD 20x4
- LPG Gas Sensor
- Buzzer
- Wi-fi Module

Arduino

Software Requirement

- Arduino nano Atmega 328p
- Embedded C language

DHT11

MQ135

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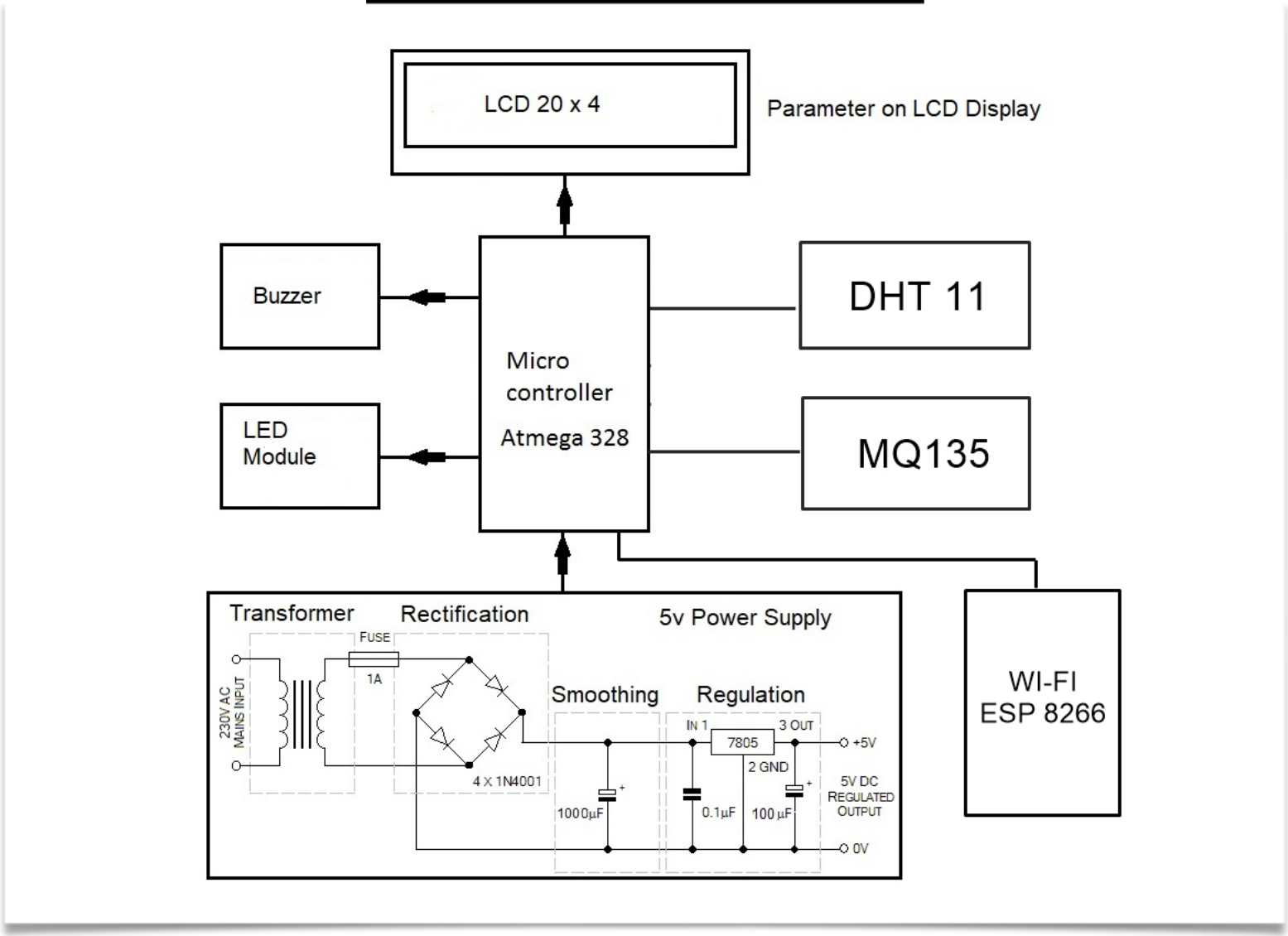
Block diagram



