SMART HEALTH MONITORING SYSTEM

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This Report Presented in Partial Fulfillment of the Requirements for the Degree of Bachelor of Science in Computer Science and Engineering

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APPROVAL

This Project titled "**SMART HEALTH MONITORING SYSTEM "**, submitted by **Md. Jaglul Omar** to the Department of Computer Science and Engineering, Daffodil International University, has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of B.Sc. in Computer Science and Engineering and approved as to its style and contents. The presentation has been held on **September 2021.**

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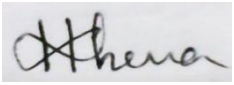

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We hereby declare that, this project has been done by us under the supervision of **Mr. Md. Azizul Hakim, Sr. Lecturer, Department of CSE** Daffodil International University. We also declare that neither this project nor any part of this project has been submitted elsewhere for award of any degree or diploma.

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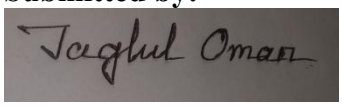

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ABSTRACT

Humanity is facing a worldwide health crisis. Increased incidence of cardiac illnesses and heart-related ailments are on the rise. It is important to monitor the health of old individuals at home or patients in hospitals, but this demands that Practitioners and Doctors be on guard at all times. Human existence is made simpler by information technology (IT) and its expanding uses. Health care and IT are being transformed by IoT. Patients' sensors and activity monitors are examples of physical devices that are connected to the internet. The Internet of Things (IoT) converts data from the internet into useful information. IoT's characteristics will enable the proposed system keep patient information and reports structured and readily available to all players in the system. Patients' data will be collected via IoT devices like as low-power sensors, shown on LCD screens, and saved on personal computers as well as in the cloud so that any actor in the system may refer back to it.

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CHAPTER 1
Introduction

1.1 Introduction

People are suffering from chronic illnesses at an alarming pace due to the ever-growing global population. This is primarily due to regular cigarette use, alcohol use, excessive stress, lack of physical activity, etc. Worldwide, millions of people die from excessive cholesterol, obesity, diabetes, etc., according to the World Health Organization (WHO). Patients with chronic diseases must live their lives with the utmost care and should be treated by a physician at all times. Heart rate, body temperature, oxygen levels in the blood, and others are key characteristics for chronic illnesses. Using the patient monitoring system, clinicians can keep an eye on a large number of patients simultaneously. As a result, the heart rate is a good indicator of the health of the heart. Adult males [1] have an average heart rate of 70bpm, whereas adult females have an average heart rate of 75bpm. These data can be used to track the heart's condition. The temperature of the body is a good indicator of the health of the human body. 98.6°F +/-0.7°F is the usual [2] body temperature for an adult male or female. Unhealthy conditions might result from any fluctuation in body temperature. The Spo2 sensor calculates the quantity of oxygen in the blood, which is a highly important metric for human health. The normal blood oxygen level [3] ranges from 75 to 100 millimeters of mercury. Oxygen concentrations below 60mm of Hg are considered low. It's also a way to measure things. The only downside was that crucial metrics were not monitored. S Nubenthan et al. devised a wireless dengue monitoring system [11]. Although GSM modules were used for transmission, a mobile application was incorporated. For patient monitoring, Sachi marathe et al. devised a system [12] that uses vital parameter measuring devices. Sensor data was saved on the cloud. The results were 3 off. Kathikamani R et al. devised [13] a wireless patient monitoring system. The obtained data is kept in the cloud and is evaluated once it is collected. Instead of employing a web service application peripheral interface, localhost was the problem. As a result of the aforementioned literature review, a design was presented that addresses the shortcomings of all systems.

1.2 Motivation

Through continuous monitoring of various physiological vital signs and providing feedback to the user and medical staff via wireless sensors, a smart health monitoring system for patients must provide many benefits to patients, medical staff, and society at large. Depending on the disease and the parameters that are monitored, different combinations of sensors, storage, and application may be depand.positive impact on time savings and cost effectiveness by preventing the patients from re-hospitalization and monitoring multiple patients' health status simultaneously.The system developed automatically alerts the physicians , emergency department personnel caregivers when an anomaly is detected through notification on the mobile web application.

1.3 Objective

Almost all of our patients are illiterate. Science and health are not well-versed in their minds. End-of-season health is affected as a result. Patients who have no knowledge of science health can utilize our proposed approach. It allows them to use their health monitoring equipment in a proper manner for optimal well-being. With the aid of this gadget, an illiterate patient may quickly comprehend what sort of info is beneficial to them. We want to employ technology in our health care system. This method can save us time by eliminating the need to read books. With this method, everyone may learn their health status in a short amount of time and receive a result. It can also help you save money, time, and energy by reducing waste.

1.4 Rationale of the Study

As illustrated in Figure 1, the system comprises of basic vital sensors that interface with a cloud and mobile application. A processor Arduino collects and processes the data received by sensors. Sensor threshold values are compared with the data collected by the processor. As soon as the sensor readings cross the threshold, an emergency message or alert is sent to doctors through a Wi-Fi module in the mobile application, including information about each sensor. This data is then sent to the cloud for analysis of the changes that have occurred over the last several hours. On the website, you may view the last few hours, and the data is kept in the cloud. A pulse sensor, a temperature sensor, and an oxygen sensor are used in the proposed system, as illustrated in figure1. Patient health may be monitored when a doctor is present or wirelessly

from anywhere using this technology.. Figure 2 shows the flowchart of the proposed system for continuous patient monitoring. Wi-Fi module sends sensor data to cloud, and if the sensor data are out of range, an alarm message is delivered to the mobile app. The doctor can act quickly to assist the patients. A fingertip's distance. Basically, it's a way of measuring how much light is absorbed. Embedded programs may connect to the internet with this module [17]. It makes use of the communication protocol to communicate. Sensor values are sent to the mobile application using this module. Module GSM with TTL output [18] It's a mobile phone standard. Messages are sent to the mobile device if the sensor value exceeds a pre-determined level.

