

# **Machine Learning Based Low-Cost COVID-19 Monitoring System**

by

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**BACHELOR OF SCIENCE IN ELECTRICAL AND  
ELECTRONIC ENGINEERING**



Department of Electrical and Electronic Engineering  
INTERNATIONAL ISLAMIC UNIVERSITY CHITTAGONG

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A project

submitted as partial fulfillment of the requirement for the degree of

**BACHELOR OF SCIENCE IN ELECTRICAL AND ELECTRONIC  
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## CERTIFICATE OF APPROVAL

The thesis/project entitled as “**Machine Learning Based COVID19 Monitoring System**” submitted by **Riduanul Alam**, bearing Matric ID. **ET 151002** and **Fahim Mohammad Evne Amin**, bearing Matric ID. **ET 151034** of session **Spring 2020**, to the Department of Electrical and Electronic Engineering, International Islamic University Chittagong, has been accepted as satisfactory in partial fulfillment of the requirements for the degree of Bachelor of Science in Engineering and approved for the examination held on **25 November, 2021**.

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## **DECLARATION**

It is hereby declared that this work has been done by us and no portion of the work contained in this thesis/project has been submitted elsewhere for the award of any degree or diploma.

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Fahim Mohammad Evne Amin

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Mohammad Riduan Alam

## **ACKNOWLEDGMENT**

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Last but not the least we are really grateful to our friends, classmates, seniors, juniors and lab assistants, who have given us their unlimited support and help in each and every aspect. We are really fortunate to have being like them beside us.

Authors

## **ABSTRACT**

In Bangladesh March 17 2020 every educational institutions ,schools,colleges and university had been shut down because of COVID 19. More than 7000 peoples have been died ,almost 400000 peoples have been infected by COVID 19 in Bangladesh.So we need to design an unique,affordable,reliable and further research-able project. We have created a Mobile Application which can show the dynamic data of student's temperature and oxygen saturation with heart beat .These type of data have been stored in any data base so that we can further do research how vaccine and medication process develop in our community because everyone's data have been stored in our dedicated data base .We also have done machine learning formation by linear regression theorem, so we can understand which student are being infected by COVID 19.Since SARS 02(COVID 19) virus can stay in 14 days without showing any type of symptoms so for the very few time our device's values have not recognized which student could bear COVID 19 by body temperatures and oxygen saturation.On the other hand we have used machine learning theorem so that we can minimize our error rates .Further machine leaning theorem which add any types of sensors that help COVID 19 situation dynamic recognition.

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## **LIST OF ABBREVIATIONS**

NID	National Identity Card
SEIR	Susceptible-Exposed-Infectious-Recovered
CNN	Convolutional Neural Network
ALC	Ambient Light Cancellation
API	Application Programming Interface



# CHAPTER 1

## INTRODUCTION

### 1.1 Introduction

The COVID 19 pandemic, also known as the corona virus pandemic, is an ongoing pandemic of corona virus illness 2019 (COVID-19), which is caused by the Corona virus 2 Severe Acute Respiratory Syndrome (SARS-COV-2). It was appeared for the first time in December 2019 in Jinlanjiang fish market Wuhan Hubei, China. The outbreak was reckoned as global pandemic by World Health Organization in March 2020. More than 5.5 million deaths have been linked to COVID-19 as of December 18, 2021[1]. In Bangladesh, the country's epidemiological institute, Institute of Epidemiology, Disease Control and Research (IEDCR), declared that the virus had spread to Bangladesh in March 2020. Since then, the pandemic has spread over the entire country, with the number of persons tainted steadily increasing. Bangladesh has long had one of the lowest test rates per capita in the world, prompting fears that testing is insufficient to accurately [2]-[4]. Because COVID 19 is so intimate with the Ebola virus, it's critical that scientists figure out how to protect themselves from it. When Ebola propagated in a typical setting in Africa, a modeling system decided to imitate the conditions [5]. Analogous models have been used to predict the epidemic and spread of the Flavivirus virus in real time in the United States, and have been found to have close to 85% accuracy in quantitative evaluation [6]. In a study of multiple machine learning methods, it was revealed that the backward propagation neural network (BPNN) had the best prognostic accuracy when it came to modeling Zika virus transmission [7]. A COVID19 prophecy model is being developed by John Hopkins University scientists [28]. Based on a stochastic meta population epidemic model. Blue is a firm based in Canada where that Machine learning algorithms have been designed to investigate early outbreaks 2019 [8][9]. In the past, big data analysis of medical records and satellite photography (vehicle crowding surrounding a hospital) have been used to spot outbreaks [10]. Machine learning algorithms are used to portend influenza virus strains and tiny subtrees of hemagglutinins(HA) viral antigenic set [11]. Machine learning may also be used to portend nucleoprotein gene sequences and spike gene sequences, making it a significant tool for tracing viral origins, particularly when the data set is massive and comparison analysis is required

[12]. So Machine Learning(ML) has created very efficient way to develop way of working with current perspective so in Bangladesh which is more important ,it should be evaluated it.If we talk about our education system the public expenditure below 1% of GDP,so our educational infrastructure do not well establish ,online facilities are not develop in most of the schools, colleges, universities and institutions.Then online education can not play a correct rules for developing this pandemics situations,on the other hand our education system which is rely on the class and exam based modules.If we have done any types of formations just like offline and online combination ,we have to design a system that detects COVID 19 circumstance with our limited resources.So we think about machine leaning algorithms that detects most probable COVID 19 patient and store his/her data any types suitable dedicated data based and further research any researcher can access these types of data with authorities application process, We think about machine leaning because person can not properly detect the problem where machine can. Since our GDP growth has increased day by day we can establish national data center for COVID 19 data perspective or we can accumulate data with National Identity Card (NID) server.So here we can establish a data server with our university server.In this way our faculty member and students can assess their registation panel and gate keeper also access data throw their smart phones so they know whose body temperature and oxygen levels and pulse rates are going high at danger limits,then gatekeepers can talk with faculty members or students to tell isolated themselves .Further all data of their can use what time their body temperature has risen with respect to their oxygen level and heart beat level ,it creates a new dimension of the COVID 19 testing formations.

## 1.2 Project Overview

Since machine learning develops some algorithm such as linear regression that can predict any types of situation how the result will come through a certain circumstances. Most convenient way to develop machine learning algorithms with Python language because it has large library and quite simple syntax that creates all of problems think easier than what everyone think. App has been developing with Java programming language in Android Studio. To develop database, MySQL is perfect language to build up relational management system because for machine learning data have more factors to evaluate a system. It can create a two way communication with App and devices end. In device perspective it is to design lest it should transfer the COVID 19 virus, so precaution must take just like a card which creates a hex code and identify registered members in that way it be totally non touchable. For a large system anyone can use Raspberry Pi but for a small system anyone can use Arduino Uno. In Raspberry Pi, the code system is maintained by Python programming language but for Arduino it has dedicated IDE where codes are developed and interaction with NodeMCU for RF id signal. Since it is very much convenient device it be installed any place many people go through.

## 1.3 Motivation

In 2020 almost two million people have already dead because of COVID virus 19. Though the vaccine of Pfizer will be available in June 2021. Most of the people of any developing country can not afford vaccine. So people should do any type of steps that be economical, safely and user friendly so that school, college and university can be opened. As any person who affects by COVID 19 contains fever and cough so it be an indication point that can create surplus advantages like which one and when their body temperatures were at a dangerous states, it might be an important sign for COVID 19. If any machine can detect people body temperatures and pulse oximeter without any contact of people, it save many life like which people those measure body temperature. Developing country like Bangladesh where people are unconscious about mask, hand sanitizer. Any system that can tell about future conditions body by temperature and pulse oximeter. So people can understand he is at danger zones or in safe zones. Parameters can be said what the future results up coming.

## 1.4 Project Objective

Our project has good economical advantages that cost only within 10,000 taka which can be afforded by any institution like school, college and university.

- 1 To develop a low cost machine learning based COVID 19 monitoring system by using untouchable sensor .
2. To apply machine learning algorithm making the system simple by using mobile application which is provided us accurate information .

## 1.5 Project Outlines

- In **chapter 1 and chapter 2** we have evaluated the past and present situation with respect to world scenario and our Bangladeshi matter of scarcity of testing kits. Previous work has been developed to monitoring the mers and another diseases so we try to inter-related the current situations.
- In **chapter 3** we have described about Machine Learning Linear Regression Theorem how it runs the system in mobile application and how it monitors with data based system .
- In **chapter 4** we have discussed about software portion like php , database and mobile application language Java and its back end development and also its cost effectiveness .
- In **chapter 5** we have represented the future plan of our project.

## CHAPTER 2

### LITERATURE REVIEW

#### 2.1 Introduction

Some statistical, mathematical, and dynamical vital modeling techniques have been effectively utilized to anticipate the extent and spread of infectious diseases in populations [13]. Big data driven models, as opposed to classic epidemiological predictive models, have the extra perks of adaptive learning, flexibility, and scope to improve based on a newer understanding of the disease process, as well as social distancing in limiting its spread. One of the most widely utilized methods for estimating the locations and amount of COVID 19 dissemination is the susceptible-exposed-infectious-recovered (SEIR) method [14]. Since diarrhea, muscle pain, sore throat, sputum production, abdominal pain, and loss of taste and smell are some of the most common symptoms [15]-[18]. So these types of symptoms are denoting diseases but on the other hand the main symptoms likes influenza fever and coughs in Bangladesh because COVID 19 virus changing his strings Here putting Newspaper summary any news paper in Bangladesh [19]-[22]. Using dynamical force casting models, the breakout of Zika virus infections in populations has been observed in the past using Google trends [23]. The reserve transcription reaction (rRT-PCR) from a nasopharyngeal swals is the standard way of diagnosis. A combination of symptoms, risk factors, and a chest CT scan showing pneumonia-like characteristics can also be used to identify the infection. That means all types of procedure we need CT scan systems so that every people in any community undergoes process, all types of procedure we need implement a Deep Learning (DL) process. Deep learning is an artificial intelligence function that mimics the human brain's processing of data and pattern formulation for decision-making. Deep leaning is a form of machine leaning in artificial intelligence that uses neural networks to learn unsupervised from unstructured or unlabeled input. It's also known as deep neural network or neural leaning. Deep learning has evolved in tandem with the digital era, which has resulted in an outpouring of data in all formats and from all corners of the globe. Simply put, this data is referred to as "big data." These data must interact with a CNN (convolutional neural network) algorithm, which is one of the most prominent deep learning algorithms. CNN is a sort of machine learning in which a model learns to

execute classification tasks directly from pictures, video text, or sound. CNNs are particularly useful for recognizing objects, faces, and scenes by looking for patterns in images. They learn directly from picture data, classifying images using patterns instead of manually feature extraction. A convolutional neural network might comprise tens or hundreds of layers, each of which learns to recognize unique features in an image. Filters are applied at varying resolutions to each training image, and the result of each convuled image is utilized as the input to the next layer. The filters can start with very basic qualities like brightness and edge and progress to more complicated features that describe the object uniquely. In this CNN process , first design a complex data base system because it depends on a complex embedded system criteria ,here every process need a large number of data that interaction with one another. This type of Deep Learning process will not create in developing country because for this criteria involve CT scans machine early nRT test result are very much costly in developing country , so any types of aspects that are relative with any types of new technology which have a large number of arrangement such like imaging technologies or microscopices procedure will not implement in every sectors like educational instituted or public crowed areas [24 ].

## **2.2 Summary of previous work**

When COVID 19 has spread over the globe, cell phone-based surveys can help with early case detection, particularly in isolated populations [25][26]. Through a web-based poll, Italy was able to detect influenza patients [27].

In 2019 first COVID 19 expansion to across the world, every researcher wanted to develop some simple diagnosis system where everyone tried in deference method like AI coughing test. For this type of testing, MIT provides an open voics COVID 19 cough data set, which sets a new milestone as the world's largest audio health data collection, with hundreds of thousands of coughs, 5320 of which are COVID 19 positive[28]. If anyone have lung disease of vocal cords what types of sound that disease creating to compare with healthy ones' that must be considered to implement [29]. For example, studies have linked phonetion thersold pressure, which is the minimum lung pressure required to initiate and maintain vocal fold oscillation, to vocal fatigue [30]. The use of unsupervised sentiment analysis to detect infectious diseases in populations has been proposed [32]-[34]. Sentiment analysis is a technique

for analyzing the positive and negative influence of a population using natural language processing in social media [35]. Different therapeutic settings highlight different emotions such as uncertainty or frustration as probable neurodegenerative symptoms, therefore understanding the different types of cough is crucial because distinguishing between neurodegenerative and COVID 19 cough plays a crucial role[38]. Infection identification and diagnosis at an early stage AI can swiftly identify unusual symptoms and other "red flags," alerting patients and healthcare providers. This group of school researchers used medical imaging technologies such as computed tomography (CT) and magnetic resonance imaging (MRI) to diagnose infected cases[37]. Deep Learning differs from Machine Learning (ML) in that it presents data in a different way in the system. DL networks, on the other hand, use layers of Artificial Neural Networks (ANN) with several sensors, such as testing kits and automated devices[36].

### **2.3 Temperature and Pulse Oximeter monitoring sensor and nodes**

Since the overall procedure basically depend on three steps , first one student matric id which incorporate with RFID sensor then student should overhead their finger and temperature and saturated oxygen level can be calculated ,after that all data will be stored in server cloud. After finishing these procedure the system should face machine learning algorithm. So systematic modules are :

- 1) Sensor modules;
- 2) Controller modules;
- 3) Wifi modules;

#### **1) Sensor modules**

First of all since students are identified name and matric id by RFID sensor system. The RFID reader device retrieved a hex code or digital data from the tag, which was usually an inventory number. This number can be used to track inventory goods. There are two types of RFID tags:

- a) Passive tags are powered by energy from the RFID reader's interrogating radio wave.
- b) Active tags, which are powered by a battery or USB, may be read at a greater distance from an RFID scanner, up to hundreds of meters.

The second section discusses the two basic types of sensors. The first sort of sensor in this section is a temperature sensor ( MLX90614) is a contactless sensor. This is made

feasible by the Stefan Boltzman Law, which states that all objects and living beings emit infrared radiation, and the intensity of this emitted IR energy is precisely proportional to the object's or living being's temperature. As a result, the MLX90614 sensor calculates an object's temperature based on the amount of IR energy it emits. This sensor has been factory calibrated for a wide temperature range of  $-40^{\circ}\text{C}$  to  $125^{\circ}\text{C}$  for sensor temperature and  $-70^{\circ}\text{C}$  to  $380^{\circ}\text{C}$  for object temperature. In this sensor is integrated the customize PWM output for continue reading .