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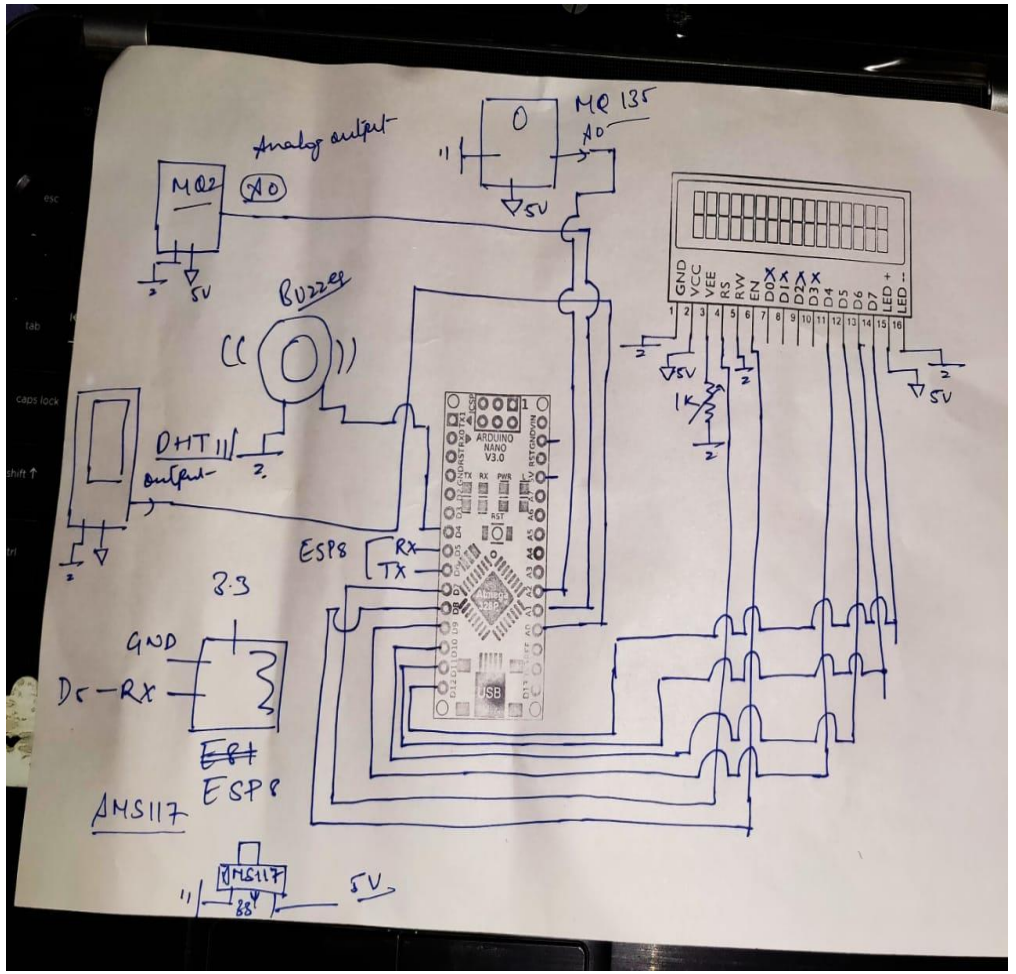
Sensors	Connections
DHT11	In this system works on Radio Frequency which has two parts Transmitter and Receiver. In the Transmitting part we have all the sensor attached such as DHT11 sensor for temperature and humidity sensing.
MQ135	MQ135 gas sensor has high sensitivity to Ammonia, Sulfide and Benze steam. It is with low cost and particularly suitable for Air quality monitoring application. MQ135 sensor connection is established on Transmitting part.
MQ 2	MQ2 Gas Sensor Module is a robust Gas sensor suitable for sensing LPG, Smoke, Carbon Monoxide concentrations in the air. All these parameter are detected continuously by sensors and if they crosses predefined limit then user get alert as a buzzer automatically turn on with LED indications.



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DHT 11 sensor

Temperature Range	0-50°C /±2°C
Humidity Range	20-80% / 5%
Sampling Rate	1 Hz (once every second)
Body Size	15.5mm x 12mm x 5.5mm
Operating Voltage	3 to 5V
Max current During Measuring	2.5mA
Distance	5 to 10 Meter

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MQ 135 Sensor

Detection Range:	10 - 300 ppm NH3, 10 - 1000 ppm Benzene, 10 - 300 Alcohol
Heater Voltage:	5.0V
Dimensions:	18mm Diameter, 17mm High excluding pins, Pins - 6mm High
Distance	3 to 10 meter

MQ 2 Sensor

Operating voltage	5V
Load resistance	20 KΩ
Heater resistance	33Ω ± 5%
Heating consumption	<800mw
Sensing Resistance	10 KΩ – 60 KΩ
Concentration Scope	200 – 10000ppm
Distance	5 to 12 meter

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Threshold values

Parameters	Mean value
Temperature	Above 50 °C
Humidity	Above 70%
Harmful Gas	Above 1000ppm
Heartrate	Above 150 bpm

Above this mean value user get alert as buzzer and LED identification.

