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IOT BASED ROBOTIC ASSISTANT AND COMPANION FOR DOCTORS AND PATIENTS

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ABSTRACT

This project aims to protect the people against the spread of disease from the affected person and to assist the elderly people's. To Solve this issue, we here design a remote IoT based health monitor robot that allows for remotely monitoring of patients over the internet. The system monitors patient heartbeat pulse, temperature and SpO2 using a temperature sensor and Pulse Sensor respectively. It also assists the patient by providing food, medicine, needy items to them based on the requirement. Also they will monitor the health status and report it to the doctors for the action to be taken regarding this. The quarantine persons feel lonely and it leads to stress. To manage it, the robot will act as a companion for them and it will provide them some activity based on the person interest with the help AI.

Keywords: Patients, Robot system protects, Tracking algorithm and Sensor Network.

1. INTRODUCTION

The world increasing population of elders at age 65 and above who are living independently in their home without help of their relatives and caregivers. Even the caregivers and relatives may can 't take care of them 24-hours by monitoring and providing the basic first aid if he/she gets hurts. people at the age of 65 or above may have health problems like cause of sudden death, heart attack, chronic lower respiratory disease, lose consciousness, strength, body pains, bones weakness etc., If he/she is in serious condition and they are unable to call an ambulance, due to that there may be cause of death situation. To overcome these situations, the real-time smart health monitoring robot assistant is provided to protect them. This paper presents a smart real-time health monitoring robot system will detect his/her daily health condition like his/her blood pressure, heart rate, temperature. In emergency situation it detects alarm to the relative so that they can protect and they can communicate and see in which conditioned person is through the video communication. The smart health monitoring robot system protects elders in emergency situation.

Now-a-days the most occurring health problem is falls in elders it is a major issue due to which above 60 age people don 't live alone. Falls cause disabling fractures and near-fall events are more difficult then fall events because they do not recognize an event by themselves. Falls can be recognized by the evaluation of their posture, vital signs, and balance through their daily activity. But near-falls can 't be determined such as cardiac attack, change in blood pressure combined with poor balance. To detect the location of the human target, the plan is to project a tracking algorithm based on pyroelectric infrared sensor network and video technologies. The PIR node detects the human movement by using PIR sensors. According to the change in angle of human body movement and also based on the space-time conversion model, then PIR nodes complete the tracking and recognition of human target. The mobility is common problem for persons with stroke, by measuring daily physical activity of a person is helpful to know the effectiveness of rehabilitation interventions. The smart wearable shoe- based sensor system was shown

to be capable of classify the three major postures and their daily activities like sitting, standing, and walking these are from people who live alone with stroke by using Artificial Neural Network.

There are two types of vital signs sensors they are pulse rate and blood pressure sensors. The pulse oximeter is attached to the patient ‘s finger and it measures the patient ‘s heart rate, blood pressure they use a cuff pressure over the patient’s upper arm it measures systolic and diastolic blood pressure and also the integrated two types of location sensing capabilities, a GPS to provide geolocation and detect the indoor location system to provide location where the GPS signal cannot be reached. The growth of data sent produced by the medical community it requires a storage capability. In order to know the medical report of any patient ‘s, to improve the advanced new technology innovation.

2.LITERATURE SURVEY

Background Mobile phone apps capable of monitoring arrhythmias and heart rate (HR) are increasingly used for screening, diagnosis, and monitoring of HR and rhythm disorders such as atrial fibrillation (AF). These apps involve either the use of photoplethysmographic recording a handheld external electrocardiographic recording device attached to the mobile phone or wristband. Objective this review seeks to explore the current state of mobile phone apps in cardiac rhythm ology while highlighting shortcomings for further research. Methods we conducted a narrative review of the use of mobile phone devices by searching PubMed and EMBASE from their inception to October 2018. Potentially relevant papers were then compared against a checklist for relevance and reviewed independently for inclusion, with focus on 4 allocated topics of mobile phone monitoring, AF, HR, and HR variability (HRV). Results the findings of this narrative review suggest that there is a role for mobile phone apps in the diagnosis, monitoring, and screening for arrhythmias and HR. Photo plethysmography and handheld electrocardiograph recorders are the 2 main techniques adopted in monitoring HR, HRV, and AF. Conclusions A number of studies have demonstrated high accuracy of a number of different mobile devices for the detection of AF. However, further studies are warranted to validate their use for large scale AF screening.