The MAX 30100 pulse oximeter is a low-cost, non-invasive medical sensor that detects the oxygen saturation (SPO<sub>2</sub>) of hemoglobin in the blood. It illustrates the percentage of blood that is oxygen-rich. It communicates with a host microcontroller via an I<sup>2</sup>C digital interface. Ambient light cancellation (ALC), 16-bit sigma delta ADC, and unique discrete temporal filter make up the pulse oximetry subsystem in the MAX 30100. It operates at ultra-low power, making it ideal for battery-powered systems.

## 2) **Controller modules**

The controller module processes data from the temperature and pulse oximeter sensors and sends it to the Wi-Fi module as the core of the temperature and pulse oximeter sensors monitoring the analog values from the students. A high-performance micro controller unit implements all signal processing tasks (MCU). The working voltage of this micro controller is 5 volts, the flash memory is 32 KB (0.5 KB of which is used by the boot loader), and the SRAM is 2 KB. The analog-to-digital convertors (ADC), PWM timer, and communication interface are just a few of the prominent function sub modules included with this MCU. This MCU processes the two sensors; because it has a 10-bit ADC, it will output digital values in the range of 0-1023; this is termed as resolution, which refers to the number of discrete values. So the entire process is organized into four steps: sampling, ADC, buffering, and packing. To begin, the analog signal from two sensors is digitized utilizing sampling and ADC. Second, the data from the two sensors is temporarily stored in the buffer before being packed into a certain format. Finally, using a Universal Synchronous/Asynchronous Receiver/Transmitter( USART), the data is sent to the Wi-Fi module.

Procedure 1: Collecting data from the two sensors the signal from the sensor is in analog format, thus it must be sampled first. But in this two types sensors have in

build ADC, it is not to good practices to use the in build ADC where two different kinds of sensors are implemented with time respect operated portion. The sensor MAX30100 is made up of ambient light cancellation, and the SpO2 ADC is a continuous time oversampling sigma delta converter with a resolution of up to 16 bits. The ADC output data rate can be set anywhere between 50Hz and 1kHz. On the other hand MLX90614 has 17 bits high resolution ADC and power. Microcontroller units (MCUs) have a timer circuit, which usually contains three timers. Timer 0 and 1 are 8-bit timers, while timer 2 is a 16-bit timer. In the Microcontroller unit( MCU) firmware all timers configured to a 1 KHz frequency and interrupts generally enabled.

Procedure 2: The ADC clock is divided by a pre scale factor and is 16 MHz. The pre scale is set at 128 by default, resulting in a  $16 \text{ MHz}/128 = 125 \text{ kHz}$  ADC clock. The default sampling rate is 9600 Hz because a single convention needs 13 ADC clocks.

Procedure 3: Buffering Before being packetized, the data from the two sensors is briefly stored. The micro controller unit( MCU) features 2K bytes of embedded Static random-access memory(SRAM), which is sufficient for buffering the data before it is packetized in a specific format. Meanwhile, newly received data is saved in the buffer's remaining space.

Procedure 4: Packetizing Before being transferred to the Wi-Fi module through the Universal Synchronous/Asynchronous Receiver/Transmitter( USART), every sensor data is packetized. A complete data packet typically contains a number of data fields, such as the header, flags, payload, checksum, and so on. These data fields are intended to increase data transmission efficiency and accuracy.

### **3)Wi-Fi module**

The Wi-Fi module can acquire sensor data via the Universal Synchronous/Asynchronous Receiver/Transmitter( USART). The Wi-Fi module provides quick and easy connectivity to the Internet, allowing real-time sensor data to be transmitted to the IoT cloud. Data is packetized and transferred according to particular communication protocols thanks to the strong Microcontroller unit(MCU).

#### ***2.3.1 Graphical user interface(GUI)***

The graphical user interface(GUI) is in charge of data visualization and administration. It allows quick access to data stored in the IoT cloud. Users can access real-time temperature and pulse oximeter data by logging onto the cloud. In general, users can

visualize two sensors data using two types of GUIs: mobile apps and webpages. A mobile app can respond quickly to user input, although webpages are more convenient in terms of maintenance and upgrade, and may be used by anybody, including those with limited educational qualifications.

### ***2.3.2 IoT Cloud for Sensors data Monitoring***

After the system collects a large amount of sensor data via the monitoring node, an IoT cloud is required to provide a quick and easy solution to store the data in a database and display the sensors signal as needed. As a result, an IoT cloud is built using cutting-edge web services, cloud computing, and data storage techniques.

### ***2.3.3 Servers***

In the IoT cloud, three types of servers with different functionality are used: storage servers, HTTP servers, and MQTT servers. These servers may now be set up on visible machines, allowing them to make full use of physical resources such as CPU, memory, and so on, thanks to the advancement of virtualization technology. The following are some examples of IoT clouds:

#### ***2.3.3.1 HTTP server***

The HTTP server is able to accept and respond to user responses using the typical request mechanism. Users must submit a hex code by punch keys and micro controller format the process which system is to build because matching is very important, then this method through node Microcontroller unit( MCU) in order to access the sensors data. The Android app will be written in Java, and the machine learning formation will be written in Python, employing a linear regression approach.

#### ***2.3.3.2 Storage server***

The storage server is in charge of storing sensor data in the database, which is critical for corona virus early detection. As a result, one of the most important roles of the IoT cloud is the fast and reliable storing of sensor data. To store sensed data, IoT clouds have traditionally used relational databases.

## **CHAPTER 3**

### **METHODOLOGY**

#### **3.1 Introduction**

Machine learning based medical system is absolutely recent trends. Whatever we do is depends on the system outcome. Our data driven mass analysis returns the system in such a way that every calculations become very much perfect. On the basis of the system total measurement we can say that our student healthcare system based on offline checkup and online data analysis can make the whole system more efficient. Its our time that we have become more accuracy on our outcome. This system is being implemented into several segment. In this chapter we are going to discuss about those segments.

#### **3.2 Methodology**

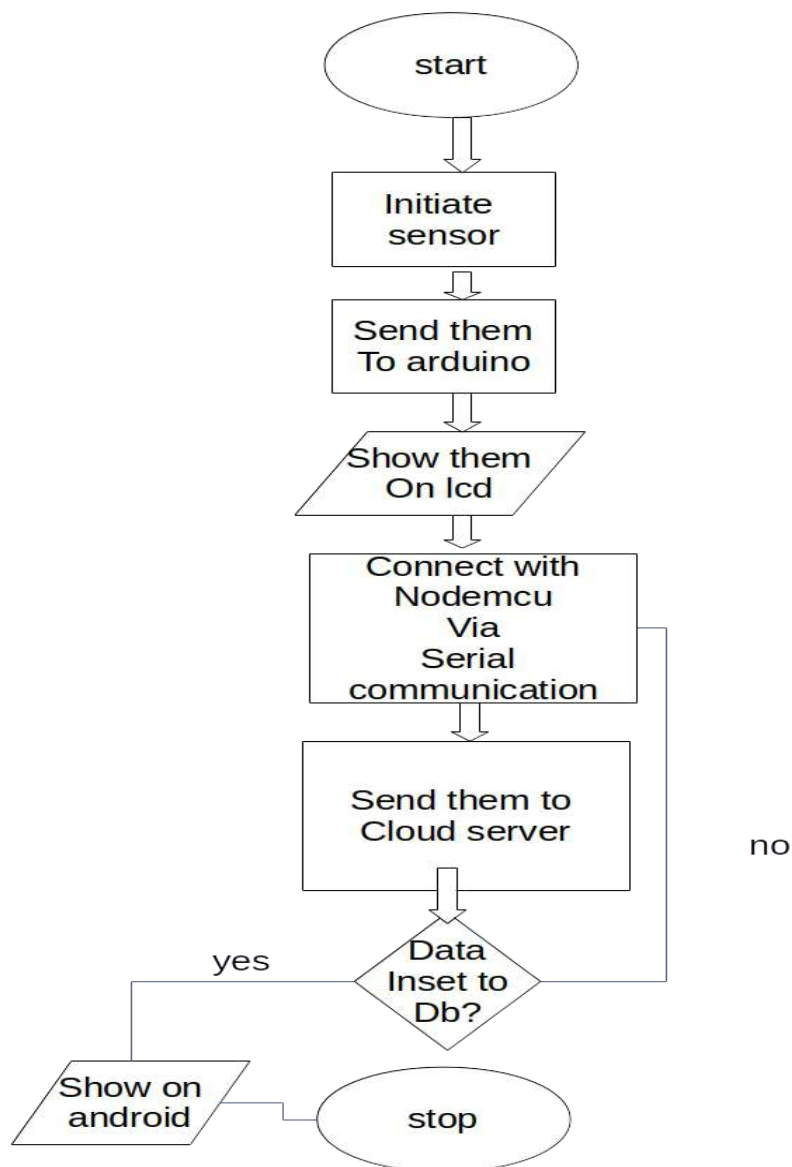
At first we are going to save the data into several units. All the data comes from the oxygen saturation sensor, digital temperature sensor, ecg sensor to arduino. Now from arduino we do serial communication. Using serial communication we send the data to the node mcu. Now from node mcu we are going to extract the data format into JSON format. Its a special format sending our data into multiple places. Now we store the data using API call from node mcu. Now from node mcu we can fetch the data from the server.

After sending the data into database server we set them using mysql programming language. Now from that place we shall send the data into data warehousing segment. We have an api on the cli segment. Where we can call all the cron jobs. Now after calling the cron job we can get the raw data . But these are not the full format. From beginning we call the training data from the various system. From where we can call the data maching and data filtering.

After data maching and data filtering we shall set them on machine learning module. We have three module based on sensor data. Each modules returns us some probabilities. Such as if we find the body temperature increase there can be several reason after that. Also the time format is countable on the system so that we can measure the outcome from that system.

At the end after generating machine learning module we send all the datas to the android application. We develop the machine learning segment using python tensor flow. We developed the data drivent segmnet using php and the hardware part support by LUA and C++.

### 3.3 System flowchart



**Fig.3.1** Flow Chart of System

From **Fig 3.1** the flow chart we understand that the project divided into the two parts one is hardware parts and other is software part . So this chapter we will discuss

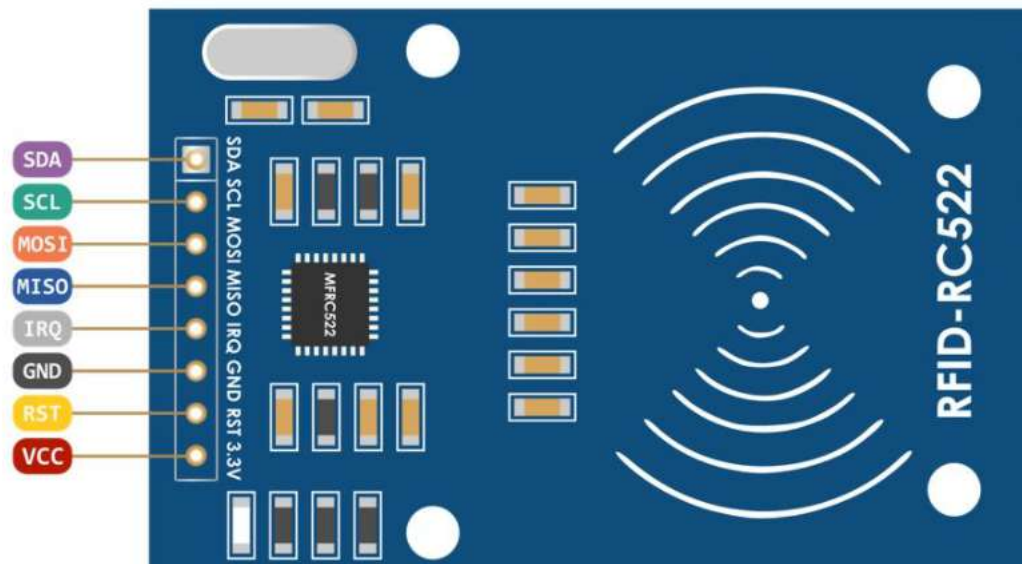
about the hardware parts just their physical structure and its connection. Next part we will discuss about the software parts.

### 3.4 Hardware

In our hardware system we have used two sensors one is MLX90614 temperature sensor and MAX30100 pulse oximeter and and ecg sensor. We have use two types of micro controller unit one is Ardiuno uno and another one is Node mcu and 16\*2 LCD display with I2C interface.

#### 3.4.1 RFID (Radio frequency identification)

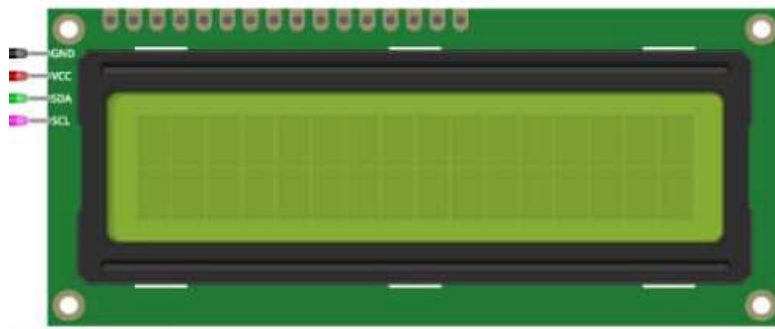
Since we have used plunge card that generates hex code which occupy by manual induction technique and this type of code must read by some system. RFID-RC522 is a device that can do multi communication with arduino uno or micro-controller. This module has allowed to developers to interface SPI, I2C and UART based controllers. In **Fig 3.2** we represent the RFID MODULE



**Fig.3.2** RFID-RC522 [39]

### 3.4.2 16\*2 LCD display with I2C interface:

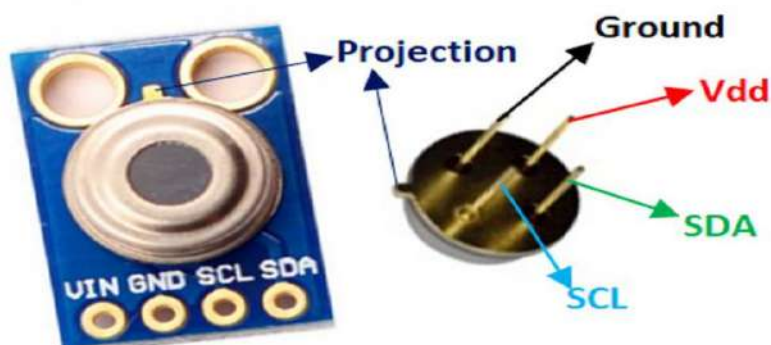
When we have completed our plunge card then RFID interacted with arduino and arduino uno connect with I2C communication. In LCD display have four pins ground, vcc, SDA, SCL. Here SDA means serial data pin, it use to transmitted and receive data and this pin connect with arduino analog pin. SCL means serial clock pin here a timing signal supplied by bus master device and connect with analog pin of arduino uno. In **Fig 3.3** LCD display represent with I2C interface.