1.5 Expected Outcome

The project's major goal is to create a personal mobile healthcare system based on a mobile video support device that allows ambulant patients to:

- remote monitoring of the patient’s state
- patient’s continuous self control
- live contact from any place and any time with professional medical staff through modern communication network.
- Remotely monitor patient health status

The full version of the system will be designed for those who are chronically unwell. A simplified version of the system with micro-electrodes incorporated directly into the cellular device/PDA is designed for healthy people interested in self-controlling their health condition.

1.6 Research Questions

Completing this task was quite difficult for us. The researchers would like to propose the following questions to convey these sentiments and results in order to have a realistic, efficient, and correct response to the situation.

- What are the impacts of Health Monitoring System?
- Can IOT based smart health monitor be a solution to predict suitable dises?
- How efficient will this project be in the long run?
- How is this project related to IOT?
- How accurate will the solution are outcomes will be?

- How effective will this project be on a large scale?

1.7 Report Layout

- In the first chapter, the project's purpose, motivation, research questions, and projected outcome are described, as is the report's overall structure.
- Chapter two discusses previous work in this area. The second chapter's last part demonstrates the breadth of their limitations. Last but not least, the research's primary hurdles or problems are described.
- Part three gives the Requirement Specification which is business procedure demonstrating, necessity accumulation, use case displaying, and legitimate information model and plan prerequisites of IoT Based Smart cultivating which are quickly portrayed in this section.
- The Design Specification, Front-end, Back-end, and Implementation discussions are covered in Chapter 4. This chapter contains method images and a database that will help you complete the project.
- Chapter five discusses Usage and testing, Database execution, and front-end and back-end structure implementation. This chapter contains several design graphics and a database that will help you realize the project.

CHAPTER 2
Background

2.1 Introduction

In this section, we will look at relevant works, study summaries, and problems linked to this research-based endeavor. In the related works area, we will discuss other research papers and their works, techniques, and projects that are relevant to our study. We shall summarize our relevant efforts in the research summary section. We shall examine how the gadget will provide patient health condition in the difficulties section.

2.2 Related Works

There are several methods for measuring important indicators for health monitoring. Alexsis Bell et al. [4] created a wireless patient monitoring system prototype. By interacting with sensors, this device measured oxygen content in the blood, pulse, and temperature. The disadvantage of the design was that the thermistor location was not calibrated, and the blood oxygen concentration was not calibrated; the hardware requirements were higher, which resulted in the high cost of the prototype. Sagar R Patil et al. [5] created a wireless patient monitoring system. It employed sensors to monitor patients' vital signs. The disadvantage was that the readings were incorrect and displayed glitches while displaying the output. Sohail Shaikh et al. created [6] an IoT-based system for patient monitoring. The primary goal was simply to transfer data from patients to doctors. The disadvantage was the absence of MAC protocols enabling still efficient data transfer. T K Ramesh et al. developed [7] a wireless network protocol for patient monitoring. The wireless network protocols are compared. The disadvantage was that communication in rural regions was inefficient. Dr. Bharath Kumar G J presented a concept [8] that uses cloud computing and IoT to monitor the patient's vegetative condition. It remotely displays the patient's condition to family members. The primary disadvantage is that it is only relevant to individuals in a vegetative condition. Sushan M et al presented a design [9] for enhancing patient and surveillance monitoring safety. The system's disadvantage was that it was difficult to use in

clinical settings. The sensor data measurement was insufficient. Pratiksha W D et al. suggested a technique [10] for monitoring patients' health. With the saline level, the patient's only temperature and heart rate The suggested model requires the following basic hardware: a pulse sensor, a temperature sensor, a SpO2 sensor, a Wi-Fi module, and a GSM module. Pulse oximeter. It calculates the [14] heart rate. It includes noise cancelling circuitry. A finger is put on the sensor, and the amount of blood in the capillary tube is calculated based on the amount of light reflected. The sensor is responsible for the difference in light transmission and reflection. Temperature sensor: The sensor[15] monitors body temperature ranging from -55 to +150 degrees Celsius. The output varies by 10mv for every 10°C increase in temperature. SpO2 meter: This sensor monitors the amount of oxygen in the blood. A little light beam traveled through the blood.

2.3 Research Summary

Because of the IT industry, every sector in this digital world is undergoing significant transformation. However, the health industry is not as up to date as other industries. We developed a model for enhanced health monitoring that incorporates IoT, cloud computing, and data mining techniques. Those who have worked with IOT-based health monitoring in the past haven't been able to make proper decisions. After conducting research, we discovered that our invention is really beneficial to patients. Because this is the only gadget that receives an ideal response. In this project, we will first examine the body temperature, then the pulse rate, and finally the pulse oximeter, which will be checked using sensors.We have provided such a benefit that the patient does not have to go through the anguish of going to a laboratory for a health monitoring test. This value is automatically saved in the database using this approach. Then we compare cloud data to current data and make a conclusion. Furthermore, in our project, we acquired data in an unconventional manner and will convey it. Our robots will make judgments based on all of this data. Patient also sees all of the worth in such a way that (pulse rate, pulse oximeter, Temp, etc.). We didn't let all of these decisions affect any other project. We believe that our initiative will contribute to the creation of something new.

2.4 Scope of the Problem

This section discusses the breadth of the problem that may arise in the future.Data Collect.

- Uneducated patient.
- Device Cost.
- Database.
- Invalid Output

Since we will be using our patient for the advantage of health, they should be able to utilize it properly. It is critical to be certain. The majority of patients in the nation are uneducated. As a result, they may encounter several difficulties. They place a high value on pricing. As a result, we believe we must be cautious regarding the device's pricing. Many times, getting data into the dataset will be challenging.

2.5 Challenges

The primary problems of this work are data collection and processing; dealing with the data set was too difficult. Previously, those who worked with IOT-based health monitoring systems were unable to make an informed judgment about which sensor range value was best for patient health. As a result, we encounter several challenges while collecting data. Then it's justified to utilize our gadget. Practical Experiments are a significant difficulty for us. Our research-based project is not a fully functional gadget. We will input a large amount of data into this gadget and then compare it to the prior average data. In Bangladesh, we now manage a limited number of patient categories. We will be able to anticipate reliable results if we handle more patient data. This gadget must have power management capabilities. Because there was insufficient evidence previously, we had to begin with our own motive.