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Component Name	Component Price
Arduino UNO	500/-
Heart Beat Sensor	250/-
MQ2	80/-
MQ135	150/-
Battery	50/-
LCD Display	200/-
Wi-fi module	400/-

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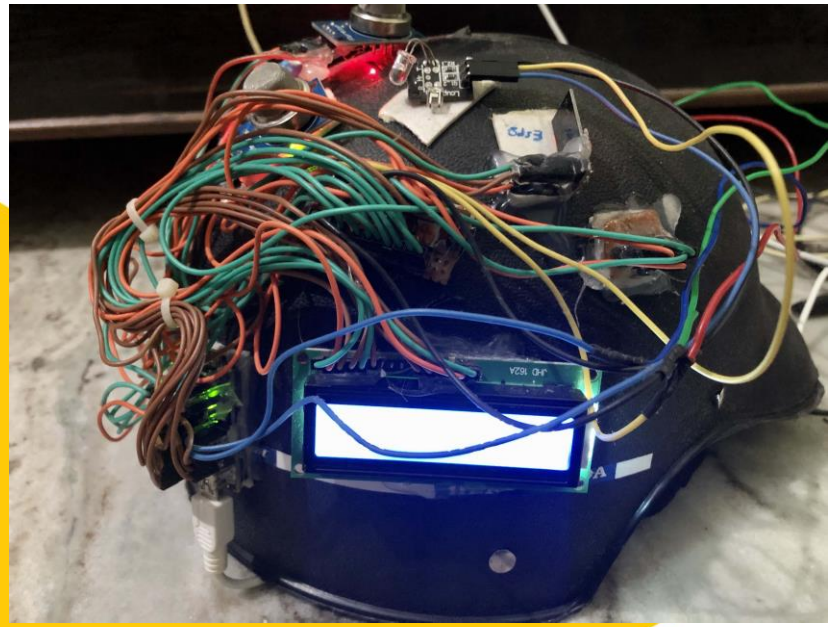
Screenshots



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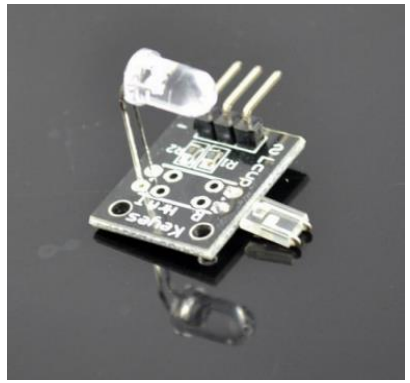
Arduino KY-039 Detect the heartbeat module

- This uses bright infrared (IR) LED and a phototransistor to detect the pulse of the finger, a red LED flashes with each pulse.
- The LED is the light side of the finger, and phototransistor on the other side of the finger, phototransistor used to obtain the flux emitted, when the blood pressure pulse by the finger when the resistance of the photo transistor will be slightly changed.

- **Connecting to the Arduino**

  - Sensor pin S connect to Arduino pin Analoog 0 / A0
  - Sensor pin + (middle pin) connect to Arduino pin 5+
  - Sensor pin - connect to Arduino pin GND



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Pulse Sensor

- **Features**

- Biometric Pulse Rate or Heart Rate detecting sensor
- Plug and Play type sensor
- Operating Voltage: +5V or +3.3V
- Current Consumption: 4mA
- Inbuilt Amplification and Noise cancellation circuit.
- Diameter: 0.625”
- Thickness: 0.125” Thick

- **Pin Configuration**

Pin Number	Pin Name	Wire Colour	Description
1	Ground	Black	Connected to the ground of the system
2	Vcc	Red	Connect to +5V or +3.3V supply voltage
3	Signal	Purple	Pulsating output signal.