Ultra-wideband (UWB) radio detection and ranging is used in almost all the major sensing signals works. It is widely used in wireless networking process which consumes only low power with more number of bandwidths can be formed in it. UWB remote sensing can also help in detecting the problems arising in respiratory functions as well as the cardiac counts occurs. In This paper relates about the monitoring of signals by using the aortic blood vessels to take out organic signals from arterial waves. The sensor is fixed near to the heart valve that detects the blocks or any other problem arises in the human body. The other method is known as catheter which is inserted into our human body to find any sort of health disorders in sequential time difference. In Sleep observance is used to observe the sleep timings in a whole day of Human ‘s life span. In this paper, respiratory and cardiac problems can be noted. Especially, during the night time there is an emergency purpose, the watch monitor is found to measure the patients’ health. This is also known as sleep monitoring using the wearable watch type. In this paper, they have used a pressure mask with ECG device for the better application. The signal can be measured using the oximeter which is used to find the amount of oxygen flow in the blood. The viscous observation is the fluid resistance flow in the blood. The viscous observation is the fluid resistance flow in the blood. The pressure therapy helps to cures any type of disorder in the human body. There are two types of pressure of airways which is negative and positive. In this project, smart chair monitoring is used with the advanced features used here is tele monitoring with additional system is implemented. This can be urged to use because of the emergency health problems. The patients can be monitored by keeping them in smart chair very comfortably for the aged people. This can also be connected by using GSM, Bluetooth, Wi-Fi and other network connections.

Many researchers have used various methods and technologies to carry out the function of heart monitoring. Some of their important research works are reviewed below in this paper. In this research paper, the researcher designed a health monitoring system using the ATmega8 microcontroller with Wireless Body Area Sensor Network. In this work, the sensors which are used here are a Temperature sensor, a Blood pressure sensor, Heartbeat sensor. The sensors have to be placed on the human body where the health condition is monitored without disturbing any kind of schedule of the patient and the parameters which help in detecting the condition are now sent to the physician's server through long-range wireless technology GSM. The health monitoring system consists of sensors, LCD, microcontrollers, and GSM modem to transmit or receive health-related data to or from the doctor. Similarly, a hospital, the same GSM modem is used to monitor the patient's health. Hence, the GSM modem helps in the establishment of a network between the patient ‘s server and the doctor ‘s server. Liquid Crystal Display is

providing to show instant results to the patient. this research paper, the heart-rate signals were collected from fingers or ears using the Infrared Transmitter and Receiver pair module which was amplified in order to convert them to an observable scale. A low pass filter was used to filter the inherent noise from the system. The signals were calculated by a microcontroller module (ATmega8L) and were represented on LCD. A microcontroller is trained with a specific algorithm to execute the heart rate counting system. The results obtained using this process when compared to those obtained from the manual test involving the counting of heart rate were found satisfactory. The proposed system is applicable for family, hospital, community medical treatment, sports healthcare and other medical purposes and many more. And this also fits the adults and the pediatrics. Hence this method is already developed and requires further examination which has a great future towards healthcare. This research paper, it mainly contains 4 parts: a heart rate sensor, a microcontroller integrated with ESP8266 (Wi-Fi module), MQTT on Raspberry pi and monitoring software. The heart rate sensor and a schematic are well built to fit on the patient's fingertips, and this reads the amount of IR light reflected by the blood circulation inside the body. When the heart pump, the blood pressure rises sharply and so the amount of infrared light from the emitter ‘s LED that get increased and reflected the photo detector. The photo detector passes more current when it gets more reflected light and then becomes a voltage drop. The two consecutive operational amplifiers are used to detect the signal baseline and stress the peaks and filter all the noises arising from the system. ESP8266 which will help to connect other devices through the network. This provides the self-contained Wi-Fi network capability which allows the host application.

