

VISVESVARAYA TECHNOLOGICAL UNIVERSITY

Jnana Sangama, Belagavi-590018



A Project Synopsis

on

“IoT Based Healthcare Monitoring System”

Submitted in partial fulfilment of the requirement for the award of the degree

BACHELOR OF ENGINEERING

in

ELECTRONICS & COMMUNICATION ENGINEERING

By

Student Name	USN.No
Milind Mishra	1ST18EC018
Mritunjay Sharma	1ST18EC021
Paveen Kumar M.B	1ST18EC025
Shubham Kumar	1ST18EC041

Under the guidance of

Dr. Shreesha Kalkoor,
Assistant Professor,
Department of ECE,
SaIT, Bengaluru-560097.



SAMBHRAM
INSTITUTE OF TECHNOLOGY

Department of Electronics and Communication Engineering

M.S Palya, Bengaluru-560097.

2021 – 2022

ABSTRACT

With an improvement in technology and miniaturization of sensors, there have been attempts to utilize the new technology in various areas to improve the quality of human life. One main area of research that has seen an adoption of the technology is the healthcare sector. The people in need of healthcare services find it very expensive this is particularly true in developing countries. As a result, this project is an attempt to solve a healthcare problem currently society is facing. The main objective of the project was to design a remote healthcare system. It's comprised of three main parts. The first part being, detection of patient's vitals using sensors, second for sending data to cloud storage and the last part was providing the detected data for remote viewing. Remote viewing of the data enables a doctor or guardian to monitor a patient's health progress away from hospital premises.

The Internet of Things (IoT) concepts have been widely used to interconnect the available medical resources and offer smart, reliable, and effective healthcare service to the patients. Health monitoring for active and assisted living is one of the paradigms that can use the IoT advantages to improve the patient's lifestyle. In this project, I have presented an IoT architecture customized for healthcare applications. The aim of the project was to come up with a Remote Health Monitoring System that can be made with locally available sensors with a view to making it affordable if it were to be mass produced. Hence the proposed architecture collects the sensor data through Arduino microcontroller and relays it to the cloud where it is processed and analyzed for remote viewing. Feedback actions based on the analyzed data can be sent back to the doctor or guardian through Email and/or SMS alerts in case of any emergencies.

INTRODUCTION

Health is characterised as a full state of physical, mental, and social well-being and not merely a lack of illness. Health is a fundamental element of people's need for a better life. Unfortunately, the global health problem has created a dilemma because of certain factors, such as poor health services, the presence of large gaps between rural and urban areas, physicians, and nurses unavailability during the hardest time. IoT is making any objects internally connected in the recent decade and it has been considered as the next technological revolution. Smart health monitoring mechanism, smart parking, smart home, smart city, smart climate, industrial sites, and agricultural fields are some of the applications of IoT. The most tremendous use of IoT is in healthcare management which provides health and environment condition tracking facilities. IoT is nothing but linking computers to the internet utilising sensors and networks. These connected components can be used on devices for health monitoring. The used sensors then forward the information to distant locations like M2M, which are machinery for computers, machines for people, handheld devices, or smartphones. It is a simple, energy-efficient, much smarter, scalable, and interoperable way of tracking and optimising care to any health problem. Nowadays, modern systems are providing a flexible interface, assistant devices, and mental health management to lead a smart life for the human being. Heart rate and body temperature are the two most significant indicators for human health. Heart rate is the per-minute amount of heartbeats, commonly known as the pulse rate. To measure the pulse rate, an increase in the blood flow volume can be used by calculating the pulses. Normal heart rate ranges between 60 and 100 beats per minute for healthy people. The typical restful heart for adult males is roughly 70 bpm and for adult females 75 bpm. Female with 12 years of age and above, typically have higher rates of heart in contrast with males. The temperature of human body is simply the heat of body and the sum of heat radiated by the body is scientifically determined. The average person's body temperature relies on different factors such as ambient temperature, the person's gender, and his eating habits. In healthy adults, it is likely to range between 97.8 °F (36.5 °C) and 99 °F (37.2 °C). Different factors such as flu, low-temperature hypothermia, or any other illness may lead to a change in body temperature. In almost all illnesses, fever is a typical indicator. Various methods exist to invasively and non invasively assess the heart rate and body temperature. For the consumer, noninvasive approaches over a while have proven accurate and convenient. It is suggested that a healthcare should provide good room conditions to facilitate the patients. Some measures like room humidity, level of all gases like CO, and CO₂ can determine the quality of room environment. The toxic gases and certain levels of humidity are very harmful to patients. For optimum comfort, the room humidity should be between 30 and 65%. Some studies are done only for a smart home, not for dedicated healthcare. There are several fatal diseases like heart disease, diabetes, breast cancer, liver disorder, etc. in medical sector but the main concern of our developed system is to monitor the fundamental signs of all types of patients and the patient's room environment. This paper