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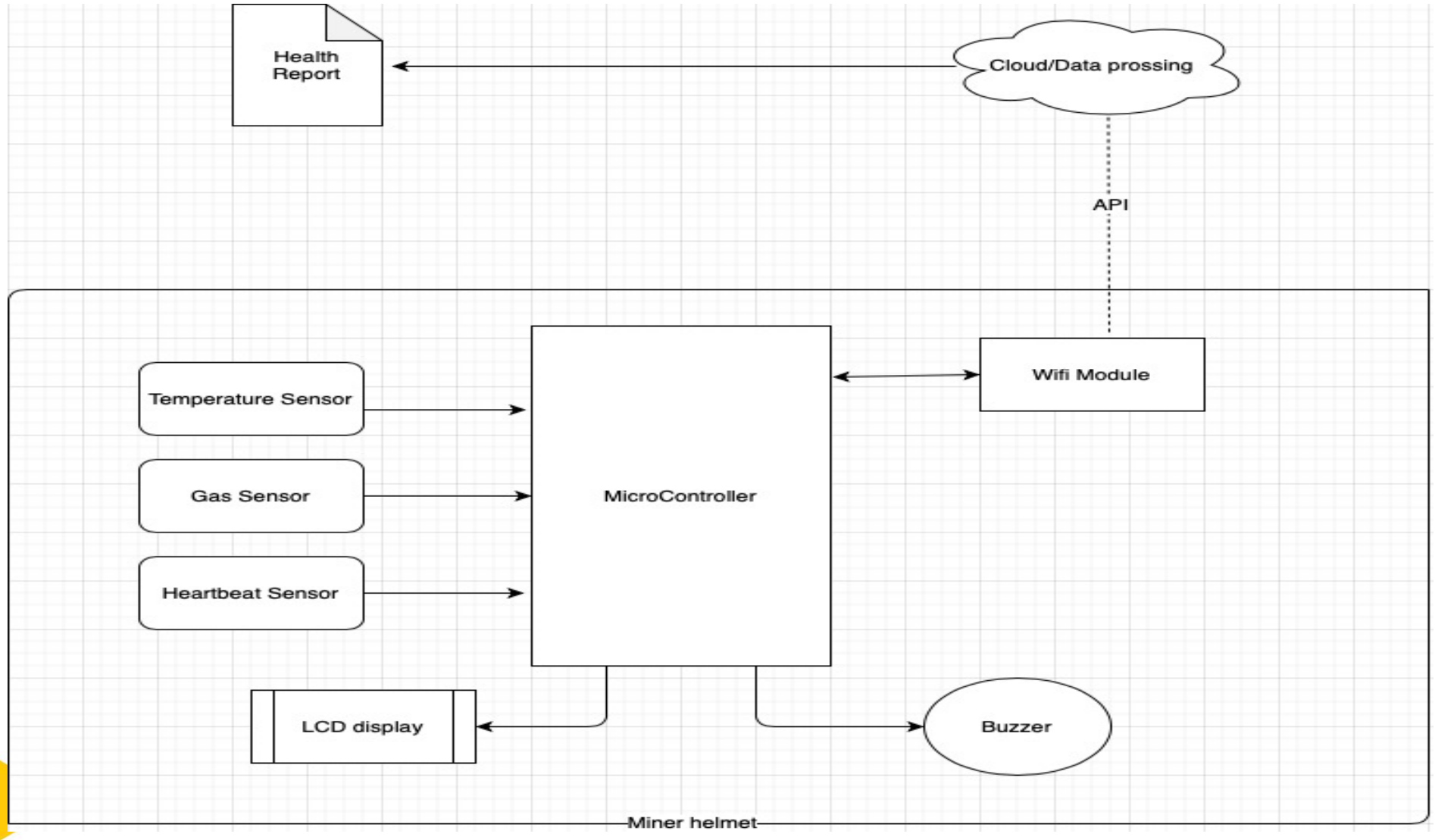
Architecture of the System