Since the term of a smart city was proposed, Internet of Things (IoT) has been considered as the infrastructure's key in a smart city. Huge research consideration is an emphasis on remote wellbeing observing system dependent on IoT technology. IoT is the internetwork of physical objects or "things" that are embedded with software and sensors to collect and send data between them and central servers with minimum human intervention. This term can assist decline with constraining on medical clinic system and healthcare suppliers, decrease insurance costs, and improve healthcare. In the modern healthcare environment, IoT is being used in various medical areas like real-time monitoring, patient information management, medical emergency management and blood information management. Over these years a number of advanced applications based on IoT have been proposed for convenience of patients, doctors and caregivers in the healthcare sector. Therefore, the current study describes the applications of IoT technologies in medical and healthcare field. Moreover, the it highlights the huge potential of this process and future directions for further research.

3. PROBLEM STATEMENT

One of the increasing popular public concerns is human health. Anything else becomes meaningless if one gets sick or dead. For this reason, people spend a lot of money to keep sound health. Unfortunately, people always find that it is too late to receive serious medical care when things are non-invertible. If early actions can be taken in time, then lots of patients can be cured. However, access to many medical equipment is inconvenient and expensive. Heart rate and body temperature are the most vital ones among the most notable indexes of the human health, and they have the advantage of easy access. Moreover, unlike the X-ray, the measurement of heart rate and body temperature has no effect on human health itself. There are some devices in the current market which can provide raw medical measurement data to patients and doctors, but the patients may not interpret the medical measurement into meaningful diagnosis since they have little medical background. On the other hand, if raw medical data is delivered to the doctor, it kills much time and may cause trouble, but in emergencies time can never be wasted. It is tough to share data over a large area within a short period. Most of the products available in the current market have these major drawbacks with limitation in flexibility and portability.

4. PURPOSE

Design a Remote Patient Health Monitoring System (RPHMS) which has heartbeat detection system, a fall detection system, temperature detection system, a humidity detection system, a toxic gas and air quality detection system and SPO2 detection system. A doctor or health specialist can use the system to monitor remotely of all vital health parameters of the patient or person of interest. An attempt at designing a remote healthcare system made with locally available components. The fall detector, temperature, humidity, pressure, toxic gas, air quality control, SPO2 modules comprise of an accelerometer, wireless transmitter and microcontroller. The data collected was transmitted wirelessly to a receiver module. ECG consists of a non-invasive infrared finger detector, Liquid Crystal Display (LCD), a designed circuit for cardiac signal detection and microcontroller. The detected analog signal was then digitized to give a

digital value that was read on the LCD. A simple cloud server where hosted with a database for all the vital data to be accessed remotely whenever required.

5. OBJECTIVE

Here the main objective is to design a Remote Patient Health Monitoring System to diagnose the health condition of the patients. Giving care and health assistance to the bedridden patients at critical stages with advanced medical facilities have become one of the major problems in the modern hectic world. In hospitals where many patients whose physical conditions must be monitored frequently as a part of a diagnostic procedure, the need for a cost- effective and fast responding alert mechanism is inevitable. Proper implementation of such systems can provide timely warnings to the medical staffs and doctors and their service can be activated in case of medical emergencies. Present-day systems use sensors that are hardwired to a PC next to the bed. The use of sensors detects the conditions of the patient and the data is collected and transferred using a microcontroller. Doctors and nurses need to visit the patient frequently to examine his/her current condition. In addition to this, use of multiple microcontroller based intelligent system provides high-level applicability in hospitals where many patients must be frequently monitored. For this, here we use the idea of network technology with wireless applicability, providing each patient a unique ID by which the doctor can easily identify the patient and his/her status of health parameters. Using the proposed system, data can be sent wirelessly to the Patient Monitoring System, allowing continuous monitoring of the patient. Contributing accuracy in measurements and providing security in proper alert mechanism give this system a higher level of customer satisfaction and low-cost implementation in hospitals. Thus, the patient can engage in his daily activities in a comfortable atmosphere where distractions of hardwired sensors are not present.