CHAPTER 3

Requirement specification

3.1 Introduction

In this part, we will look through the requirements for our project. Our research-based endeavor also necessitates the investigation of technique. We are also discussing several essential points such as data collection, processing, and the suggested model, which is also detailed with appropriate equations, graphs, tables, and descriptions. The section concludes by clarifying our project's quantifiable hypotheses and providing a clear understanding of the use conditions.

3.2 Business Process Model:

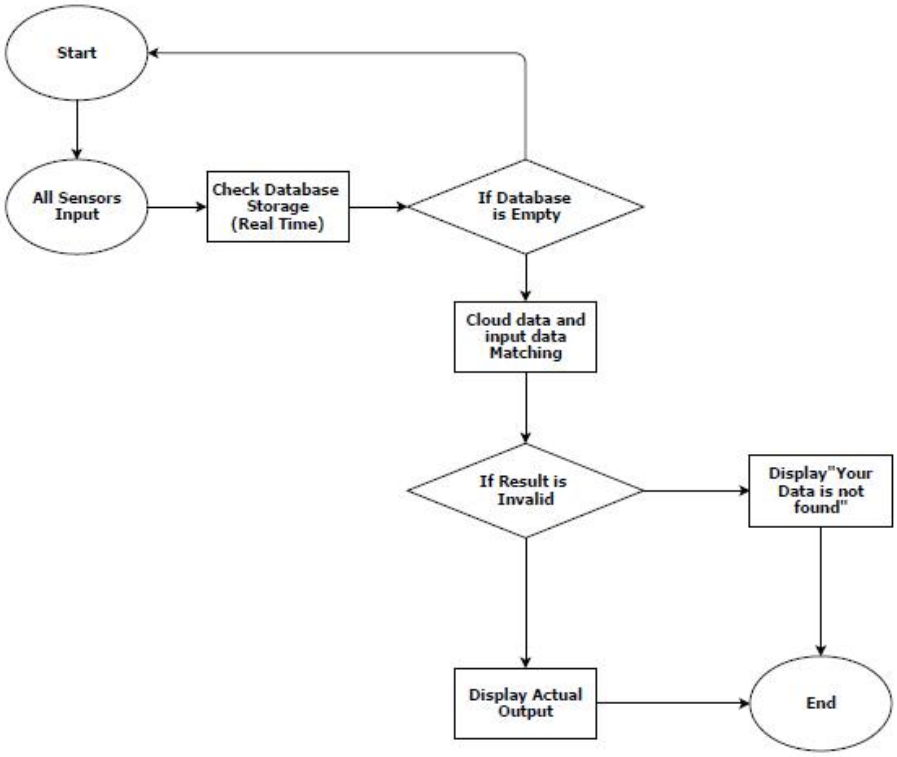

Fig 3.1: Business process model

3.3 Components List

In this Table we have given component list which we used in our project

TABLE 1: COMPONENT LIST OF PROPOSED SYSTEM

SL NO	NAME OF COMPONENTS	QUANTITY
1.	Solder less Breadboard	2
2.	Node MCU 1.0 (ESP8266 12E Wi-Fi module	2
3.	Temperature Sensor	1
4.	MAX30100	1
5.	USB cable	1
6.	Jumper wire	10
7.	Battery	1

3.3.1 MAX30100 Sensor

The MAX30100 is an integrated pulse oximetry and heart-rate monitor sensor solution. It combines two LEDs, a photo detector, optimized optics, and low-noise analog signal processing to detect pulse oximetry and heart-rate signals [2].

Fig 3.2: MAX30100 Sensor

Key Features:

- ❖ Complete Pulse Oximeter and Heart-Rate Sensor.
- ❖ Tiny 5.6mm x 2.8mm x 1.2mm 14-Pin Optically.
- ❖ Ultra-Low-Power Operation Increases Battery Life for Wearable Devices.

❖ -40°C to +85°C Operating Temperature Range.

The MAX30100 operates on a single 1.8V power supply and a separate 3.3V .wer supply for the internal LEDs. Communication is through a standard I2Ccompatible interface [2].

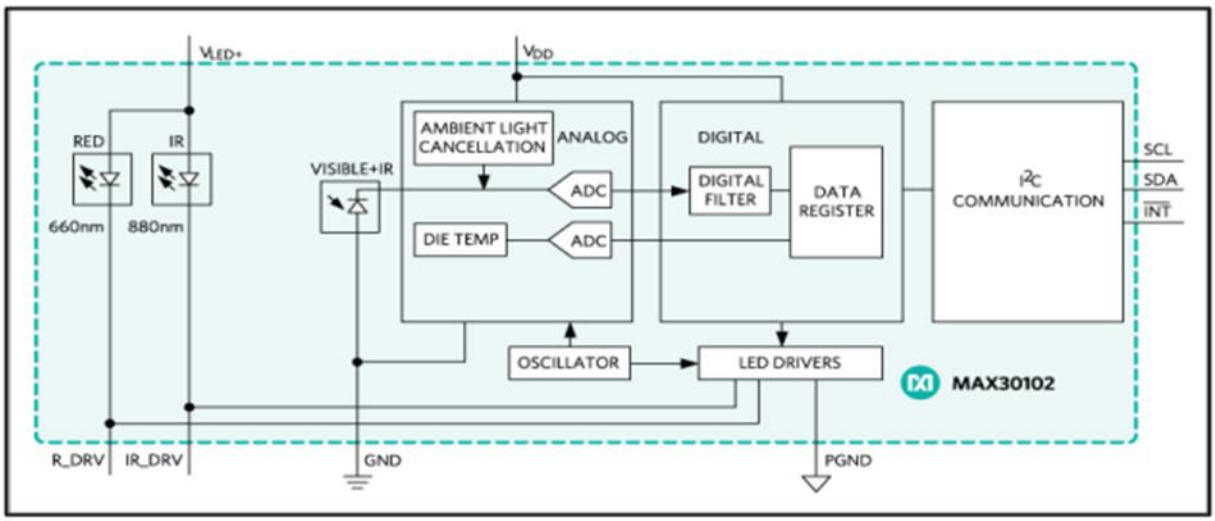

Fig 3.3: MAX30100 Functional Diagram, source

This sensor was chosen for its ability to make two readings (Heart-Rate and Oximeter Biosensor) in one sensor instead of two. Also, to save wire connection and save energy consumption