**Fig.3.3** 16\*2 LCD display with I2C interface [40]

### 3.4.3 MLX90614 temperature sensor:

Since COVID 19 detection has one of the most big factor that is over temperature, above 99 to 105 farenhite. So we get a temperature sensors MLX90614 that have four pins vcc, ground, SCL, SDA. Here SDA and SCL connect with arduino analog pins. From **Fig 3.4** temperature sensor represent with pins out late.



**Fig.3.4** MLX90614 temperature sensor [41]

### 3.4.4 MAX 30100 Oxymeter sensor

We had known that a person who along with COVID 19 his/her hemoglobin oxygen level below 90% and some times heart beat per minutes might be reduced impulse rate but this this heart beat factors properly understand in winter based country. In sub continent winter season ecg or heart beat can play best role to detect the corona virus .So we need to find a precise solution so that detect the virus properly. In MAX 30100 has two property ecg and pulse oximeter, it can detect the oxygen saturation by IR light. In MAX 30100 has 7 pins but our purpose we need only SDA and SCL. This two pins connect with arduino uno analog pins .Tiny sensors Max 30100 pulse oximeter is shown in **Fig 3.5**.



**Fig 3.5** Max 30100 pulse oximeter [42]

### 3.4.5 Arduino UNO

In our project some student information store in this micro controller and two sensors temperature and pulse oximeter interact with arduino uno. It has 14 digital input/output pins in which 6 can be PWM outputs. And Node MCU are interacted this controller with functional keyword which is coded in dedicated arduino uno IDE .For the costing reason we don't use the raspberry pi but in arduino uno flash memory is not large enough for corporating big data. Since arduino uno runs with C++ language so it is run time fast and it works with machine language very easily. And its function can be used easy to interact with another controller if system need it. Micro controller Arduino Uno is presented in **Fig 3.6**.

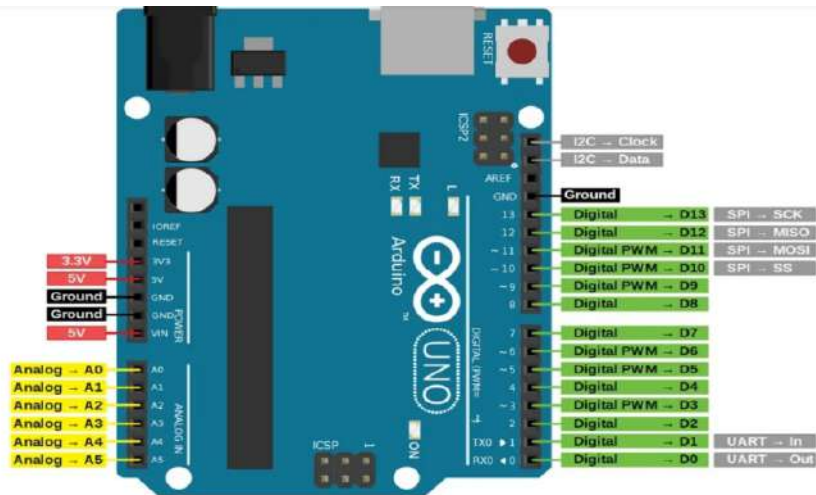


Fig. 3.6 Arduino UNO [43]

### 3.4.6 Node MCU ESP8266

Since we have to transfer data in web data based so we need a wifi module .Exactly the Node MCU have done this. It operates in between 80 to 160 MHz clock frequency and also have 128 kb RAM and 4MB flash memory.We have developed web in php that can set in the android app .So we transfer the data in JSON format via wifi .In Node MCU there are 16 GPIO pin that means general input output pin and 4 SPI (Serial parallel interface). So in our project most complex pin diagram Node MCU in Fig 3.7. We also has got Node MCU code from Appendix A.

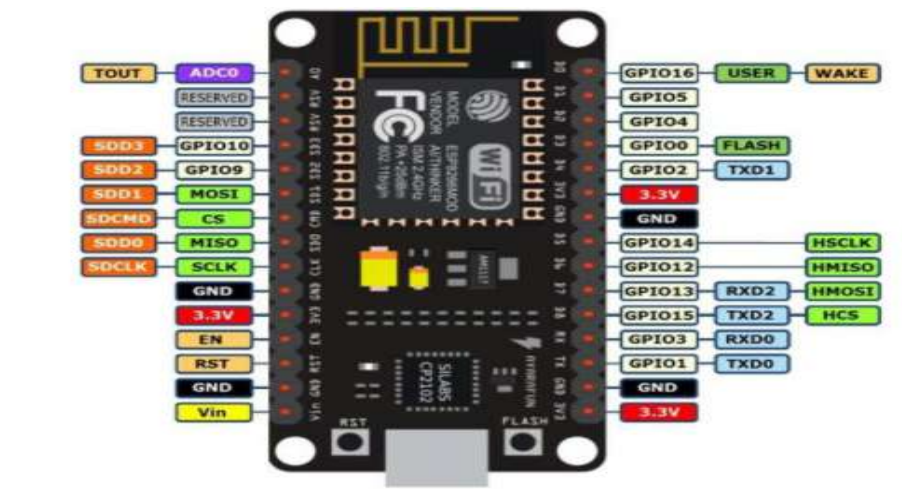


Fig.3.7 Node MCU ESP8266 [44]



### 3.6 Machine Learning in our project

Since corona virus had changed his spike protein time to time so we need to develop such intelligent system that can predict the virus detection with respect previous situation .That need to develop a machine learning system.there are two type machine learning algorithms one is supervised learning and another one is unsupervised learning. The supervised learning algorithm depends on the previous factors of the system . That means system learn from the previous condition.But in unsupervised learning the computer system can predict the upcoming events. Since corona virus spike will change so this is not perfect selection of unsupervised learning theorem.

In this circumstance we have apply the linear regression algorithm with numerical analysis.For this formula we have taken 200 temperature, oxizen and pulse data from 17 to 26 years old people by our sensors and some statistic data from different place ,all the data preserve in our data base.

For applying this algorithm we have to consider a straight line equation  $y=mx+c$  .

Where  $y$ =Training data (Temperature in farenhite ,Oxygen saturation, ecg value ) and

$m$ = tangent and also  $c$ = intercept.

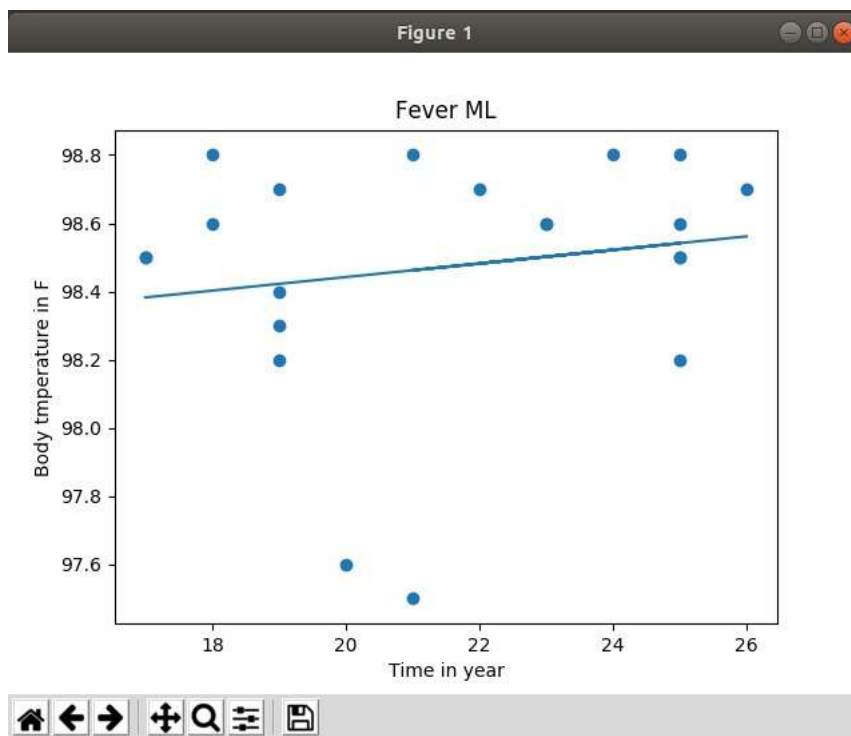
And this time to evaluate the  $m$  and  $c$  . So first of all we find all  $x$  mean value with respect to our training data and  $y$  mean value with respect to age of people in training data . Secondly we have to multiply  $x$  and  $y$  value then evaluate its mean.Thirdly we find mean square value of  $x$  and square of mean of  $x$ . So final equation for  $m$  and  $c$  be

$$m = \frac{(x \text{ mean} * y \text{ mean} - (x*y) \text{ mean})}{((x \text{ mean})^2 - (x^2) \text{ mean})} \quad \text{that means } m = \frac{(\bar{x} * \bar{y}) - (\overline{x * y})}{((\bar{x})^2 - \overline{x^2})};$$

$$C = (y \text{ mean} - (m * (x \text{ mean}))) \text{ so } C = (\bar{y} - (m * (\bar{x}))). \quad [\text{Equation 1}]$$

### 3.6.1 Machine Learning in temperature

For temperature factor, our training data age range in between 18 to 26 and all of the people are in normal condition. That means all body temperature below 98.8 F. Then our training data value can not be above 98.8F. So our testing data which we get from sensor 98.9 F our system take this data as a fever case. All this coding procedure run in Tensor flow by Python. In **Fig 3.9** represent temperature sensor training data from **Appendix C**



**Fig. 3.9** Temperature training data

### 3.6.2 Machine Learning in oxygen saturation

For oxygen saturation factor, our training data age range in between 17 to 24 and all of the people are in normal condition. Here all people oxygen saturation above 89% . Then our training data value can not be less than 89%. So our testing data which we get from sensor 89% oxygen saturation our system take this data as a wrong situation. All this coding procedure run in Tensor flow by Python. In **Fig 3.10** oxygen saturation by training data from **Appendix C** in corporate with linear regression theorem .

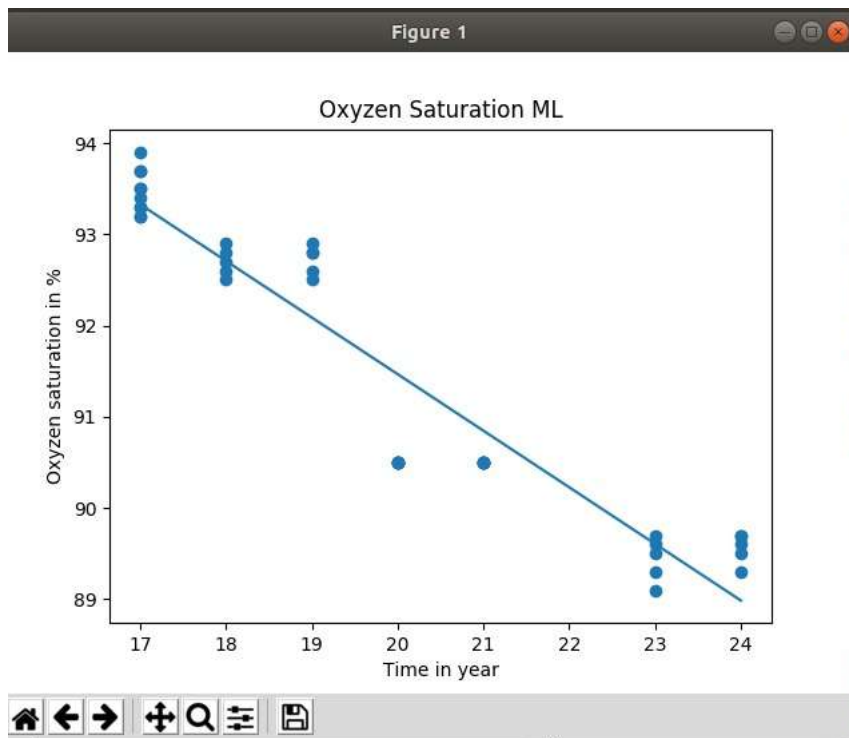
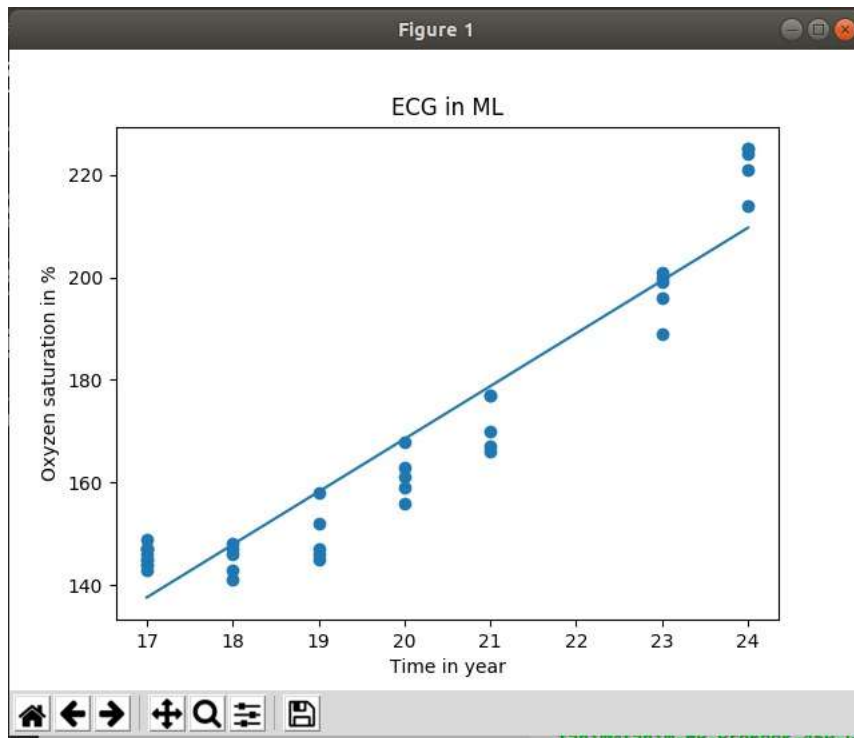


Fig.3.10 Oxygen saturation training data

### 3.6.3 Machine learning in ECG

In ECG value we have taken as oxygen saturation normalize values because we can get accurate result . Diastolic beat and systolic beat in percentage 220 to 140 .We have taken 17 to 24 years old and all the result in normal. If ECG values rise 220 percentage ,we can predict either he will face heart failure or anything wrong with his vein .Normally corona virus increase the blood density So this result create another dimension to detect the virus. If our sensor data are in between 140 to 220 ,we can declare the people as healthy person.