This will allow development of such low-cost devices based on natural human-computer interfaces. The system we proposed here is efficient in monitoring the different physical parameters of many number bedridden patients and then in alerting the concerned medical authorities if these parameters bounce above its predefined critical values. Thus, remote monitoring and control refer to a field of industrial automation that is entering a new era with the development of wireless sensing devices. The Internet of Things (IoT) platform offers a promising technology to achieve the healthcare services, and can further improve the medical service systems. IoT wearable platforms can be used to collect the needed information of the user and its ambient environment and communicate such information wirelessly, where it is processed or stored for tracking the history of the user. Such a connectivity with external devices and services will allow for taking preventive measure (e.g. Upon foreseeing an upcoming heart stroke) or provide immediate care (e.g., when a user falls and needs help).

6. SYSTEM METHODOLOGY

6.1 EXISTING SYSTEM

There are some existing approaches designed and developed for measuring heart rate. At present, the recent technologies for measuring heart rate are consist of several methods using optical and electrical methods. Casually electrical method provides a bulky strap around one ‘s chest. But the optical method requires no such strap and it can be used more effectively. Low cost heart rate measuring devices were developed using optical technology. In optical method powerful LED and Light Dependent Resister (LDR) are used to sense pulses. The pulse signals are then amplified by an amplifier circuit and filtered through a band pass filter. There are some existing approaches designed and developed for measuring heart rate. At present, the recent technologies for measuring heart rate are consist of several methods using optical and electrical methods. Casually electrical method provides a bulky strap around one ‘s chest. But the optical method requires no such strap and it can be used more effectively. Low cost heart rate measuring devices were developed using optical technology. In optical method powerful LED and Light Dependent Resister (LDR) are used to sense pulses. The pulse signals are then amplified by an amplifier circuit and filtered through a band pass filter. There are some existing approaches designed and developed for measuring heart rate. At present, the recent technologies for measuring heart rate are consist of several methods using optical and electrical methods. Casually electrical method provides a bulky strap around one ‘s chest. But the optical method requires no such strap and it can be used more effectively. The amplified and filtered pulse signals are sent to the microcontroller. The microcontroller checks the analog signals whether they are valid or not comparing with a standard voltage. Microcontroller counts the heart rate and displays the result in a LCD display. There exists another approach where infrared Tx and Rx are used. In that system it senses pulses, amplifies the pulses and filters pulses by a low pass filter. Finally, the pulse signal is sent to a microcontroller. The microcontroller also give output comparing with a reference

voltage. Both the approaches give inaccurate result in many cases because analog signal of pulse varies from person to person and the approaches fail to calibrate analog signal of pulses for each person.

6.2 PROPOSED SYSTEM

With tons of new healthcare technology start-ups, IoT is rapidly revolutionizing the healthcare industry. In this project, we have designed the IoT Based Patient Health Monitoring System using ESP8266 & Arduino. The IoT platform used in this project is Thing Speak. Thing Speak is an open-source Internet of Things (IoT) application and API to store and retrieve data from things using the HTTP protocol over the Internet or via a Local Area Network. This IoT device could read the pulse rate and measure the surrounding temperature. It continuously monitors the pulse rate and surrounding temperature and updates them to an IoT platform. The Arduino Sketch running over the device implements the various functionalities of the project like reading sensor data, converting them into strings, passing them to the IoT platform, and displaying measured pulse rate and temperature on character LCD.

WORKING

This is a simple block diagram that explains the IoT Based Patient Health Monitoring System using ESP8266 & Arduino. Pulse Sensor and LM35 Temperature Sensors measure BPM & Environmental Temperature respectively. The Arduino processes the code and displays it to 16*2 LCD Display. ESP8266 Wi- Fi module connects to Wi-Fi and sends the data to IoT device server. The IoT server used here is Thing speak. Finally, the data can be monitored from any part of the world by logging into the Thing speak channel.

7 SYSTEM REQUIREMENTS

7.1 HARDWARE REQUIREMENTS

Arduino UNO
Node MCU board
MLX90614 Temperature sensor
MAX30100 Pulse Sensor
LED Display
Power supply
4.7k resistor