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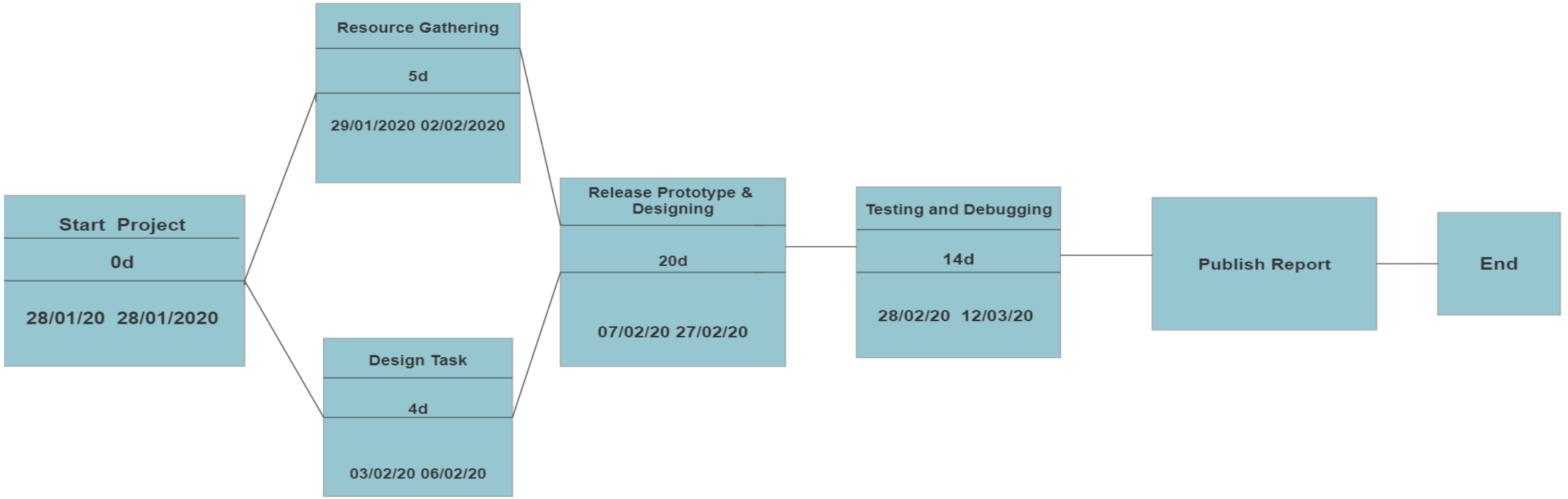
Project Scheduling



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Predictive Analysis

This section computes the precision, recall, and accuracy of Temperature prediction, gas prediction and heartbeat in bpm prediction. The polarities of Temperature prediction, gas prediction, and heartbeat prediction are described in Equation 1, 2, and 3.

- $$Polarities_{Temperature} = \begin{cases} Polarities_{Temperature} \geq above\ 35\%\ Noticeable\ Impact \\ Polarities_{Temperature} \leq above\ 35\%\ Unoticeable\ Impact \end{cases} \quad (1)$$

- $$Polarities_{gas} = \begin{cases} Polarities_{gas} \geq above\ 35\%\ Noticeable\ Impact \\ Polarities_{gas} \leq above\ 35\%\ Unoticeable\ Impact \end{cases} \quad (2)$$

- $$Polarities_{heartbeat} = \begin{cases} Polarities_{heartbeat} \geq above\ 35\%\ Noticeable\ Impact \\ Polarities_{heartbeat} \leq above\ 35\%\ Unoticeable\ Impact \end{cases} \quad (3)$$

Subject: Heartbeat, Temperature and Gas measuring
Opinion Holder: Participants for evaluation.

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Table 1 2×2 confusion matrix

True Positive **Criteria:** Noticeable Impact if accurately predicted	**False Positive** **Criteria:** Noticeable Impact if accurately predicted
False Negative **Criteria:** Un-Noticeable Impact if not-accurately predicted	**True Negative** **Criteria:** Un-Noticeable Impact if not-accurately predicted

$$Precision_{Predict} = {True_{Positive}}/{True_{Positive} + False_{positive}} \quad (4)$$

$$Recall_{Predict} = {True_{Positive}}/{True_{Positive} + False_{Negative}} \quad (5)$$

$$Accuracy_{Predict} = \frac{True_{Positive} + True_{Negative}}{True_{Positive} + False_{Positive} + True_{Negative} + False_{Negative}} \quad (6)$$

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Equation 4,5, and 6 are used to compute accuracy, recall, and precision. Precision indicates the accurate prediction of positive cases. Recall indicates the proportion of accurate prediction and accuracy indicates the accurate prediction of both positive and negative cases.