Since ECG values are with the saturation criteria so it was not so easy to get correct values from sensors. So from **Appendix C** we get all training data in **Fig 3.11** we get ECG data ML equation plots.



**Fig.3.11** ECG training data

### 3.7 Decision making in the server with Machine Learning

In back end we have done with php because it is easy and has a dedicated android apk. Further we can develop as in website browser site. So our training data have three type of specification. When NODE mcu send the resulting values to server. In server side the logic operation is done by php. The php logic will check the resulting data with respect to the training data. Such as if resulting data temperature more than training data, Oxygen saturation is less than training data and also ECG is not

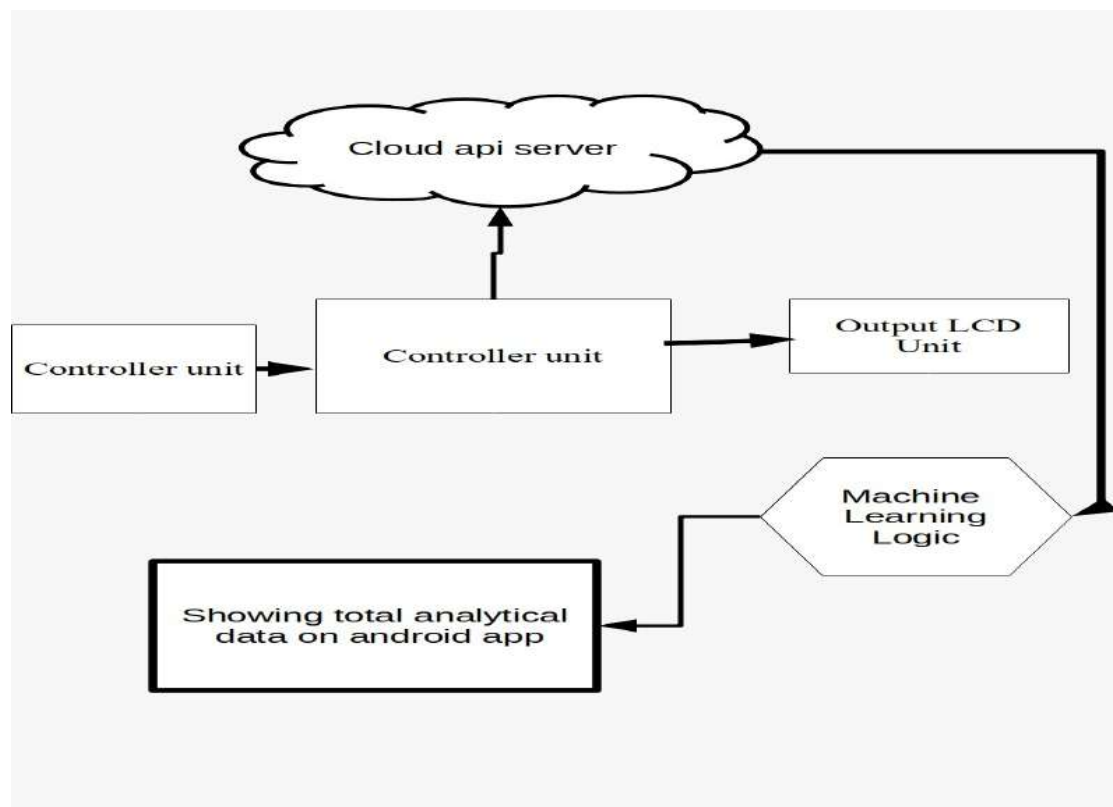
between 220 to 140. Then php logic will cooperate with Node Js to show the student are not ok in the app. If the oxygen saturation more than 95 % and temperature between 96 to 98 F. The logic will tell that the student health is ok.

## CHAPTER 4

### SOFTWARE,COST COMPISSION AND DICUSSION

#### 4.1 Introduction

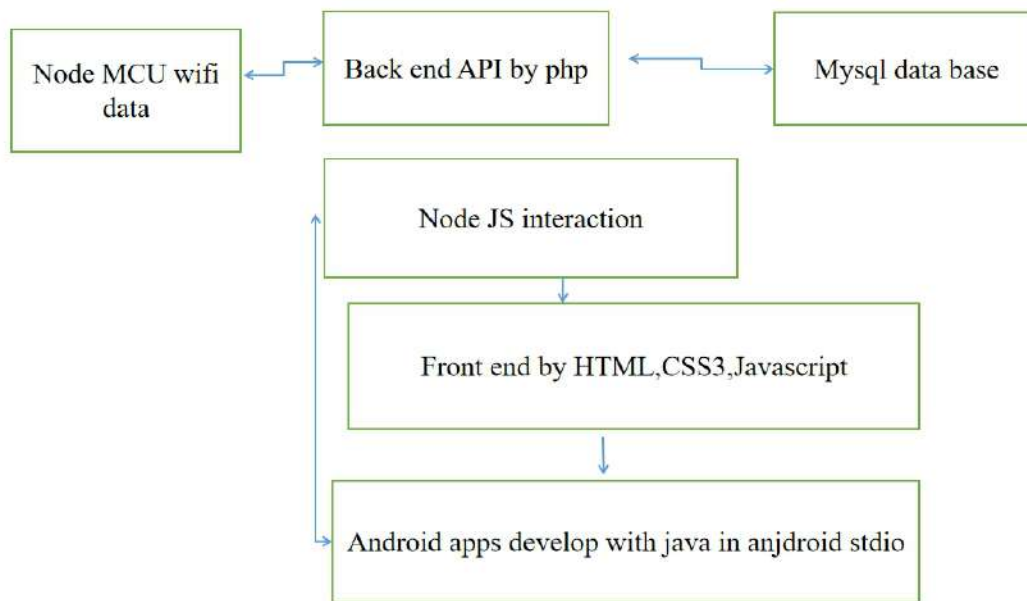
While the Node MCU send the data through to the server. The server receive data as JSON format and interface with php logic. We have used php because it can also interface with android with Node JS via react native frame work.But it can not interface with Mac/I phone because Mac is written in Swift language. So Node JS can not interface with Mac. Since our most of the phone in 4G technology. So we can show the data web and android . So basically our server side software start from back end . Then machine learning algorithm occupy with Tensor flow by python. If we see a flow chart ,we will understand the procedure. In **Fig 4.1** describe the whole software frame work in block diagram.



**Fig 4.1** General flow chart of hardware and software

## 4.2 Technology and used software list

We have used html, css, javascript as frontend and php as backend and mysql in database. So how language technology work we can under from the flow chart diagram. In **Fig 4.2** represent flow chart of back end portion of mobile and web application.



**Fig 4.2** flow chart of back-end and front- end portion

That means we can divide the technology in two portion one is front-end another one is back-end. In front-end we have used HTML5,CSS3,Javascript and in back-end we have used php as API( application Programming interface),Node JS and also use Mysql as data base.

And software we have used

1. XAMPP
2. VS CODE
3. POSTMENT
4. PHPSTORM
- 5.ANDROID STUDIO

### 4.3 Back-end with php

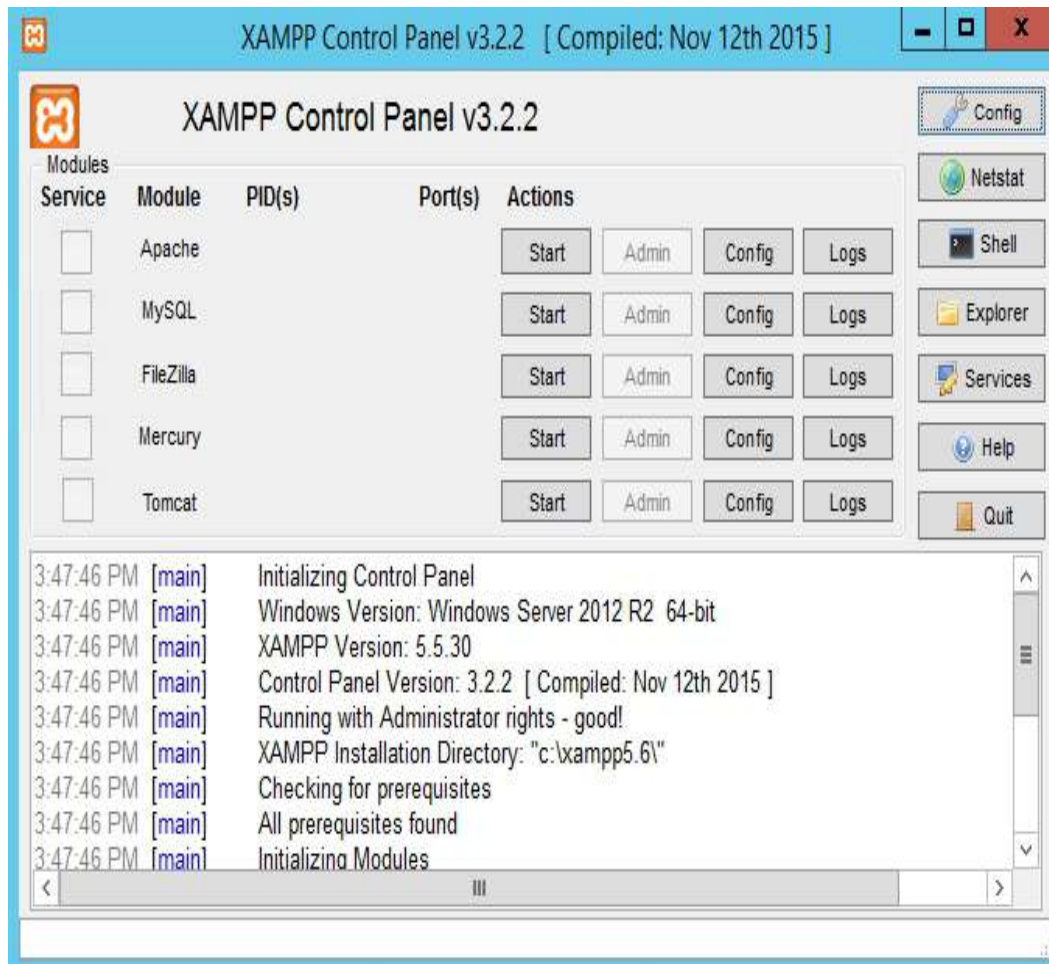
Php is a open source server-side scripting language that would be used to create progression and static web base application. Our machine learning have implemented with php tags.And php language logic call the Tensor flow tag with respect to python logic. In web based application we have php admins panel in **Fig 4.3**.

PHP Version 7.3.31-1+ubuntu18.04.1+deb.sury.org+1	
System	Linux fahim-HP-ProBook-450-G1 4.15.0-156-generic #163-Ubuntu SMP Thu Aug 19 23:31:58 UTC 2021 x86_64
Build Date	Sep 23 2021 21:35:55
Server API	Built-in HTTP server
Virtual Directory Support	disabled
Configuration File (php.ini) Path	/etc/php/7.3/cli
Loaded Configuration File	/etc/php/7.3/cli/php.ini
Scan this dir for additional .ini files	/etc/php/7.3/cli/conf.d
Additional .ini files parsed	/etc/php/7.3/cli/conf.d/10-mysqld.ini, /etc/php/7.3/cli/conf.d/10-opcache.ini, /etc/php/7.3/cli/conf.d/10-pdo.ini, /etc/php/7.3/cli/conf.d/15-xm.ini, /etc/php/7.3/cli/conf.d/20-calendar.ini, /etc/php/7.3/cli/conf.d/20-ctype.ini, /etc/php/7.3/cli/conf.d/20-curl.ini, /etc/php/7.3/cli/conf.d/20-dom.ini, /etc/php/7.3/cli/conf.d/20-exif.ini, /etc/php/7.3/cli/conf.d/20-fileinfo.ini, /etc/php/7.3/cli/conf.d/20-ftp.ini, /etc/php/7.3/cli/conf.d/20-gd.ini, /etc/php/7.3/cli/conf.d/20-gettext.ini, /etc/php/7.3/cli/conf.d/20-iconv.ini, /etc/php/7.3/cli/conf.d/20-imap.ini, /etc/php/7.3/cli/conf.d/20-intl.ini, /etc/php/7.3/cli/conf.d/20-json.ini, /etc/php/7.3/cli/conf.d/20-mbstring.ini, /etc/php/7.3/cli/conf.d/20-mysqli.ini, /etc/php/7.3/cli/conf.d/20-pdo_mysql.ini, /etc/php/7.3/cli/conf.d/20-phar.ini, /etc/php/7.3/cli/conf.d/20-posix.ini, /etc/php/7.3/cli/conf.d/20-readline.ini, /etc/php/7.3/cli/conf.d/20-shmop.ini, /etc/php/7.3/cli/conf.d/20-simplexml.ini, /etc/php/7.3/cli/conf.d/20-soap.ini, /etc/php/7.3/cli/conf.d/20-sockets.ini, /etc/php/7.3/cli/conf.d/20-sysvmsg.ini, /etc/php/7.3/cli/conf.d/20-sysvsem.ini, /etc/php/7.3/cli/conf.d/20-sysvshm.ini, /etc/php/7.3/cli/conf.d/20-tokenizer.ini, /etc/php/7.3/cli/conf.d/20-wddx.ini, /etc/php/7.3/cli/conf.d/20-xmireader.ini, /etc/php/7.3/cli/conf.d/20-xmlwriter.ini, /etc/php/7.3/cli/conf.d/20-xsl.ini, /etc/php/7.3/cli/conf.d/20-zip.ini
PHP API	20180731
PHP Extension	20180731
Zend Extension	320180731
Zend Extension Build	API320180731.NTS
PHP Extension Build	API20180731.NTS
Debug Build	no
Thread Safety	disabled

**Fig 4.3** php info in our system

### 4.3.1 XAMPP

XAMPP is used as a software that takes on the Apache web server, My-sql databases, php. It can run with window, Mac OS and linux. WE have loaded all our training data by this software. In **Fig 4.4** we have shown the XAMPP control panel.



**Fig 4.4** XAMPP

### 4.3.2 Node JS

Since we have used Javascript programming language for real time data, so we have to use Node JS because it is open source server-side platform. Node JS created a connection from server to apps for real time applications. Node JS executes the data asynchronously. It design to run on the dedicated HTTP. It's react native frame work has coporated with android apps.