3.3.2: Node MCU 1.0 (ESP8266 12E Wi-Fi module)

Wi-Fi system operating on a chip that is integrated with the popular Esp8266 Wi-Fi system. In addition to the 32-bit 10 silica processor, the Esp8266 EX has an antenna, switches, RF balloons, power amplifiers, filters, and power management modules built into its design. With a clock speed of 160MHZ, it has a very low power consumption. With three modes of operation, including rest mode, dynamic mode, and profunde rest mode, it uses power-saving engineering techniques. There will be around 80 percent of the client application programming and enhancement capacity available when dealing with a continuing functioning framework (RTOS)

Fig 3.3.2: Node MCU 1.0(ESP8266 12-E Wi-Fi) [4]

3.3.3: Project Board

You may sort problems, pull requests and notes into columns of your choice on project boards. The cards can also be rearranged using drag-and-drop or keyboard shortcuts.

Cards on the venture board include a wealth of information about issues and drag requests, including names, assigners, status, and who opened the card when it was first accessed. Click on the issue or drag request's title to view and make minor changes.

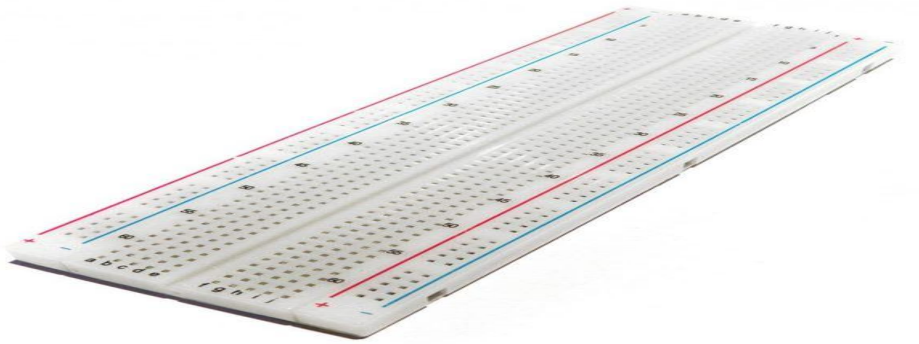

Fig 3.3.3: Project board

3.3.4: Body Temperature Sensor

Use an instant-read thermometer designed for cooking to determine the body's temperature. Test the body temperature as deeply as possible with the thermometer.

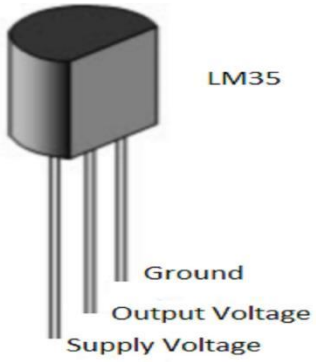

Fig 3.3.4: LM35 Temperature Sensor

3.3.8: Battery

As a result of the PV show throughout the day, batteries are employed in PV systems to store energy and to deliver it to electrical loads as needed (during the night and times of obscure atmosphere). There are a few reasons batteries are employed in PV systems: to power PV displays at their most efficient power points, to stabilize voltages, and to supply flood streams for electrical weight and inverters. These methods rely on a battery charge controller to protect the battery from cheating and over-discharge.

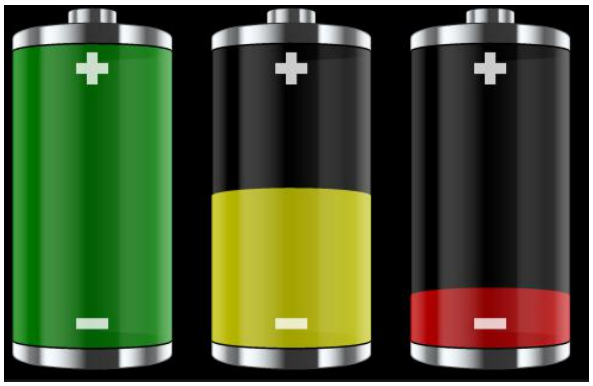

Fig 3.3.5: Battery

3.4: Use case Diagram:

An extremely simple use case diagram depicts the client's interaction with the system by showing how it is connected to various use cases in which the client is involved.

Sensors transmit values to the Node MCU, and the Node MCU transfers data to Firebase Server wirelessly. The Firebase server is the only thing that the administrator has authority over.