7.2 Software Requirements

ARDUINO NANO
ESP8266
THING SPEAK

8.1 SYSTEM REQUIREMENTS

Healthcare solutions are carefully designed because it is crucial and involve dealing with patient‘s life. Thus, developing an effective healthcare monitoring system, several factors need to considered, such as data availability, consistency, and reliability. However, the most important factor is data freshness that needs to be well supported during runtime [20, 31] by the healthcare systems which deal with people health. More precisely, when authorized people monitoring patient‘s symptom, the data it has to be refreshed with high frequency so that doctor‘s platform update continuously to pull the latest data from patients with warbles. Healthcare systems rely on several approaches to transfer patient‘s data from one platform to another. Some of these approaches can be internal, like data is already on one of the system platforms then it sends the data in a secure channel to other platforms. While other approaches require middle-ware devices to collect these data and send it to system platforms, this what so-called system Getaway. The basic gateways performance is to accumulate data from sensors or any wearable devices that measure patient ‘s physiological data, then send it to data-centres (e.g., Cloud data-centre). Thus, in this instance gateway can be seen as a bridging point, for example, the UT-GATE, is provide data monitoring from original data sources (e.g., sensors) to the main monitoring platform. Moreover, there are different type of devices that can be used as a gateway such as a network router, and smart-phones. The Gateway, can be any micro-controller that is programmed to act on the data able to transmit from one platform to another.

Wireless sensor network (WSN) is the core of smart healthcare monitoring systems, where it represents than main sources of data, thus providing symptom physiological data from patient ‘s body.

There is different type of sensor use in healthcare monitoring, each sensor has different capabilit, for instance, Pulse sensor use to measure heart-rate, BMP180 sensor measuring blood pressure, and ADS1292R sensor use for both ECG and respiration. These sensors provide data from patient ‘s body in real-time, and the output data is either in analogue format or digital format. Therefore, the sensors should be connected to an appropriate Gateway that is able to read sensors output data and act on it or transmitted to data-center.

8.2 IMPLEMENTATION

The development of the proposed system starts with a database that is able to handle system services and storing patient data. The entity relationship diagram of the data based is depicted. The database comprises 11 tables that have been constructed to handle system data interactions and functionalities. The tables and attributes have been selected carefully to avoid any overlapping, dependencies and data redundancy that could burden the network and slow down the performance of the system. The process of storing and retrieving data within the system have two-part processes. First process involves data encryption/decryption according to the appropriate standard of patient ‘s data security. Second process involves the method of data representation changes (i.e., for storing data). For example, analogue data outputs from sensors are converted to some readable row-data format to be stored in the data repositories. Thus, stored data can be retrieved by another process at a later stage and the same method of data representation will be applied to provide a proper data visualization.

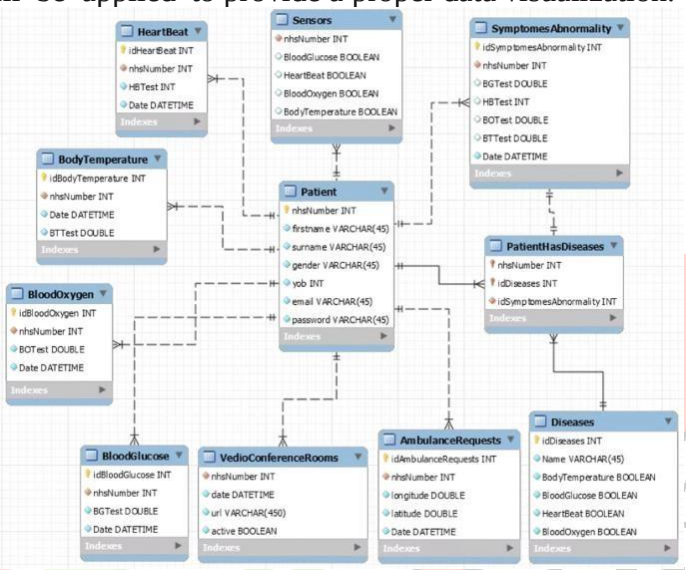
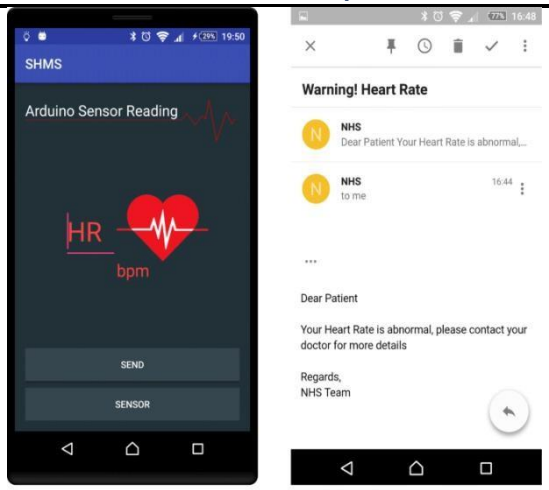