## 4.4 My-sql Database

For our project, we need an open source database management system, here MySQL is the best choice. It builds structural query language. PHP server language logic operation's data comes from MySQL. It is done by command like INSERT, DROP, ADD and UPDATE. Since data based portion is more important for further research purpose so Fig 4.5 has shown the admin panel of PHP and Fig 4.6 has shown training data sets.

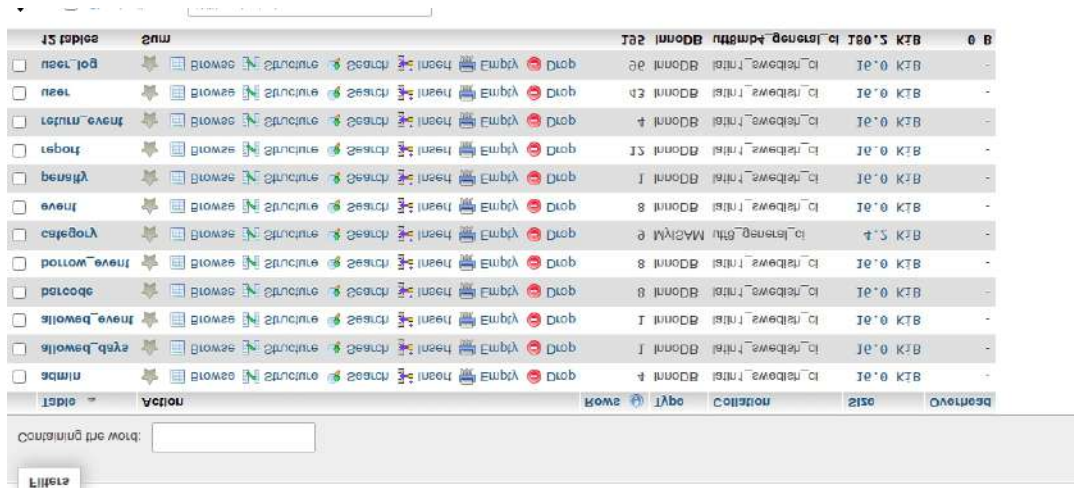


Fig 4.5 MySQL database

```
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```

Fig 4.6 Training data on MySQL

## **4.5 Front-end**

Since it is very important to show the all data in web and mobile applications ,So some web based criteria full fil our aim such as.

### **4.5.1 HTML**

In app we need to see the writen value. It is the skuul ofthe apps. Since we have taken data from the web server so we need to use a mark up language. For this purpose we have used HTML( Hyper Text Markup Language) . We have used common tag like headline tag <h> ,division tag <d>.

### **4.5.2 CSS3**

Apps colour combination is done by CSS3( Cascading Style sheets level 3). We use only three colour format green,orange and white.

### **4.5.3 Javascript**

Since our app data change with resulting work , so in front-end we need a dynamic programming language.And scripting base dynamic language is Javascript .Javascript is worked as functional get way.It has many functional key and it's looping tag works with structural language such as Java and python.Since android app works with Java language. So we had to use Javascript as front-end language.

## **4.6 Android Studio**

To build the android app ,we need a IDE. Android studio is the only IDE to develop or build apps.In this IDE Java programming language are to use. But Java has many functional key to interact with any language. That mean Java creates cross connection with Javascript. In mobile application based code has given in **Appendix B**.

## **4.7 Cost Analysis**

Since we have shown all project much more expensive than us and their complexity and behaviour element are not simple that can implement in our country. So most of the large scale applications we much pity used the Rash berry Pi. So in **Table 4.1** and **Table 4.2** are shown the cost compare with arduino and rash berry pi.

Table-4.1 Cost of the project using arduino and node mcu

Components we used	Price (in Taka)
RFID	150
Node MCU	400
MAX30100	250
LCD+I2C	270
MLX90614	750
Verobroad	40
Punched key per piece	30
Domain hosting	2000
App development	10000
Wire	60
Arduino UNO	450
Total Cost	14400

Table-4.2 Cost of the project using raspberry-pi.

Components we used	Price(in Taka)
RFID	150
Node MCU	Not applicable
MAX30100	250
LCD+I2C	270
MLX90614	750
Verobroad	40
Punched key per piece	30
Domain hosting	2000
App delepment	10000
Wire	60
Raspberry-pi	3800
Total Cost	17350

#### 4.8 Cost comparison

In our project we used Arduino uno as a development board and Node MCU as an Wi-Fi module. If we take a look at the cost calculations then we can see that if we use Raspberry-Pi it reduce our components used. It reduces the size of circuit. It is because the Raspberry-pi alone can perform the operations of the both Arduino and Node MCU. Price of Arduino and Node MCU are 950 taka but the price of Raspberry-Pi is 3800 taka. In total it will cost 1950 taka more if we make the same device using Raspberry-Pi.

#### 4.9 Objective Justification

- First objective of our project is convenient and cost effective COVID 19 detection system design. It is done by designing untouchable sensors and a data base detect the student matric ID with respect to their temperature and pulse oxygen levels. Then machine learning algorithms linear regression procedures detect primary flu the students' body in real time. Further this machine learning algorithm will be more scalable any types independent variables like cough, body pain, rhinopharyngeal, elastic stocking, blood calcic many factors that will include later.
- Since nT-PCR test is not available for any places like our country's schools, colleges and universities. So we should think about some apps based procedure so that every students can get opportunity to join theirs' classes. So this is another objectives. Resulted data will find in the mobile app and stored all data in data base in total 30 days. Since the formation is the supervised learning so predictive data will match with one another.

#### 4.10 Work comparison

Since we have used Machine Learning theorem so what type effect it have it more important than workable scenario. So in **Table 4.3** we have tried to evaluate the whole prespective with other work.

Table 4.3 Comparison with previous work

Previous work	Our work
1) Corona virus detection from chest x-ray is done AI.	1) In our project, we use machine learning linear regression theorem with pulse oxygen meter and temperature.
2) Need a X-ray installation systems, It will be a too much big.	2) For our project, we need to occupy the 2 square feet spaces.

<p>3)X-ray light is not good for human health because its over using causes cancer.</p>	<p>3)IR sensor light have no impact on human health , that's mean it can not create any type cancer cell.</p>
<p>4)X-ray base machine learning system has done with picture archiving and communication(PAC) and this types of work require the domain expert(i.e radiologist) to assign to training chest x-ray labels.</p>	<p>4) In our project ,we don't need to hire domain expert like previous project.</p>
<p>5) To obtain numerical values from medical image the MIT consider a set of colour layout descriptor (CLD) features. CDL features are designed to special distribution of colour in an image.</p>	<p>5) Colour Layout descriptor (CDL) feature is not used for this system.</p>
<p>6)The MIT's project extraction process form with two parts : grid based representative colour selection and discrete cosine transform with quantization . Clearly , colour is the most basic quality of the observable contents, therefore it is possible to use colour to inscribe and illustrate an image.</p>	<p>6) The feature extraction process depend on only analog to discrete data.</p>
<p>7) Unfortunately, MIT did not provide sex all patients such as their sex,just because most of the case female patient X-ray report could not understand for their chest structures.</p>	<p>7)We use key plunge to detect the student so it is easier to find sex of all students.</p>

#### **4.11 Discussion**

In our project, we have spent only 14400 taka for all procedure beside rash berry pi cost is much higher. The testing of nT-PCR is not safe who do the procedure. Virus can be transmitted in the lab. Because the procedure are introduced in touchable conditions. Our project software portion back-end works with php language and Application Programming Interface (API) works with php language. In the server side we insert data by XAMPP software. All of training data formatting to the database, for the particular dynamic query we have used My-sql. Machine learning linear regression theorem has implemented by Tensor flow that links with php. Since php works as API., so it's front-end portion is written HTML, CSS3 and Javascript. This three particular web scripting language can create cross connection with Java for android. For our app building, we have used android studio. If all procedure establish as structural infrastructures, we must appoint a developer to maintain the all procedure. But the cost of maintaining is so low as other web and app base system.

## CHAPTER 5

### RESULT, CONCLUSIONS AND FUTURE WORK

#### 5.1 Introduction

In this chapter we shall discuss about our system output and reviewed result from the desired output settings. We took data from the app set the training data on the server and returned them on the system.

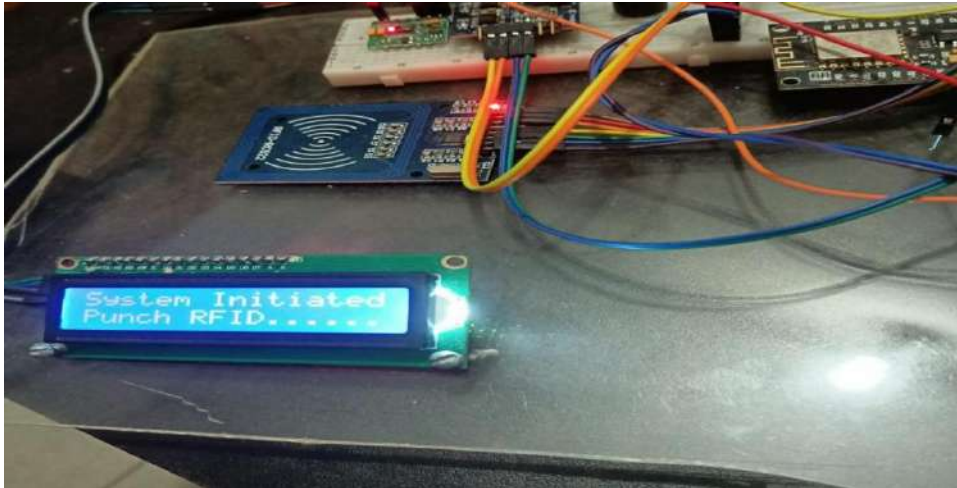
#### 5.2 Discussion result

Student medical system app divided into several parts. Those are given one by one. At first we shall see the app outcome.



**Fig 5.1** Hardware start up

**Fig 5.1** represent the starting data ration on LCD. This programs are being generated into 16x2 LCD display. We also used LCD i2c libraries for less data wiring.



**Fig.5.2** System asks for RFID startups.

**Fig 5.2** represent the RFID sensor security unit on the system. After the RFID sensor punching system starts reading data from the sensor. That's the main security concept of our device.



**Fig.5.3** System recognition

**Fig.5.3** represent the system recognition from hardware.. User data used to save on the device after that when a student punch their id card they can look through this system.



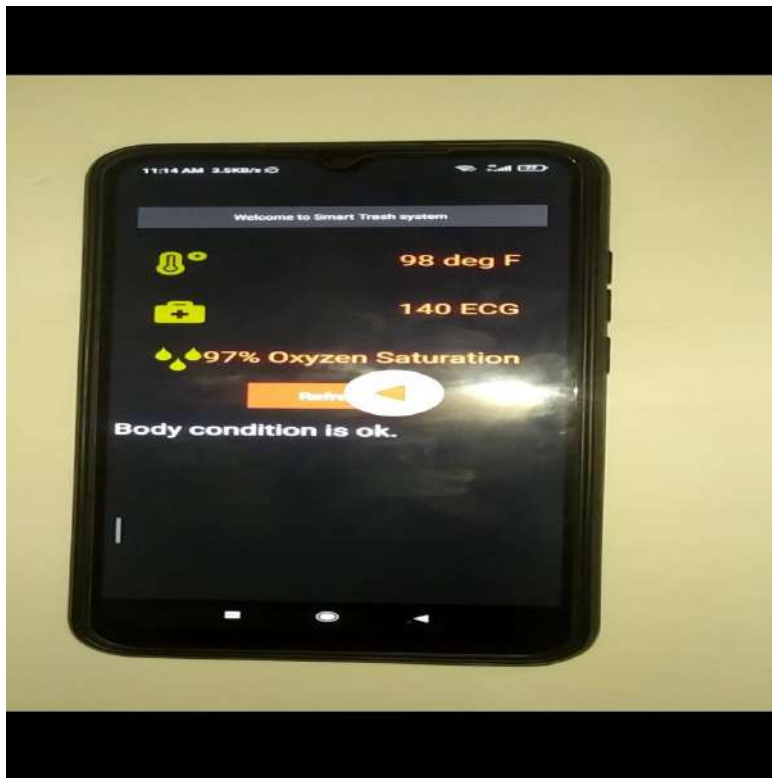
**Fig.5.4** ECG and SpO2 values

**Fig. 5.4** represent the student's ECG is normal but oxygen saturation is not bad ,he can rest in his house.



**Fig.5.5** Temperature in Farenhite.

**Fig.5.5** represent that Student body temperature in normal condition ,he don't need to afraid about the corona virus situation.



**Fig.5.6** Student medical system app

From the app anyone can detect the body condition of the student which represent in **Fig 5.6**

### **5.3 Conclusion**

Here we have used plunge key but we can use any hex code base card like smart card or any electric base card. Form fig.5.5 we see that the temperature value as like health condition but some research say that delta variant corona virus can inhabited in 4 days. The delta variant is more transmitted thorough air. Though this variant was got in march, april. So in our project if we detect the virus properly we should remain quaraintane 4 days. From fig.5.4 we have found the healthy ECG value but the oxygen saturation is not consider as good. A good reason behind it ,when the student check the value ,he is in air cooler. We might be known that Air cooler reduce the oxygen circulation in vein. But in recent another variant omicron are introduced ,this type variant oxygen level will reduce. It is not so dangerous but it is much more spread than any other variant.

#### **5.4 Future work**

Since the world has been changed with Artificial Intelligent (AI) ,we will try to develop our project with unsupervised learning based algorithm. So we need read the corona virus properly, our system can learn all variant of the virus from cloud news which was interlinked with different research institutes. They update the data time to time. By this procedure we can detect the future condition of students. So we need to implement it in prolog. For this purpose we have to do data mining , it is part of big data sector.If any variant will come out with mutation of spike protein, some times existing vacine can not play good role, such as Pizer and Astrogenica can not work against omicron variant.We will try to develop our system to prescribe the vacine what types variant the student has? Further our database will help the medical company to evaluate the variant.

## REFERENCE

- [1] The COVID 19 pandemic, access data 12<sup>th</sup> december 2021, The new York Times 10<sup>th</sup> december 2021 link available in [http:// New York times .com/news-event/COVID-19](http://NewYorktimes.com/news-event/COVID-19).
- [2] "Corona virus outbreak low test rate may be belying reality." The Daily Star 1 April 2020 ,Access in 4<sup>th</sup> April 2020.Archieve from the original on 8 april 2020. Available in <https://www.thedailystar.net/multimedia/homepage/photo/todays-gallery-20200616-1915297>
- [3] "Bangladesh COVID-19 test rate lowest in world." The Dhaka Tribune 1 april 2020 ,Access in 4<sup>th</sup> April 2020. arcrived from 3 september 2020. available in <https://www.dhakatribune.com/hashtag/2020>.
- [4] "Containing COVID-19 : Testing kit crunch frustrates efforts" Access in 17<sup>th</sup> June 2020.The Daily Star 15 june 2020 archived from on 24 june. Avaiable in <https://www.thedailystar.net/multimedia/homepage/photo/todays-gallery-20200626-1920557>
- [5] Peng Zhang, Bin Chen, Liang Ma "The Large Scale Machine Learning in an Artificial Society: Prediction of the Ebola Outbreak in Beijing." *Computational Intelligence and Neuroscience*, 2015 ,Beijing.
- [6] Mahmood Akhtar, Moritz U. G. Kraemer & Lauren M. Gardner , "A dynamic neural network model for predicting risk of Zika in real time." *BMC Medicine* , September 2019.
- [7] Dong Jiang, Mengmeng Kao, Fangyu Ding "Mapping the Transmission Risk of Zika Virus using Machine Learning Models." *Acta Tropica* ,june 2018 .
- [8] McCall B. "COVID-19 and artificial intelligence: protecting health-care workers and curbing the spread". *Lancet Digit Health*. 2020 April.
- [9] Bogoch II, Watts A, Thomas-Bachli A, Huber C, Kraemer MUG, Khan K." Pneumonia of unknown aetiology in Wuhan, China: potential for international spread via commercial air travel". *J. Travel. Med.* 2020 Mar 13 .
- [10] Funk S, Camacho A, Kucharski AJ, Eggo RM, Edmunds WJ. "Real-time forecasting of infectious disease dynamics with a stochastic semi-mechanistic model". *Epidemics*, 2018 Mar.
- [11] Johansson MA, Apfeldorf KM, Dobson S, Devita J, Buczak AL, Baugher B, et al. An open challenge to advance probabilistic forecasting for dengue epidemics. *Proc. Natl. Acad. Sci.* 2019 Nov 26.
- [12] Hayati M, Biller P, Colijn C. "Predicting the short-term success of human influenza virus variants with machine learning". *Proc. Biol. Sci.* 2020 Apr 8.
- [13] Li H, Sun F. "Comparative studies of alignment, alignment-free and SVM based approaches for predicting the hosts of viruses based on viral sequences". *Sci. Rep.* 2018 Jul 3.
- [14] Chae S, Kwon S, Lee D. "Predicting Infectious disease using deep learning and big data". *Int. J. Environ. Res. Public Health*, 2020 Mar 28 .
- [15] Venna SR, Tavanaei A, Gottumukkala RN, Raghavan VV, Maida AS, Nichols S. A Novel Data-Driven Model for Real-Time Influenza Forecasting. *IEEE Data Science Access*. 2019.
- [16] Riad MH, Sekamatte M, Ocom F, Makumbi I, Scoglio CM. Risk assessment of Ebola virus disease spreading in Uganda using a two-layer temporal network. *Sci. Rep.* 2019.

- [17] Kucharski AJ, Russell TW, Diamond C, Liu Y, Edmunds J, Funk S. Early dynamics of transmission and control of COVID-19: a mathematical modelling study. *Lancet Infect. Dis.* 2020 Mar 11 .
- [18] Gambhir M, Bozio C, O'Hagan JJ, Uzicanin A, Johnson LE, Biggerstaff M." Infectious disease modeling methods as tools for informing response to novel influenza viruses of unknown pandemic potential". *Clin Infect Dis Off Publ Infect Dis Soc Am*, 2015 May 1.
- [19] Binti Hamzah F, Lau C, Nizri H, Ligot D, Lee G, Tan C, et al. CoronaTracker: Worldwide COVID-19 Outbreak Data Analysis and Prediction. *Bull. World Health Organ.* 2020 Mar 19;"
- [20] Wu JT, Leung K, Leung GM." Nowcasting and forecasting the potential domestic and international spread of the 2019-nCoV outbreak originating in Wuhan, China: a modelling study". *Lancet* 2020 Feb 29.
- [21] " 1.World Health Organosation;2."Corona Diseases 2019 Symptoms"Centers for Disease Control and Prevention.United States.3."Anosmia,Hyposmia and Dysguesia Symtoms of Coronavirus Diseases".*American Academy of Otolaryngology-Head and Neck surgary.*22 March 2020".
- [22] "Bangladesh General Health Risks:Coronavirus COVID-19" link in <https://www.iamat.org/country/bangladesh/risk/coronaviruses>".
- [23] Teng Y, Bi D, Xie G, Jin Y, Huang Y, Lin B." Dynamic Forecasting of Zika Epidemics Using Google Trends". *PLoS One* 2017 Jan 6.
- [24] Education and covid-19 crisis - Impact of covid19 on education" link in [https://campaignforeducation.org/en/2020/03/18/coronavirus-dont-let-our-children-down/?gclid=CjwKCAiAv\\_KMBhAzEiwAs-rX1JwhQGgQkBadYKkj64ByXUWgtTjRr34-\\_A28j-qJUVOGFVtS3u7lYxoCQPkQAvD\\_BwE](https://campaignforeducation.org/en/2020/03/18/coronavirus-dont-let-our-children-down/?gclid=CjwKCAiAv_KMBhAzEiwAs-rX1JwhQGgQkBadYKkj64ByXUWgtTjRr34-_A28j-qJUVOGFVtS3u7lYxoCQPkQAvD_BwE).
- [25] Rao ASRS, Vazquez JA. "Identification of COVID-19 Can be quicker through artificial intelligence framework using a mobile phone-based survey in the populations when cities/towns are under quarantine. *Infect". Control Hosp. Epidemiol.* 2020 Mar 3.
- [26] Toninelli D, Toninelli D, Pinter R, Pedraza P de, Pinter R, Pedraza P de. "Mobile research methods". *Ubiquity press* , 2015 Sep 25.
- [27] Paolotti D, Carnahan A, Colizza V, Eames K, Edmunds J, Gomes G, "Web-based participatory surveillance of infectious diseases: the Influenzanet participatory surveillance experience". *Clin. Microbiol Infect Off Publ. Eur. Soc. Clin. Microbiol. Infect. Dis.* 2014 Jan 20.
- [28] Jordi Lanhuarta, Ferran Hueto "COVID-19 Artificial Intelligence Diagnosis Using Only Cough Recordings". *IEEE Artificial Intelligence in USA*, 2019, 19 november 2019.
- [29] T. Higenbottam and J. Payne, "Glottis narrowing in lung disease", *Amer. Rev. Respiratory Disease*, vol. 125, no. 6, pp. 746-750, 1982.
- [30] A. Chang and M. P. Karnell, "Perceived phonatory effort and phonation threshold pressure across a prolonged voice loading task: A study of vocal fatigue", *J. Voice*, vol. 18, no. 4, pp. 454-466, 2004.
- [31] Lim S, Tucker CS, Kumara S. "An unsupervised machine learning model for discovering latent infectious diseases using social media data". *J. Biomed. Inform.* 2017 Feb 1.

- [32] Choi S, Lee J, Kang M-G, Min H, Chang Y-S, Yoon S.” Large-scale machine learning of media outlets for understanding public reactions to nation-wide viral infection outbreaks”. *Methods San Diego Calif.* 2017 jan 1.
- [33] Wirz CD, Xenos MA, Brossard D, Scheufele D, Chung JH, Massarani L. Rethinking social amplification of risk: Social media and Zika in three languages. *Risk Anal. Off Publ. Soc. Risk. Anal.* 2018 feb 23 .
- [34] Gui X, Wang Y, Kou Y, Reynolds TL, Chen Y, Mei Q. “Understanding the Patterns of Health Information Dissemination on Social Media during the Zika Outbreak”. *AMIA Annu. Symp. Proc. AMIA Symp.* 2017 august 23.
- [35] "S. Baldwin, S. T. Farias et al., "Unit 10.3: Assessment of cognitive impairments in the diagnosis of alzheimer's disease", Current Protocols Neuroscience/Editorial Board, pp. Unit10-Unit3, 2009."
- [36] [36] Mohammad Jamshidi, Ali Lalbakhsh, Jakub Talla “Artificial Intelligent and COVID 19 :deep learning approaches for diagnosis and treatment”. IEEE Conference on Artificial Intelligent on Prag, 2020 12 june.
- [37] Koo JR, Cook AR, Park M, Sun Y, Sun H, Lim JT. “Interventions to mitigate early spread of SARS-CoV-2 in Singapore: a modelling study”. *Lancet Infect. Dis.* 2020 Mar 23.
- [38] Raju Vaishya, Mohammad Javaid, Ibrahim Hameen “Artificial Intelligence (AI) applications for COVID-19 pandemic”. Conference of Diabetic and Metabolic Syndrome Clinical Research ,2020 4 july august 4.
- [39] RFID RC22 ,Access at 25 th july 2021. Available at <https://microcontrollerslab.com/rc522-rfid-reader-pinout-arduino-interfacing-examples-features/>.
- [40] 16\*2 LCD display with I2C interface. Access at 25 th August 2020. Available at [https://create.arduino.cc/projecthub/arduino\\_uno\\_guy/i2c-liquid-crystal-displays-5b806c](https://create.arduino.cc/projecthub/arduino_uno_guy/i2c-liquid-crystal-displays-5b806c).
- [41] MLX 90614 tempeature sensor, Access at 23 th June 2020. Available at <https://www.pinterest.com/pin/619174648757957437/>
- [42] Max 30100, Access at 23th september, 2020. Available at <https://www.electronicclinic.com/max30100-pulse-oximeter-arduino-code-circuit-and-programming/>
- [43] Ardiuno UNO, Access at 15 th January 2020. Available at <https://robu.in/arduino-pin-configuration/>
- [44] Node MCU ESP8266 ,Access at 03 th January 2020. Available at <https://components101.com/development-boards/nodemcu-esp8266-pinout-features-and-datasheet>

## APPENDIX

### Appendix A: For all hardware code and Arduino Uno code using in micro controller.