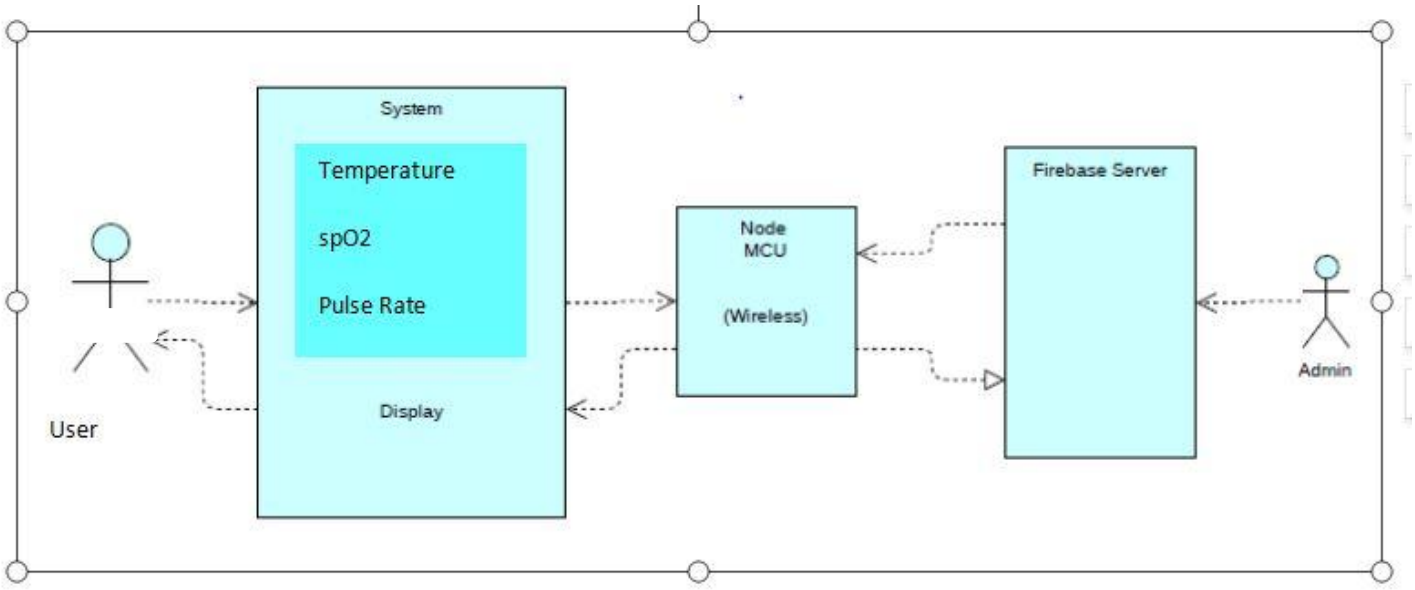

Fig 3.3.6: Use Case Diagram

3.5 Circuit Diagram

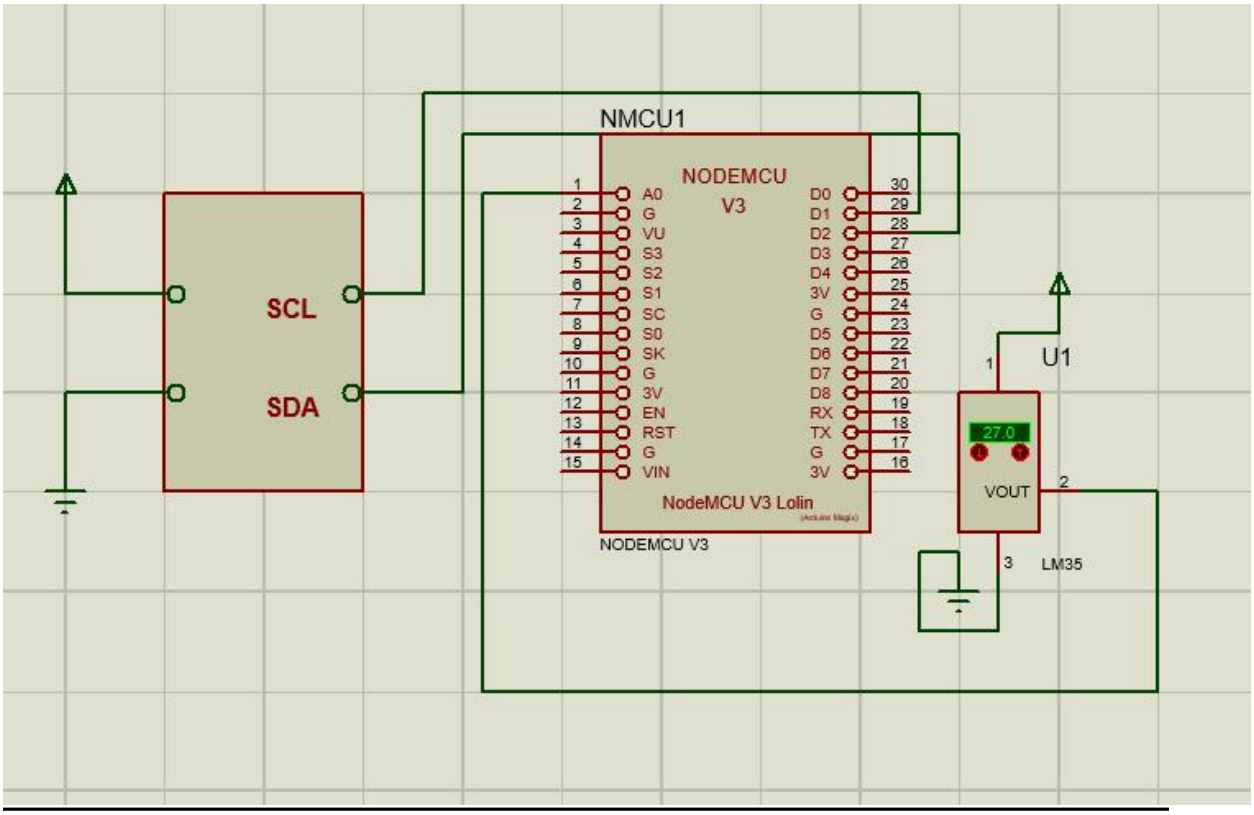

Fig 3.3.7: Circuit Diagram

CHAPTER 4

Design specification

4.1 Front-end Design

The front end is a layer that sits on top of the back end, and it contains all PC programs or equipment that has a customer interface. As part of a program's front-end decision, human or propelled consumers have direct access to numerous points such as client-inputted data, catch, project, and site information.