For quantifying the prediction model, the feedback taken from the participants is deliberated as control parameters and deliberated as a predictive model as a aforementioned that there are a total of 2 participants and the process is iterative thus, the total number of samples for the experiment is 27

Table 2 describes the confusion matrix.

Table 2 confusion matrix for Module

$True_{Positive}$ **19**	$False_{Positive}$ **0**
$False_{Negative}$ **5**	$True_{Negative}$ **3**

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From Equation 4,5 and 6 values for accuracy, recall and precision are quantified. These are as follows.

- $Precision_{Predict} = \frac{19}{19+0} \quad \Rightarrow\Rightarrow \quad 1$ (7)
- $Recall_{Predict} = \frac{19}{19+5} \quad \Rightarrow\Rightarrow \quad 0.7916$ (8)
- $Accuracy_{Predict} = \frac{19+3}{19+5+0+3} \quad \Rightarrow\Rightarrow \quad 0.8148$ (9)

Thus from Equation 7,8,9 the predictive accuracy of the Prototype module is 81% and recall is 79%.

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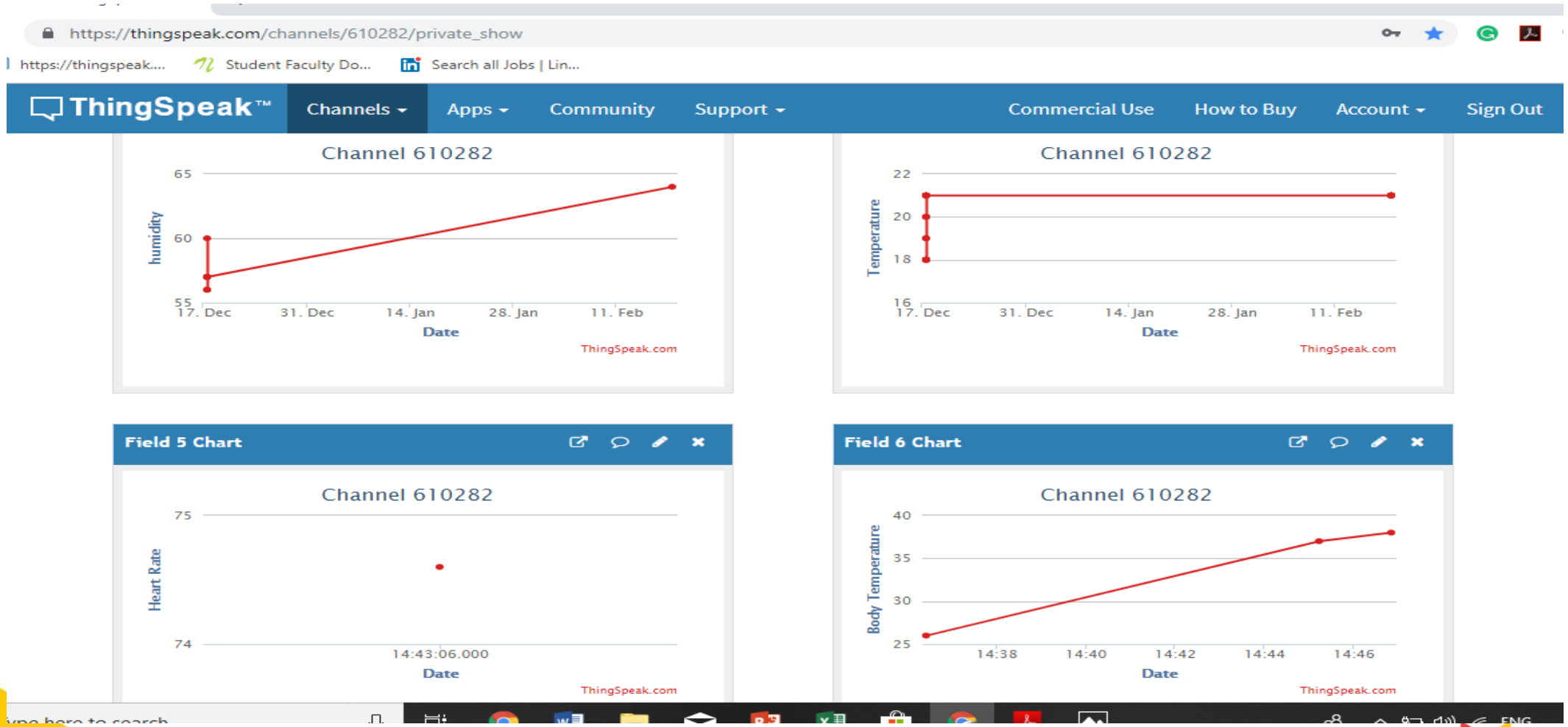
Result