FIG 1: HOSPITAL ANALYSIS

8.3 SYSTEM DATABASE DESIGN

A pulse sensor has been used to measure patient ‘s heart-rate and transfer the data through Bluetooth device to the mobile app. The pulse sensor used to measure heart-rate through an optical heart-rate chip. The output data will be analogy data format. Therefore, Arduino UNO has been used to receive the pulse sensor readings. The reading of the sensor sends to patient mobile app through the HC-06 Bluetooth device which is connected to the Arduino UNO. Figure 5 shows the connection between the pulse sensor and the Arduino UNO. The pulse sensor has three points of connections. The first one, is the red colored wire which is the power wire, this wire accept voltage value between + 3V to + 5V. The black wire represents the ground connection (GND). The blue wire is responsible for transferring the signal from the sensor to the Arduino UNO. The open- source Arduino Software has been used to program the UNO in order to receive and send sensor readings.



(a) Readings from the sensor (b) Email Notification

FIG 2: DATA BASE MONITORING

The following step involves sending the sensory data to the SW-SHMS mobile app. After sensors 'readings have been collected from the Pulse sensor in the Arduino UNO, it will be sent to the android app through a Bluetooth device. Therefore, the UNO has been connected with a Bluetooth device, which is the HC-06 version. The physical connection between the Bluetooth HC-06 device a. Arduino Bluetooth version HC-06 has four connection points, these are VCC, GND, TXD and RXD. The four connection points need to be connected to the UNO board in order to complete the operation of sending Pulse readings to the app through the HC-06. Moreover, the Bluetooth device connected to the Arduino board through the following wires: 1) Connecting Bluetooth VCC pin to 5V pin on the Arduino board. 2) Connecting Bluetooth GND pin to the GND pin on the Arduino board. 3) Connecting Bluetooth TXD pin to RXD pin on the Arduino board. 4) Connecting Bluetooth RXD pin to TXD pin on the Arduino board.

In order to send sensor data from the Arduino to SW-SHMS mobile app through the HC-06, it is required to print these data in the Arduino series after configuring the correct serial use by the Arduino board. This can be generated for each device or just using a stander identifier configure for the app. Once the connection made, data will be displayed on SW-SHMS patient 's app as per. In addition, they will have the ability to send these data to the Cloud, where all patient 's records are kept.

8.4. VIRTUAL DOCTOR ROBOT

FIG 3: ROBOT MODEL

Doctors are usually needed to work at every hospital and emergency center every now and then. But it is not feasible for every doctor to be available at every place at desired time. The problem with video calling is that video calls need to be done from a PC or laptop on a desk. This limits the doctor's capacity to view patient or around operation theatre at will or even move through hospital rooms as needed. To help solve this issue we here develop a virtual doctor robot that allows a doctor to virtually move around at a remote location at will and even talk to people at remote location as desired. The doctor can use an IOT based panel to control the robot. The control commands sent online are received by the robot

controller. The robot controller operates over wifi internet. The received commands are received in real time and the robot motors are operated to achieve the desired movement commands. Also the root has other functions including battery status alert to remind of battery charging on time. There is a growing trend in the medical field to minimize the need for hospitalization, moving several health care procedures from hospitals (hospital centric) to patient's homes (home-centric). This strategy has been raised mainly due to its possibility for improving patient's wellness and treatment effectiveness. It can also reduce the costs of the public health system worldwide and its efficiency, which in the last decade has been challenged by the population aging and the rise of chronic diseases. Furthermore, the current COVID-19 outbreak has exposed the importance of rapidly scaling the health system and keeping at home patients who are high-risk but not severe enough to stay hospitalized.