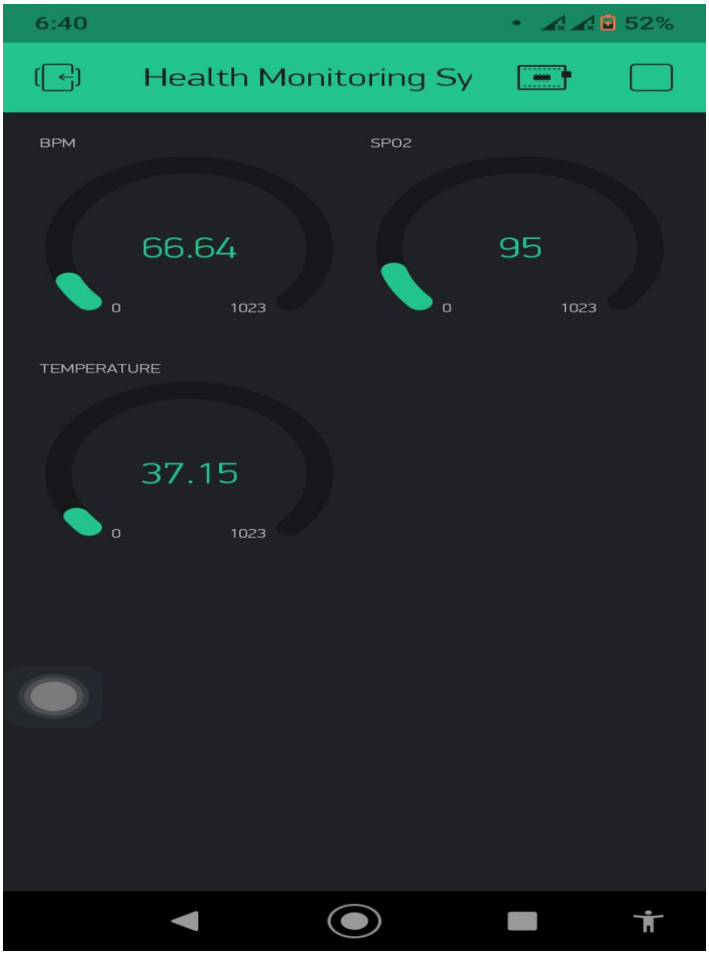

Fig 4.1: Front end Design (Apps)

A simple working principle governs this system. Human body values are sensed by all the sensors here. In this model, temperature, pulse rate, and spO2 sensors are employed. The microcontroller receives the values from the sensors. An Android App and an LCD display are used to display the results of this health monitoring system, which is controlled by a microcontroller that sends data to a data base.

4.2 Back-end Design

As a type of programming, back-end configuration is used to ensure that a site, application or data structure is properly synchronized. You are on a very basic level concerned with how the site functions while you are working at the back end of the development process. The database information is given to the application using code created by back end designers. A back-end engineer creates databases and servers, for example, that cannot be

seen with the naked eye. The back end of our business is handled by the following individuals:

- Firebase Dataset.

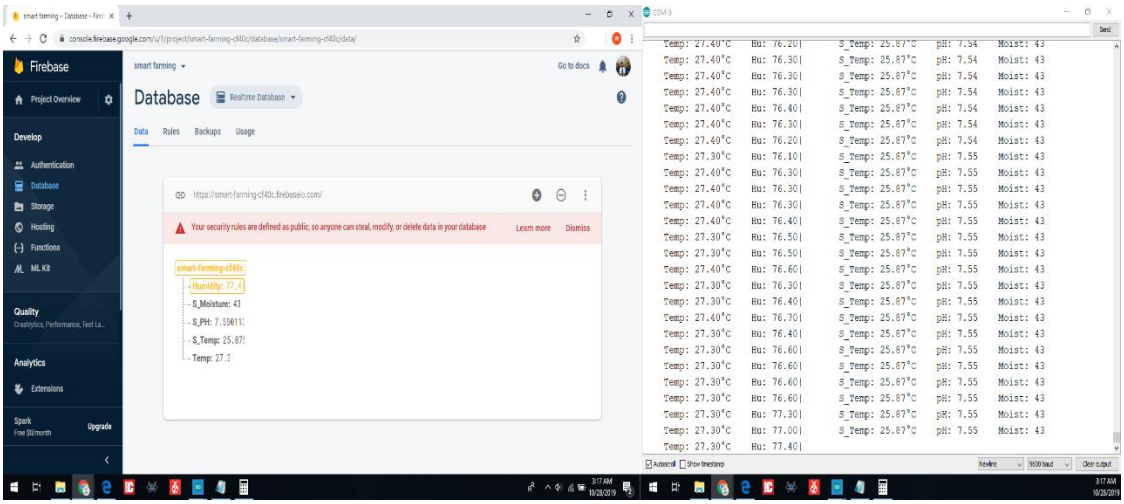

Fig 4.2: Firebase Database

To develop iOS, Android, and web apps using Firebase's data synchronization and confirmation administrations as well as reporting, record storage capacity, analytics, and more. Constructing or modeling flexible backend administrations is easier if you start with Firebase. Firebase is our project's database, which is used to store and retrieve data.

4.3 Interaction Design and UX

Interaction plan can be caught on in basic (but not rearranged) terms: it is the plan of the interaction between clients and items.

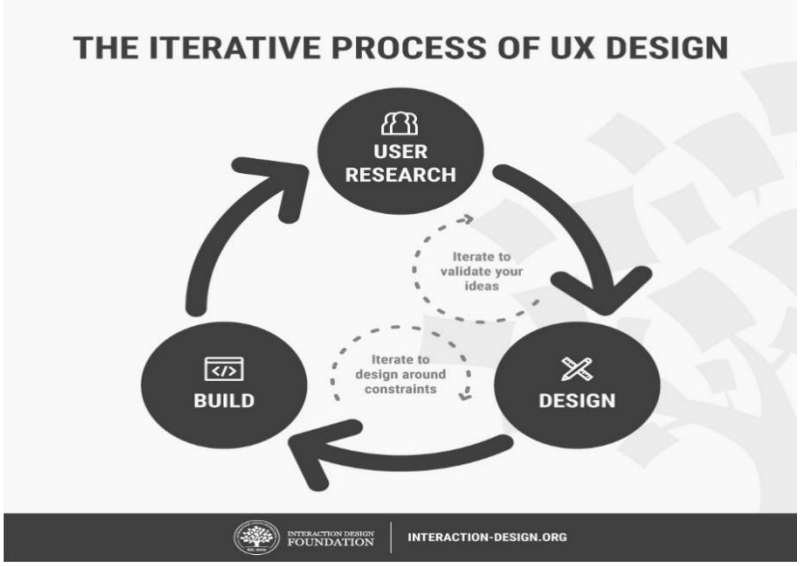

Fig 4.3.1: The iterative process [10]

For Our Projects: First of all we had to collect our all require sensors. Such as (spO2,pulse rate, Temperature sensor). Finally we had to face silly problem to collect read data from max30100.