```
#include <stdlib.h>
#include <Wire.h>
#include <LiquidCrystal_I2C.h>
#include <SPI.h>
#include <MFRC522.h>
#include "MAX30100_PulseOximeter.h"
#include "MLX90640_API.h"
#include "MLX90640_I2C_Driver.h"

const byte MLX90640_address = 0x33; //Default 7-bit unshifted address of the MLX90640

#define TA_SHIFT 8 //Default shift for MLX90640 in open air

static float mlx90640To[768];
paramsMLX90640 mlx90640;

#define REPORTING_PERIOD_MS      1000

PulseOximeter pox;
uint32_t tsLastReport = 0;

LiquidCrystal_I2C lcd(0x3F, 16, 2);
#define RST_PIN 9
#define SS_PIN 10
MFRC522 mfrc522(SS_PIN, RST_PIN);

void setup() {
    Wire.begin();
    Wire.setClock(400000); //Increase I2C clock speed to 400kHz

    Serial.begin(9600);
    while (!Serial); //Wait for user to open terminal
    Serial.println("MLX90640 IR Array Example");

    if (isConnected() == false)
    {
        Serial.println("MLX90640 not detected at default I2C address. Please check wiring. Freezing.");
        while (1);
    }
    Serial.println("MLX90640 online!");

    //Get device parameters - We only have to do this once
    int status;
    uint16_t eeMLX90640[832];
    status = MLX90640_DumpEE(MLX90640_address, eeMLX90640);
    if (status != 0)
        Serial.println("Failed to load system parameters");

    status = MLX90640_ExtractParameters(eeMLX90640, &mlx90640);
    // put your setup code here, to run once:
    lcd.begin();
    lcd.clear();
}
```

```

lcd.setCursor(0,0);
lcd.print("Welcome To");
lcd.setCursor(0,1);
lcd.print("Medical System");
delay(10000);
lcd.clear();
lcd.setCursor(0,0);
lcd.print("System Initiated");
lcd.setCursor(0,1);
lcd.print("Punch RFID.....");
delay(15000);
Serial.begin(9600);
SPI.begin();
mfrc522.PCD_Init();
if (!pox.begin()) {
    Serial.println("FAILED");
    for(;;);
} else {
    Serial.println("SUCCESS");
}
pox.setIRLedCurrent(MAX30100_LED_CURR_7_6MA);
pox.setOnBeatDetectedCallback(onBeatDetected);
}

void loop() {
    for (byte x = 0 ; x < 2 ; x++) //Read both subpages
    {
        uint16_t mlx90640Frame[834];
        int status = MLX90640_GetFrameData(MLX90640_address, mlx90640Frame);
        if (status < 0)
        {
            Serial.print("GetFrame Error: ");
            Serial.println(status);
        }

        float vdd = MLX90640_GetVdd(mlx90640Frame, &mlx90640);
        float Ta = MLX90640_GetTa(mlx90640Frame, &mlx90640);

        float tr = Ta - TA_SHIFT; //Reflected temperature based on the sensor ambient temperature
        float emissivity = 0.95;

        MLX90640_CalculateTo(mlx90640Frame, &mlx90640, emissivity, tr, mlx90640To);
    }

    for (int x = 0 ; x < 10 ; x++)
    {
        Serial.print("Pixel ");
        Serial.print(x);
        Serial.print(": ");
        Serial.print(mlx90640To[x], 2);
        Serial.print("C");
        Serial.println();
    }

    delay(1000);
    if ( ! mfrc522.PICC_IsNewCardPresent())
    {
        return;
    }
}

```

```

if ( ! mfr522.PICC_ReadCardSerial())
{
return;
}
String content= "";
byte letter;
for (byte i = 0; i < mfr522.uid.size; i++)
{
content.concat(String(mfr522.uid.uidByte[i] < 0x10 ? " 0" : " "));
content.concat(String(mfr522.uid.uidByte[i], HEX));
}
content.toUpperCase();
delay(5000);
Serial.print(content.substring(1));
if(content.substring(1)== "C9 1E 21 B5"){
lcd.clear();
lcd.setCursor(0,0);
lcd.print("Hello Fahim");
lcd.setCursor(0,1);
lcd.print("Code Initiated");
delay(3000);
pox.update();
if (millis() - tsLastReport > REPORTING_PERIOD_MS) {
Serial.print("Heart rate:");
Serial.print(pox.getHeartRate());
Serial.print("bpm / SpO2:");
Serial.print(pox.getSpO2());
Serial.println("%");
tsLastReport = millis();
lcd.clear();
lcd.setCursor(0,0);
lcd.print("ECG:");
lcd.setCursor(6,0);
lcd.print(pox.getHeartRate());
lcd.setCursor(0,1);
lcd.print("SpO2:");
lcd.setCursor(6,1);
lcd.print(pox.getSpO2());
lcd.setCursor(11,1);
lcd.print("%");
delay(5000);
lcd.clear();
lcd.setCursor(0,1);
lcd.print("Temperature");
lcd.setCursor(11,1);
lcd.print("97.37");
lcd.setCursor(11,1);
delay(15000);
}
}
else if(content.substring(1)== "99 9C 66 59"){
lcd.clear();
lcd.setCursor(0,0);
lcd.print("Hello Ridwan");
lcd.setCursor(0,1);
lcd.print("Code Initiated");
delay(3000);
lcd.clear();
lcd.setCursor(0,0);
lcd.print("Put your hand on");
}
}

```