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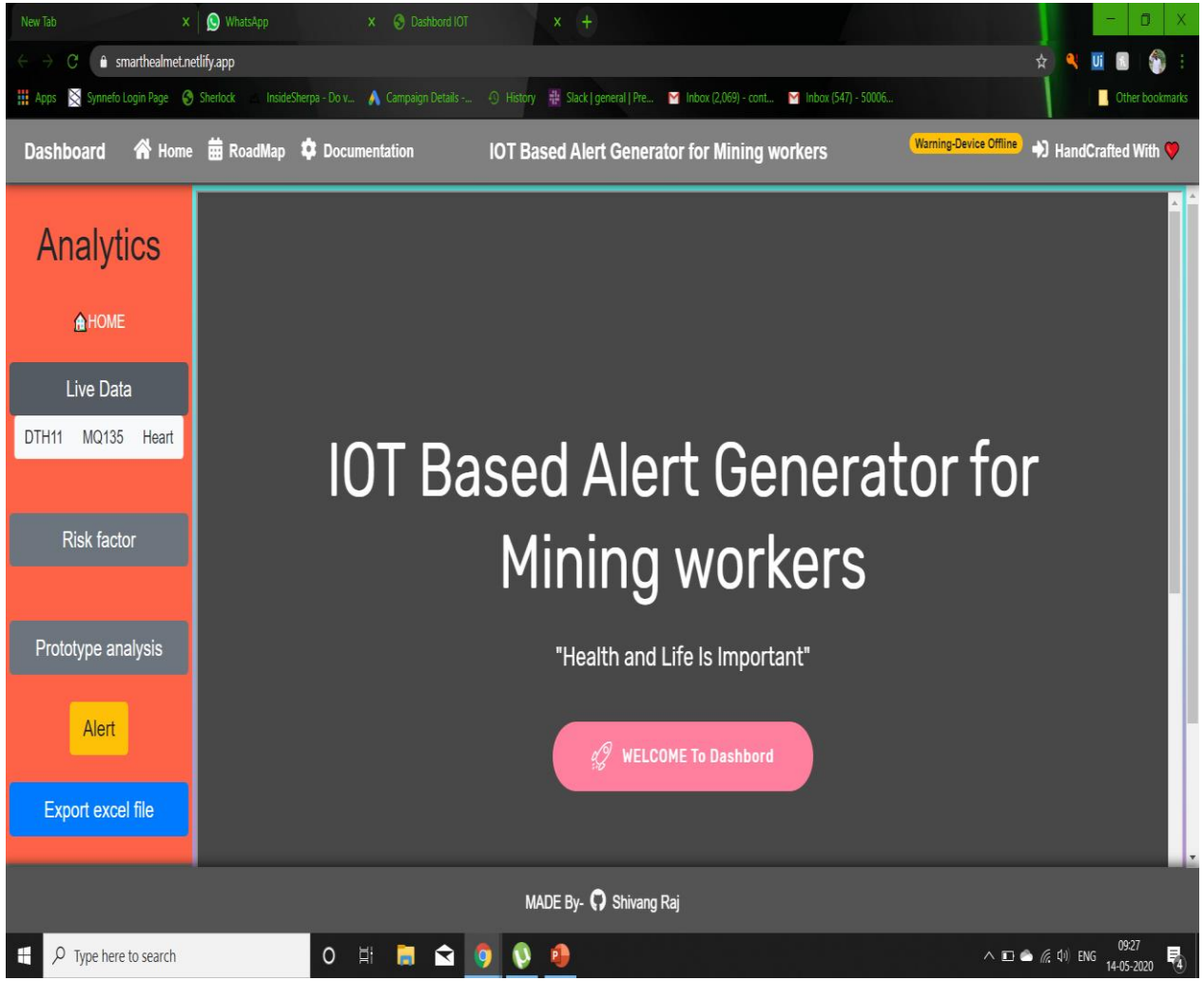

Dashboard

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Future scope

This Prototype has been developed and can be improved. It has high potential to commercialized for Industry. In Coal mining Industry It can further use in large scale. It can help in rescue of mining worker and monitor their health.

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THANK YOU

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