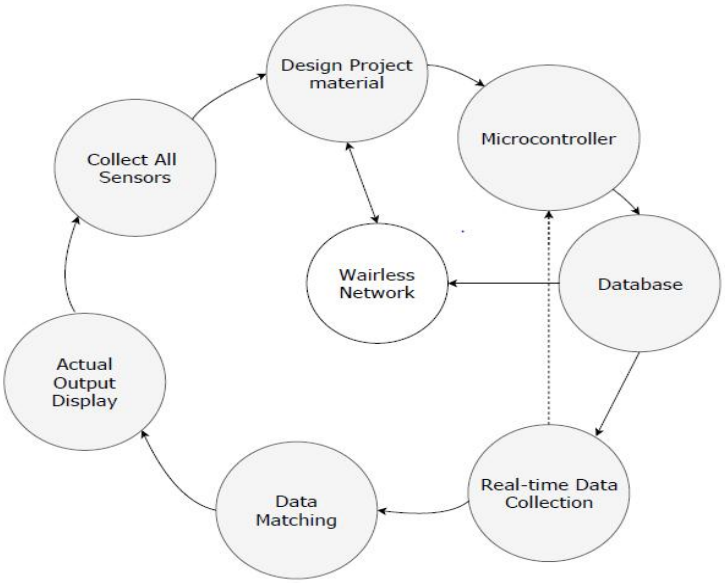

Fig 4.3.2: Interaction Design

Afterwards, our approach had to be simulated. Circuit diagrams, use case diagrams, and business process models are examples of this type. The fact that wireless networking is essential to this procedure. Micro controller then stores all data in the cloud. Also, a micro controller's memory may be used to store and process data and data processes. We do, however, require real-time information. It is for this reason that we utilize Firebase as a database. The next step was to compare all of our sensor data to the database values. Last but not least, all of the circles in this UX design are interconnected

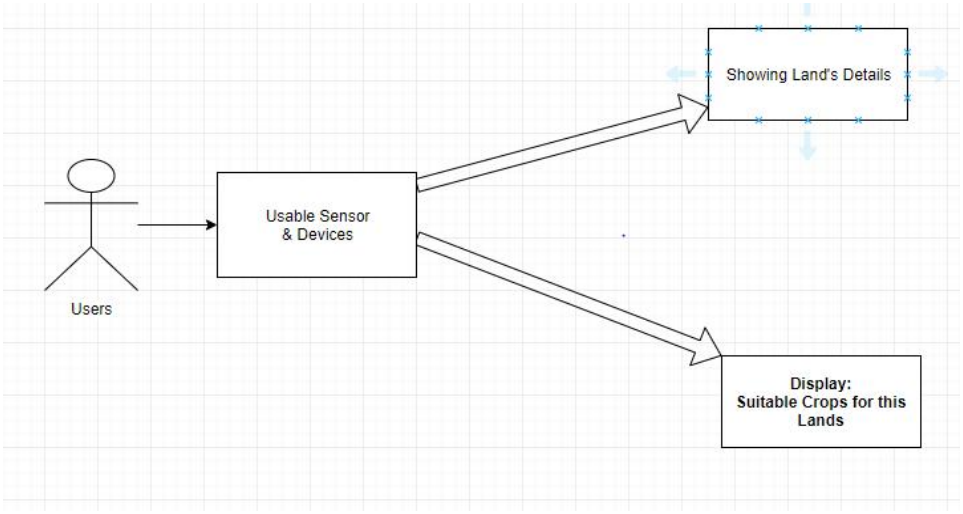

Fig 4.3.3: User's Interface

4.4 Implementation Requirements

In implementation we are using 5 kind of sensors. Such that:

- Temperature Sensor LM35
- spO2 Sensor.
- Pulse Rate Sensor.

We must have this sensor for implementation. It is extremely important to create and enhance contemporary sensors for health applications. There are commercially available sensors for measuring bodily moisture and body temperature, however they are susceptible to retrieval constraints. Small scale ranchers in developing nations, who cannot afford the high costs of existing sensors, need inexpensive body temperature monitors. Micro controllers are used to store all data in the cloud for those devices that are less expensive but are not digital. Also, a micro controller's memory may be used to store and process data and data processes. We do, however, require real-time data in order to produce a final product.

CHAPTER 5

Implementation and testing

5.1: Introduction

Implementation is the process of putting strategies and plans into action in order to achieve significant goals and objectives. Execution testing is, in general, a technique to test the usage of specialized information. Additionally, they assist to enhance usage compliance by offering systematic ways for checking for conformity to well-defined standards. Adventures must be tested in order to be realistic. The software must be free of mistakes, which might become costly in the future or in subsequent development cycles.

5.2 Implementation of Database

You present the DBMS on a suitable device, update your database so that it runs optimally on that device, and then program the database and weight the data. Data imported from a DBMS may be the important information, or it may be useless information that has become evident. Database security is also handled in this manner by makers, who provide the different consumers that architects considered to be in need of assistance with their requirements.

The taking after are the steps within the usage stage:

- Create FIREBASE Database.
- Tune the setup factors as demonstrated by the equipment, programming, and use conditions.
- Create database tables.
- Load the data from sensors.
- Set up the security.

5.3 Implementation of Interactions

Large display used to present value and final findings to make our system (IoT-based smart health monitoring system) interactive. We also provide a well-built server to ensure a trouble-free experience. Plan of the framework is easy to understand and utilize. As long as all the sensors are positioned correctly, the app will be able to display all of the sensor data and provide a simple prediction.

5.4 Testing Implementation and Report

The most essential element of a development project is the implementation testing and report. Thus, we can determine if the outcome is what we expected. This will be clarified after we run the system. It will produce unique findings for specific sensors. There will be findings for various items in each sensor's testing, which is a running process.