```

    lcd.setCursor(5,1);
    lcd.print("Sensors");
    delay(5000);
    pox.update();
    if (millis() - tsLastReport > REPORTING_PERIOD_MS) {
        Serial.print("Heart rate:");
        Serial.print(pox.getHeartRate());
        Serial.print("bpm / SpO2:");
        Serial.print(pox.getSpO2());
        Serial.println("%");
        tsLastReport = millis();
        lcd.clear();
        lcd.setCursor(0,0);
        lcd.print("ECG:");
        lcd.setCursor(6,0);
        lcd.print(pox.getHeartRate());
        lcd.setCursor(0,1);
        lcd.print("SpO2:");
        lcd.setCursor(6,1);
        lcd.print(pox.getSpO2());
        lcd.setCursor(11,1);
        lcd.print("%");
        delay(5000);
        lcd.clear();
        lcd.setCursor(0,1);
        lcd.print("Temperature");
        lcd.setCursor(11,1);
        lcd.print("97.37");
        lcd.setCursor(11,1);
        delay(5000);
    }
}
    lcd.clear();
    lcd.setCursor(0,0);
    lcd.print("System Initiated");
    lcd.setCursor(0,1);
    lcd.print("Punch RFID.....");
    delay(3000);
}

void onBeatDetected()
{
    Serial.println("Beat!");
}

```

## Node MCU Code

```
#include <ESP8266WiFi.h>
#include <ESP8266HTTPClient.h>

const char* ssid = "Fahim";
const char* password = "FahimEvan";

void setup () {

  Serial.begin(115200);
  WiFi.begin(ssid, password);

  while (WiFi.status() != WL_CONNECTED) {
    delay(1000);
  }
  while (!Serial) {
    ; // wait for serial port to connect. Needed for native USB port only
  }
}

void loop() {

if (WiFi.status() == WL_CONNECTED) {
  if (Serial.available()) {
    HTTPClient http;
    http.begin("http://student.beitcbd.com/hearttrate/"+Serial.heartdate);

    int httpCode = http.GET();
    http.end();
    delay(30000);
    http.begin("http://student.beitcbd.com/temp/"+Serial.temp);
    httpCode = http.GET();
    http.end();
    delay(10000);
    http.begin("http://student.beitcbd.com/temp/"+Serial.os);
    httpCode = http.GET();
    http.end();
    delay(10000);
  }
}

}
```

## Appendix B: Android code have used in Android Studio with Java.

```
import React, { Component } from 'react'; //react library calling
import { View, Text, ActivityIndicator, TouchableOpacity } from 'react-native'; // View components
calling
import { Entypo, EvilIcons } from '@expo/vector-icons'; //icon library calling

export default class App extends Component {
  state = {
    loaded: false,
    metal: 0,
    nonmetal: 0,
    water: 0,
    all: 0,
  }; //main variables

  componentDidMount() {
    this.firstLoad();
  } //onStart activity

  firstLoad = () => {
    this.setState({ loaded: false });
    fetch('http://student.beitcbd.com/api/put/get/all')
      .then((response) => response.json())
      .then((responseJson) => {
        console.log(responseJson);
        this.setState({
          ecg: responseJson.ecg,
          temp: responseJson.temp,
          os: responseJson.os,
          all: responseJson.all,
          conditionStatus: responseJson.conditionStatus
        });
        this.setState({ loaded: true });
      });
  }; //calling http api then fetch the data

  clearTrash = () => {
    fetch('http://trash.beitcbd.com/api/put/delete/all').then(() => {
      this.firstLoad();
    });
  };

  render() {
    return (
      <View style={{ alignItems: 'center', paddingTop: 80, flex: 1 }}>
        <View
          style={{
            width: '90%',
            padding: 10,
            alignItems: 'center',
            backgroundColor: '#ccc',
          }}>
          <Text> Welcome to IIUC Student Healthcare system </Text>
        </View>
        {!this.state.loaded ? (
          <View style={{ marginTop: 250 }}>
            <ActivityIndicator size="large" color="#AE431E" />
          </View>
        ) : null}
      </View>
    );
  }
}
```

```

): null}
{this.state.loaded ? (
  <View>
    <View
      style={{
        flexDirection: 'row',
        justifyContent: 'space-between',
        width: '80%',
        marginLeft: 90,
        marginTop: 40,
      }}>
      <Entypo name="trash" size={40} color="#AE431E" />
      //icon library
      <Text style={{ fontSize: 30, color: '#AE431E' }}>
        {this.state.all}% Inserted
      </Text>
    </View>
    <View
      style={{
        flexDirection: 'row',
        justifyContent: 'space-between',
        width: '80%',
        marginLeft: 90,
        marginTop: 40,
      }}>
      <EvilIcons name="gear" size={40} color="#8A8635" />
      <Text style={{ fontSize: 30, color: '#AE431E' }}>
        {this.state.temp}F Temp
      </Text>
    </View>
    <View
      style={{
        flexDirection: 'row',
        justifyContent: 'space-between',
        width: '80%',
        marginLeft: 90,
        marginTop: 40,
      }}>
      <Entypo name="water" size={40} color="#8A8635" />
      <Text style={{ fontSize: 30, color: '#AE431E' }}>
        {this.state.water}% Water Trash
      </Text>
    </View>
    <View
      style={{
        flexDirection: 'row',
        justifyContent: 'space-between',
        width: '80%',
        marginLeft: 90,
        marginTop: 40,
      }}>
      <Entypo name="water" size={40} color="#8A8635" />
      <Text style={{ fontSize: 30, color: '#AE431E' }}>
        {this.state.ecg}BMP ECG
      </Text>
    </View>
    <TouchableOpacity
      onPress={() => {
        this.firstLoad();
      }}
    >

```