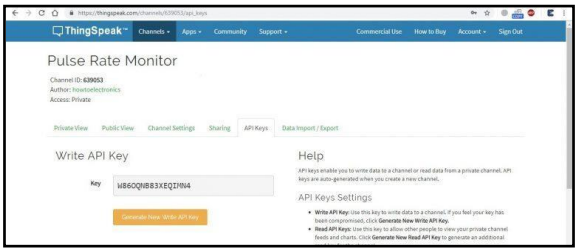
For this purpose, Internet of Things (IoT) provides the scalability which supports continuous and reliable health monitoring on a global scale. This paradigm is increasingly becoming a vital technology in healthcare. Furthermore, the recent progress in low-power consumption, miniaturization, and biosensors has revolutionized the process of monitoring and diagnosing health conditions. For patients' de-hospitalization the platform proposed initially were designed, by including wearable and unobtrusive sensors. The software is developed and the components are guided by the Reference Architecture for IoT-based Healthcare Applications for a real intensive care unit (ICU) and the interoperability with existing multipara metric monitors for COVID-19. By describing the engineering process and the application deployment steps performed in this experience, we provided relevant guidelines to practisioner. The researchers concerned with IoT-Healthcare Applications. An ultrasonic sensor is used to detect the presence of a patient. The sensor sends ultrasonic waves for about 20 milliseconds. When those waves are reflected back to the sensor, it detects the distance by calculating the time the wave was sent and then returned.

HOW THE SYSTEM WORKS

The system only works when a person is in front of the device. The ultrasonic distance-measurement sensor (HC SR-04) senses the change in the distance around the device (because of the patient in front of it). The device then asks for the details programmed on the screen. For example, it asks the patient to open their mouth and their eyes, and takes photos using the camera module, saving the images locally. The device also requests the patient ‘s ID. After all of the data is documented, it emails the registered doctor with the attached images, using the ―multipart content type.‖ This is a type of data that specifies that the email contains media content. This email is sent using the SMTP protocol. The physician downloads the email using the standard, Internet message access protocol (IMAP). The physician examines the information and images and contacts the patient. Understanding the source code, the code can be understood from its functions. For example, there is a calling of one of the functions in the main one that’s an ―intrusion ()‖. This function then calls two others, the ―Capture image‖ and the ―Send Email‖.

9. RESULT

The experimentation outcomes are analyzed in this section discussing various compliances and assessing outcomes obtained from their implementation. Various modules like pulse acquisition, body temperature monitoring, ECG, and physiological information acquisition are observed in the upcoming subsections.



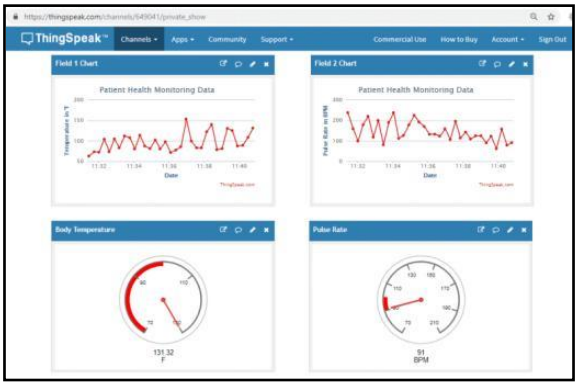


FIG :4 RESULT FOR ROBOT MODEL

10. CONCLUSION

In the study, the wireless sensor technology is combined with the human health monitoring terminal based on the Internet of Things to test the health-related indexes. The test results are analyzed. It is observed that the human health monitoring system of the Internet of Things is relatively stable and has functions such as an accurate collection of human health data, real-time monitoring and alarming, and evaluation of subjects. The subjects were assessed for temperature using the thermometer, which provides the temperature values of 36.4, 36.7, and 36.5 (°C), respectively, demonstrating relatively accurate and stable testability. Similarly, the pulse rate monitoring module employing the ECG observes the test outcomes of 78, 78, and 79 (times/min), respectively, similar to the medical pulse meter results. The human health monitoring system based on the Internet of Things designed in this study has completed collecting the user ‘s blood pressure, pulse, body temperature, heart rate, physiological information, and other vital sign data, which is suggested in practice. After long-term data collection, factors related to a potential risk prediction should be further explored in the future to expand the application of human health monitoring systems based on the Internet of Things. This will provide a scientific and effective basis for preventing and controlling chronic high-risk diseases in the near future.

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