TABLE 3: TESTING REPORTS

Test No	**Test Input**	**Expected Outcome**	**Obtained Outcome**	**Status**	**Date**
Object 1	Temperature Pulse Rate Pulse Oximeter	• Get sensor value • Successfully store in database • Predict the result	• Yes • Successfully stored • Yes	Pass	29 October, 2021
Object 2	Temperature Pulse Rate Pulse Oximeter	• Get sensor value • Successfully store in database • Predict the result	• Yes • Successfully stored • Yes	Pass	29 October, 2021

Object 3	Temperature Pulse Rate Pulse Oximeter	• Get sensor value • Successfully store in database • Predict the result	• Yes • Successfully stored • Yes	Pass	29 October, 2021
Object 4	Temperature Pulse Rate Pulse Oximeter	• Get sensor value • Successfully store in database • Predict the result	• Yes • Successfully stored • No	No	29 October, 2021
Object 5	Temperature Pulse Rate Pulse Oximeter	• Get sensor value • Successfully store in database • Predict the result	• No • Successfully stored • Yes	Fail	29 October, 2021

5.5 Summary

In this chapter, we learned that sensors play a significant part in the process. In this setup, output is virtually impossible without a sensor. The max30100 sensor, for example, will not save data in a database or forecast results if it cannot receive input. This system's most important component is not just max30100, but all of its sensors. A wireless gadget will send data to an online database if the sensor detects values. If there is a problem with the database storage, it will not be stored. The database will not include the information if there is no data storage. Prediction is the final phase in the process. As long as the values are valid, the program will provide a satisfactory output. Code parts that do not match will produce incorrect results if sensors' ranges cross the ranges indicated in code parts. In this system, the most important goal is to place the sensor.

CHAPTER 6

Conclusion and future scope

6.1 Introduction

In this stage, we will discuss the results which we get from this system, conclusion, recommendation of and implication for future research of the study in the health sector, first, it'll be examined the major discoveries of each study as affirmed within the investigate destinations, the moment the conclusion from the discoveries of the ponder, in conclusion the inquire about will propose proposal of the think about and zones future inquire about.

6.2 Summary of the Study

Monitoring patients is the goal of this initiative, which aims to improve health productivity. Using the sensors, we can measure the patient's vital signs and track his or her progress. Sensors acquire their values from the patient's body, which is why they're called biosensors. Because the micro controller stores information in a database, it can also anticipate output for LCD displays and Android apps, which are displayed on an LCD screen.

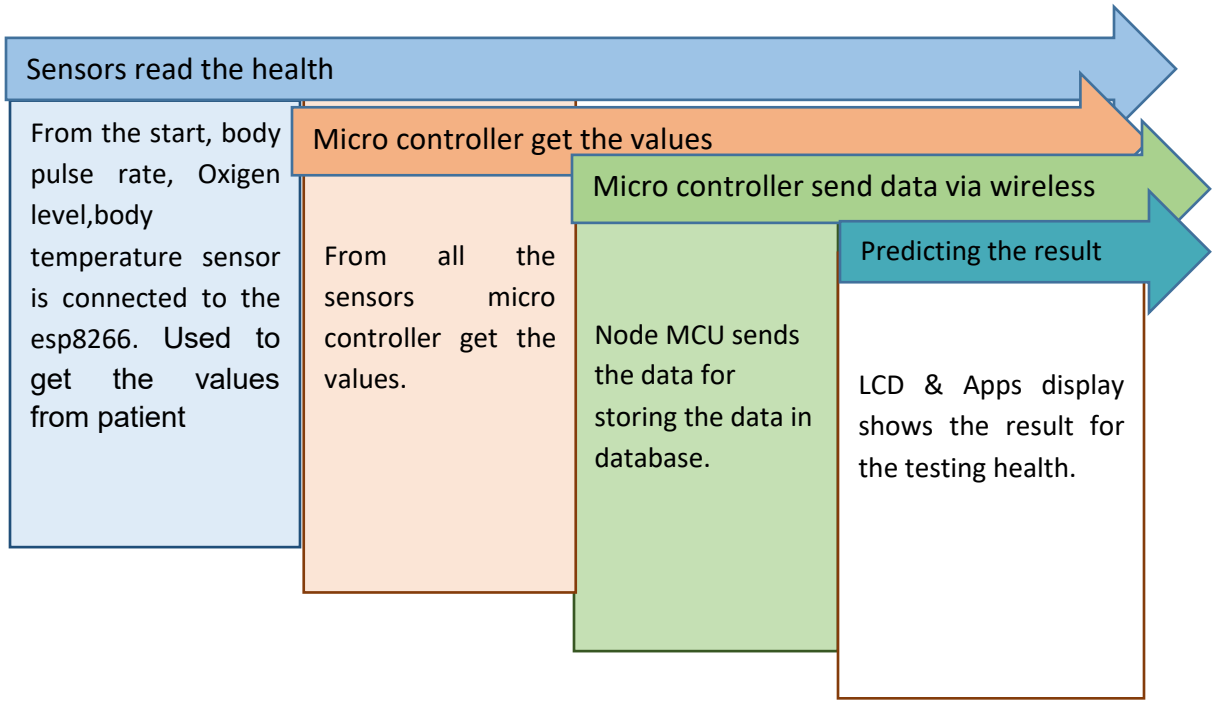

Fig 6.1: Work flow of the study

6.3 Scope for the Further Developments

While under lockdown, physicians are able to observe the patient's status easily. It is also possible to use this method to COVID-19 patients The method may be adjusted to make it easier for patients to come in for frequent checkups from a distance, as it minimizes travel time. Smart ID cards may be used to link all of the people's data to track the country's health. The patient's whereabouts can be followed in the event that he or she is late for the hospital appointment or otherwise leaves early. Sensor data can be shared to family members. To inform doctors, each patient must be mapped to the doctor's treatment zone. System may be incorporated as a kit and delivered at a reasonable price

6.4 Conclusion

In this work, we provide a method for monitoring health in real time. We utilized two sensors to measure heart rate, oxygen level, and temperature. Inputs from sensors are sent to the micro controller. Micro controllers make decisions based on circumstances, and then store the resulting data in a database for later use. A positive outcome has been reached. Future contributions in the health sector may include this technique, and it might play a key role in increasing the health's productivity.

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APPENDIX

Appendix:

From the Fall-2019 Semester, we had started our journey to make a system through that we can monitor patient health for the health sector. A Doctor, Patient can benefits though this system. We also thought about an easy and hassle-free system so it can be saved valuable time. We followed the model to implement and monitor our system with the all hard work and spending a lot of time and finally, we were able to reach our goal at last. This is our keen believe that our — Smart Health Monitoring System will have a useful and positive thing for the users. Very soon we will ready to upgrading our system with a regular basis as it required.

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