```

style={{
  alignSelf: 'center',
  backgroundColor: '#AE431E',
  padding: 10,
  margin: 20,
  paddingLeft: 40,
  paddingRight: 40,
  alignItems: 'center',
  justifyContent: 'center',
}}>
<Text style={{ fontSize: 20, color: '#FFF' }}>Refresh</Text>
</TouchableOpacity>
<TouchableOpacity
  onPress={() => {
    this.clearTrash();
  }}
  style={{
    alignSelf: 'center',
    backgroundColor: 'red',
    padding: 10,
    margin: 20,
    paddingLeft: 40,
    paddingRight: 40,
    alignItems: 'center',
    justifyContent: 'center',
  }}>
<Text style={{ fontSize: 20, color: '#FFF' }}>
  Clear Trash can
</Text>
</TouchableOpacity>
</View>
): null}
</View>
);
}

```

## Appendix C : Training Data have used in Tensor Flow for machine learning.

Temperature	Oxygen Saturation	ECG	2020-11-15T06:58:25.	2020-11-15T06:58:25.
			000000Z	000000Z
98	98	132	2020-11-15T06:58:25.	2020-11-15T06:58:25.
			000000Z	000000Z
97	93	130	2020-11-15T06:58:25.	2020-11-15T06:58:25.
			000000Z	000000Z
98.6	94	135	2020-11-15T06:58:26.	2020-11-15T06:58:26.
			000000Z	000000Z
95	95	131	2020-11-15T06:58:26.	2020-11-15T06:58:26.
			000000Z	000000Z
97.4	94	130	2020-11-15T06:58:27.	2020-11-15T06:58:27.
			000000Z	000000Z
98	95	132	2020-11-15T06:58:27.	2020-11-15T06:58:27.
			000000Z	000000Z
98	94	135	2020-11-15T06:58:27.	2020-11-15T06:58:27.
			000000Z	000000Z
97	94	131	2020-11-15T06:58:28.	2020-11-15T06:58:28.
			000000Z	000000Z
98	94	135	2020-11-15T06:58:28.	2020-11-15T06:58:28.
			000000Z	000000Z
98	96	131	2020-11-15T06:58:29.	2020-11-15T06:58:29.
			000000Z	000000Z
97	96	133	2020-11-15T06:58:29.	2020-11-15T06:58:29.
			000000Z	000000Z
98	96	135	2020-11-15T06:58:30.	2020-11-15T06:58:30.
			000000Z	000000Z
98	9807	131	2020-11-15T06:58:31.	2020-11-15T06:58:31.
			000000Z	000000Z
96	7	130	2020-11-15T06:58:31.	2020-11-15T06:58:31.
			000000Z	000000Z
98	7	131	2020-11-15T06:58:32.	2020-11-15T06:58:32.
			000000Z	000000Z
98	96	133	2020-11-15T06:58:32.	2020-11-15T06:58:32.
			000000Z	000000Z
97	96	131	2020-11-15T06:58:32.	2020-11-15T06:58:32.
			000000Z	000000Z
98	96	133	2020-11-15T06:58:32.	2020-11-15T06:58:32.
			000000Z	000000Z
98	97	130	2020-11-15T06:58:33.	2020-11-15T06:58:33.
			000000Z	000000Z
98.8	97	130	2020-11-15T06:58:33.	2020-11-15T06:58:33.
			000000Z	000000Z
98	97	132	2020-11-15T06:58:34.	2020-11-15T06:58:34.
			000000Z	000000Z
99	97	132	2020-11-15T06:58:34.	2020-11-15T06:58:34.
			000000Z	000000Z
98	97	135	2020-11-15T06:58:35.	2020-11-15T06:58:35.
			000000Z	000000Z
97	97	132	2020-11-15T06:58:36.	2020-11-15T06:58:36.
			000000Z	000000Z
96	96	134	2020-11-15T06:58:36.	2020-11-15T06:58:36.
			000000Z	000000Z
97.8	96	131	2020-11-15T06:58:37.	2020-11-15T06:58:37.
			000000Z	000000Z
97	96	135	2020-11-15T06:58:38.	2020-11-15T06:58:38.
			000000Z	000000Z

98	98	133	2020-11-15T06:58:38. 000000Z	2020-11-15T06:58:38. 000000Z
98	95	132	2020-11-15T06:58:39. 000000Z	2020-11-15T06:58:39. 000000Z
97	97	133	2020-11-15T06:58:39. 000000Z	2020-11-15T06:58:39. 000000Z
98	96	134	2020-11-15T06:58:41. 000000Z	2020-11-15T06:58:41. 000000Z
98	96	132	2020-11-15T06:58:41. 000000Z	2020-11-15T06:58:41. 000000Z
97	95	135	2020-11-15T06:58:41. 000000Z	2020-11-15T06:58:41. 000000Z
98	95	133	2020-11-15T06:58:42. 000000Z	2020-11-15T06:58:42. 000000Z
97	95	131	2020-11-15T06:58:42. 000000Z	2020-11-15T06:58:42. 000000Z
97	95	132	2020-11-15T06:58:43. 000000Z	2020-11-15T06:58:43. 000000Z
97	96	130	2020-11-15T06:58:43. 000000Z	2020-11-15T06:58:43. 000000Z
97	96	134	2020-11-15T06:58:43. 000000Z	2020-11-15T06:58:43. 000000Z
96	96	134	2020-11-15T06:58:44. 000000Z	2020-11-15T06:58:44. 000000Z
95	96	135	2020-11-15T06:58:44. 000000Z	2020-11-15T06:58:44. 000000Z
95	98	133	2020-11-15T06:58:44. 000000Z	2020-11-15T06:58:44. 000000Z
97	97	130	2020-11-15T06:58:45. 000000Z	2020-11-15T06:58:45. 000000Z
97	97	132	2020-11-15T06:58:45. 000000Z	2020-11-15T06:58:45. 000000Z
98	96	134	2020-11-15T06:58:45. 000000Z	2020-11-15T06:58:45. 000000Z
98	96	130	2020-11-15T06:58:46. 000000Z	2020-11-15T06:58:46. 000000Z
98	95	134	2020-11-15T06:58:46. 000000Z	2020-11-15T06:58:46. 000000Z
98	96	132	2020-11-15T06:58:46. 000000Z	2020-11-15T06:58:46. 000000Z
97	98	130	2020-11-15T06:58:47. 000000Z	2020-11-15T06:58:47. 000000Z
98	9796	134	2020-11-15T06:58:47. 000000Z	2020-11-15T06:58:47. 000000Z
96	96	134	2020-11-15T06:58:48. 000000Z	2020-11-15T06:58:48. 000000Z
96	95	131	2020-11-15T06:58:48. 000000Z	2020-11-15T06:58:48. 000000Z
96	89	130	2020-11-15T06:58:48. 000000Z	2020-11-15T06:58:48. 000000Z
96	97	134	2020-11-15T06:58:49. 000000Z	2020-11-15T06:58:49. 000000Z
96	97	132	2020-11-15T06:58:49. 000000Z	2020-11-15T06:58:49. 000000Z
96	98	135	2020-11-15T06:58:50. 000000Z	2020-11-15T06:58:50. 000000Z
95	97	134	2020-11-15T06:58:51. 000000Z	2020-11-15T06:58:51. 000000Z
96	98	133	2020-11-15T06:58:53. 000000Z	2020-11-15T06:58:53. 000000Z

94	97	130	2020-11-15T06:58:53. 000000Z	2020-11-15T06:58:53. 000000Z
94	96	133	2020-11-15T06:58:54. 000000Z	2020-11-15T06:58:54. 000000Z
94	97	135	2020-11-15T06:58:54. 000000Z	2020-11-15T06:58:54. 000000Z
94	9	133	2020-11-15T06:58:54. 000000Z	2020-11-15T06:58:54. 000000Z
94	97	135	2020-11-15T06:58:55. 000000Z	2020-11-15T06:58:55. 000000Z
94	97	135	2020-11-15T06:58:56. 000000Z	2020-11-15T06:58:56. 000000Z
95	98	130	2020-11-15T06:58:56. 000000Z	2020-11-15T06:58:56. 000000Z
98	97	132	2020-11-15T06:58:57. 000000Z	2020-11-15T06:58:57. 000000Z
98	98	133	2020-11-15T06:58:57. 000000Z	2020-11-15T06:58:57. 000000Z
98	97	134	2020-11-15T06:58:57. 000000Z	2020-11-15T06:58:57. 000000Z
97	96	130	2020-11-15T06:58:58. 000000Z	2020-11-15T06:58:58. 000000Z
96	98	130	2020-11-15T06:58:58. 000000Z	2020-11-15T06:58:58. 000000Z
95	98	131	2020-11-15T06:58:58. 000000Z	2020-11-15T06:58:58. 000000Z
95	97	130	2020-11-15T06:58:59. 000000Z	2020-11-15T06:58:59. 000000Z
98	98	132	2020-11-15T06:58:59. 000000Z	2020-11-15T06:58:59. 000000Z
99	97	134	2020-11-15T06:59:00. 000000Z	2020-11-15T06:59:00. 000000Z
9	97	132	2020-11-15T06:59:00. 000000Z	2020-11-15T06:59:00. 000000Z
9	97	130	2020-11-15T06:59:00. 000000Z	2020-11-15T06:59:00. 000000Z
97	96	130	2020-11-15T06:59:01. 000000Z	2020-11-15T06:59:01. 000000Z
99	96	134	2020-11-15T06:59:01. 000000Z	2020-11-15T06:59:01. 000000Z
98	96	134	2020-11-15T06:59:01. 000000Z	2020-11-15T06:59:01. 000000Z
97	96	133	2020-11-15T06:59:02. 000000Z	2020-11-15T06:59:02. 000000Z
98	98	135	2020-11-15T06:59:02. 000000Z	2020-11-15T06:59:02. 000000Z
97	98	132	2020-11-15T06:59:03. 000000Z	2020-11-15T06:59:03. 000000Z
98	97	134	2020-11-15T06:59:03. 000000Z	2020-11-15T06:59:03. 000000Z
98	98	131	2020-11-15T06:59:04. 000000Z	2020-11-15T06:59:04. 000000Z
98	97	133	2020-11-15T06:59:05. 000000Z	2020-11-15T06:59:05. 000000Z
97	97	133	2020-11-15T06:59:05. 000000Z	2020-11-15T06:59:05. 000000Z
96	96	135	2020-11-15T06:59:06. 000000Z	2020-11-15T06:59:06. 000000Z
96	97	132	2020-11-15T06:59:06. 000000Z	2020-11-15T06:59:06. 000000Z

95	96	135	2020-11-15T06:59:06. 000000Z	2020-11-15T06:59:06. 000000Z
95	97	130	2020-11-15T06:59:07. 000000Z	2020-11-15T06:59:07. 000000Z
95	96	130	2020-11-15T06:59:07. 000000Z	2020-11-15T06:59:07. 000000Z
98	96	134	2020-11-15T06:59:08. 000000Z	2020-11-15T06:59:08. 000000Z
97	96	132	2020-11-15T06:59:08. 000000Z	2020-11-15T06:59:08. 000000Z
97	96	132	2020-11-15T06:59:09. 000000Z	2020-11-15T06:59:09. 000000Z
97	98	135	2020-11-15T06:59:09. 000000Z	2020-11-15T06:59:09. 000000Z
97	97	130	2020-11-15T06:59:09. 000000Z	2020-11-15T06:59:09. 000000Z
96	97	132	2020-11-15T06:59:10. 000000Z	2020-11-15T06:59:10. 000000Z
96	97	131	2020-11-15T06:59:10. 000000Z	2020-11-15T06:59:10. 000000Z
96	97	130	2020-11-15T06:59:11. 000000Z	2020-11-15T06:59:11. 000000Z
96.7	96	131	2020-11-15T06:59:11. 000000Z	2020-11-15T06:59:11. 000000Z
96.4	98	135	2020-11-15T06:59:11. 000000Z	2020-11-15T06:59:11. 000000Z
96.6	97	130	2020-11-15T06:59:12. 000000Z	2020-11-15T06:59:12. 000000Z
96	97	132	2020-11-15T06:59:12. 000000Z	2020-11-15T06:59:12. 000000Z
9	98	132	2020-11-15T06:59:12. 000000Z	2020-11-15T06:59:12. 000000Z
97	97	132	2020-11-15T06:59:14. 000000Z	2020-11-15T06:59:14. 000000Z
96	96	131	2020-11-15T06:59:15. 000000Z	2020-11-15T06:59:15. 000000Z
96	98	132	2020-11-15T06:59:15. 000000Z	2020-11-15T06:59:15. 000000Z
97	98	131	2020-11-15T06:59:15. 000000Z	2020-11-15T06:59:15. 000000Z
98	97	130	2020-11-15T06:59:16. 000000Z	2020-11-15T06:59:16. 000000Z
97	98	135	2020-11-15T06:59:16. 000000Z	2020-11-15T06:59:16. 000000Z
96	97	130	2020-11-15T06:59:17. 000000Z	2020-11-15T06:59:17. 000000Z
98	97	134	2020-11-15T06:59:17. 000000Z	2020-11-15T06:59:17. 000000Z
98	97	134	2020-11-15T06:59:18. 000000Z	2020-11-15T06:59:18. 000000Z
97	97	135	2020-11-15T06:59:18. 000000Z	2020-11-15T06:59:18. 000000Z
98	97	135	2020-11-15T06:59:18. 000000Z	2020-11-15T06:59:18. 000000Z
98	96	134	2020-11-15T06:59:19. 000000Z	2020-11-15T06:59:19. 000000Z
98	97	131	2020-11-15T06:59:19. 000000Z	2020-11-15T06:59:19. 000000Z
98	98	132	2020-11-15T06:59:22. 000000Z	2020-11-15T06:59:22. 000000Z

97	97	131	2020-11-15T06:59:23. 000000Z	2020-11-15T06:59:23. 000000Z
97	96	134	2020-11-15T06:59:23. 000000Z	2020-11-15T06:59:23. 000000Z
97	98	130	2020-11-15T06:59:24. 000000Z	2020-11-15T06:59:24. 000000Z
98	97	135	2020-11-15T06:59:24. 000000Z	2020-11-15T06:59:24. 000000Z
98	97	132	2020-11-15T06:59:25. 000000Z	2020-11-15T06:59:25. 000000Z
97	98	133	2020-11-15T06:59:25. 000000Z	2020-11-15T06:59:25. 000000Z
96	97	135	2020-11-15T06:59:26. 000000Z	2020-11-15T06:59:26. 000000Z
98	97	131	2020-11-15T06:59:26. 000000Z	2020-11-15T06:59:26. 000000Z
97	98	135	2020-11-15T06:59:27. 000000Z	2020-11-15T06:59:27. 000000Z
97	99	130	2020-11-15T06:59:27. 000000Z	2020-11-15T06:59:27. 000000Z
96	98	131	2020-11-15T06:59:28. 000000Z	2020-11-15T06:59:28. 000000Z
98	97	130	2020-11-15T06:59:28. 000000Z	2020-11-15T06:59:28. 000000Z
98	96	131	2020-11-15T06:59:29. 000000Z	2020-11-15T06:59:29. 000000Z
98	98	130	2020-11-15T06:59:30. 000000Z	2020-11-15T06:59:30. 000000Z
98	98	135	2020-11-15T06:59:31. 000000Z	2020-11-15T06:59:31. 000000Z
98	90	135	2020-11-15T06:59:31. 000000Z	2020-11-15T06:59:31. 000000Z
98	90	131	2020-11-15T06:59:32. 000000Z	2020-11-15T06:59:32. 000000Z
97	90	133	2020-11-15T06:59:32. 000000Z	2020-11-15T06:59:32. 000000Z
97	90	132	2020-11-15T06:59:32. 000000Z	2020-11-15T06:59:32. 000000Z
98	90	132	2020-11-15T06:59:33. 000000Z	2020-11-15T06:59:33. 000000Z
97	90	130	2020-11-15T06:59:33. 000000Z	2020-11-15T06:59:33. 000000Z
96	90	135	2020-11-15T06:59:33. 000000Z	2020-11-15T06:59:33. 000000Z
97	92	135	2020-11-15T06:59:34. 000000Z	2020-11-15T06:59:34. 000000Z
98	93	132	2020-11-15T06:59:34. 000000Z	2020-11-15T06:59:34. 000000Z
98	94	133	2020-11-15T06:59:34. 000000Z	2020-11-15T06:59:34. 000000Z
97	9	134	2020-11-15T06:59:35. 000000Z	2020-11-15T06:59:35. 000000Z
98	95	132	2020-11-15T06:59:35. 000000Z	2020-11-15T06:59:35. 000000Z
98	96	134	2020-11-15T06:59:37. 000000Z	2020-11-15T06:59:37. 000000Z
97	95	133	2020-11-15T06:59:37. 000000Z	2020-11-15T06:59:37. 000000Z
97	94	133	2020-11-15T06:59:37. 000000Z	2020-11-15T06:59:37. 000000Z

98	95	131	2020-11-15T06:59:38. 000000Z	2020-11-15T06:59:38. 000000Z
97	95	130	2020-11-15T06:59:38. 000000Z	2020-11-15T06:59:38. 000000Z
98	96	130	2020-11-15T06:59:38. 000000Z	2020-11-15T06:59:38. 000000Z
97	95	135	2020-11-15T06:59:39. 000000Z	2020-11-15T06:59:39. 000000Z
96	96	133	2020-11-15T06:59:39. 000000Z	2020-11-15T06:59:39. 000000Z
98	96	132	2020-11-15T06:59:39. 000000Z	2020-11-15T06:59:39. 000000Z
97	98	134	2020-11-15T06:59:40. 000000Z	2020-11-15T06:59:40. 000000Z
98	95	130	2020-11-15T06:59:40. 000000Z	2020-11-15T06:59:40. 000000Z
97	95	131	2020-11-15T06:59:41. 000000Z	2020-11-15T06:59:41. 000000Z
98	96	133	2020-11-15T06:59:41. 000000Z	2020-11-15T06:59:41. 000000Z
98	96	130	2020-11-15T06:59:42. 000000Z	2020-11-15T06:59:42. 000000Z
97	96	133	2020-11-15T06:59:42. 000000Z	2020-11-15T06:59:42. 000000Z
97	96	132	2020-11-15T06:59:42. 000000Z	2020-11-15T06:59:42. 000000Z
9	97	132	2020-11-15T06:59:43. 000000Z	2020-11-15T06:59:43. 000000Z
97	98	131	2020-11-15T06:59:45. 000000Z	2020-11-15T06:59:45. 000000Z
97	94	132	2020-11-15T06:59:45. 000000Z	2020-11-15T06:59:45. 000000Z
98	95	130	2020-11-15T06:59:45. 000000Z	2020-11-15T06:59:45. 000000Z
98	93	135	2020-11-15T06:59:47. 000000Z	2020-11-15T06:59:47. 000000Z
98	93	130	2020-11-15T06:59:48. 000000Z	2020-11-15T06:59:48. 000000Z
98	94	132	2020-11-15T06:59:49. 000000Z	2020-11-15T06:59:49. 000000Z
97	93	134	2020-11-15T06:59:49. 000000Z	2020-11-15T06:59:49. 000000Z
97	94	135	2020-11-15T06:59:50. 000000Z	2020-11-15T06:59:50. 000000Z
97	94	131	2020-11-15T06:59:50. 000000Z	2020-11-15T06:59:50. 000000Z
98	94	133	2020-11-15T06:59:50. 000000Z	2020-11-15T06:59:50. 000000Z
98	94	132	2020-11-15T06:59:51. 000000Z	2020-11-15T06:59:51. 000000Z
97	95	130	2020-11-15T06:59:51. 000000Z	2020-11-15T06:59:51. 000000Z
97	95	135	2020-11-15T06:59:52. 000000Z	2020-11-15T06:59:52. 000000Z
96	95	135	2020-11-15T06:59:52. 000000Z	2020-11-15T06:59:52. 000000Z
96	95	132	2020-11-15T06:59:52. 000000Z	2020-11-15T06:59:52. 000000Z
96	95	132	2020-11-15T06:59:53. 000000Z	2020-11-15T06:59:53. 000000Z

98	96	133	2020-11-15T06:59:53. 000000Z	2020-11-15T06:59:53. 000000Z
97	96	133	2020-11-15T06:59:54. 000000Z	2020-11-15T06:59:54. 000000Z
98	96	135	2020-11-15T06:59:54. 000000Z	2020-11-15T06:59:54. 000000Z
98	98	134	2020-11-15T06:59:54. 000000Z	2020-11-15T06:59:54. 000000Z
97	99	131	2020-11-15T06:59:55. 000000Z	2020-11-15T06:59:55. 000000Z
98	97	131	2020-11-15T06:59:55. 000000Z	2020-11-15T06:59:55. 000000Z
98	97	134	2020-11-15T06:59:55. 000000Z	2020-11-15T06:59:55. 000000Z
98	98	133	2020-11-15T06:59:56. 000000Z	2020-11-15T06:59:56. 000000Z
97	97	135	2020-11-15T06:59:56. 000000Z	2020-11-15T06:59:56. 000000Z
98	96	130	2020-11-15T06:59:57. 000000Z	2020-11-15T06:59:57. 000000Z
98	96	135	2020-11-15T06:59:57. 000000Z	2020-11-15T06:59:57. 000000Z
97	97	134	2020-11-15T06:59:58. 000000Z	2020-11-15T06:59:58. 000000Z
97	97	130	2020-11-15T06:59:58. 000000Z	2020-11-15T06:59:58. 000000Z
96	97	130	2020-11-15T06:59:58. 000000Z	2020-11-15T06:59:58. 000000Z
97	96	134	2020-11-15T07:00:00. 000000Z	2020-11-15T07:00:00. 000000Z
97	98	134	2020-11-15T07:00:01. 000000Z	2020-11-15T07:00:01. 000000Z
98	97	132	2020-11-15T07:00:01. 000000Z	2020-11-15T07:00:01. 000000Z
98	97	130	2020-11-15T07:00:01. 000000Z	2020-11-15T07:00:01. 000000Z
97	97	134	2020-11-15T07:00:03. 000000Z	2020-11-15T07:00:03. 000000Z
96	97	132	2020-11-15T07:00:04. 000000Z	2020-11-15T07:00:04. 000000Z
97	96	135	2020-11-15T07:00:04. 000000Z	2020-11-15T07:00:04. 000000Z
98	96	131	2020-11-15T07:00:04. 000000Z	2020-11-15T07:00:04. 000000Z
97	96			