proposes a customised healthcare system that monitors the pulse and body temperature of patients as well as room humidity, CO, and CO₂ gas level of patient's room via sensors and transmits the data through Wi-Fi that enables the medical staffs to get data from the server. The developed system also provides a solution for the problem of maintaining a single database of patients in hospitals using a web server, apart from the personalisation of critical health-related criteria. In this system, the gas sensor is used to identify an unexpected occurrence that contrasts the performance with the threshold and produces a PPM signal if the output value crosses the threshold. Health is characterised as a full state of physical, mental, and social well-being and not merely a lack of illness. Health is a fundamental element of people's need for a better life. Unfortunately, the global health problem has created a dilemma because of certain factors, such as poor health services, the presence of large gaps between rural and urban areas, physicians, and nurses unavailability during the hardest time. IoT is making any objects internally connected in the recent decade and it has been considered as the next technological revolution. Smart health monitoring mechanism, smart parking, smart home, smart city, smart climate, industrial sites, and agricultural fields are some of the applications of IoT. The most tremendous use of IoT is in healthcare management which provides health and environment condition tracking facilities. IoT is nothing but linking computers to the internet utilising sensors and networks. These connected components can be used on devices for health monitoring. The used sensors then forward the information to distant locations like M2M, which are machinery for computers, machines for people, handheld devices, or smartphones. It is a simple, energy-efficient, much smarter, scalable, and interoperable way of tracking and optimising care to any health problem. Nowadays, modern systems are providing a flexible interface, assistant devices, and mental health management to lead a smart life for the human being. Heart rate and body temperature are the two most significant indicators for human health. Heart rate is the per-minute amount of heartbeats, commonly known as the pulse rate. To measure the pulse rate, an increase in the blood flow volume can be used by calculating the pulses. Normal heart rate ranges between 60 and 100 beats per minute for healthy people. The typical restful heart for adult males is roughly 70 bpm and for adult females 75 bpm. Female with 12 years of age and above, typically have higher rates of heart in contrast with males. The temperature of human body is simply the heat of body and the sum of heat radiated by the body is scientifically determined. The average person's body temperature relies on different factors such as ambient temperature, the person's gender, and his eating habits. In healthy adults, it is likely to range between 97.8 °F (36.5 °C) and 99 °F (37.2 °C). Different factors such as flu, low-temperature hypothermia, or any other illness may lead to a change in body temperature. In almost all illnesses, fever is a typical indicator. Various methods exist to invasively and non invasively assess the heart rate and body temperature. For the consumer, noninvasive approaches over a while have proven accurate and convenient. It is suggested that a healthcare should provide good room conditions to facilitate the patients. Some measures like room humidity, level of all gases like CO, and CO₂ can determine the quality of room environment. The toxic gases and certain levels of humidity are very harmful to patients. For optimum

comfort, the room humidity should be between 30 and 65%. Some studies are done only for a smart home, not for dedicated healthcare. There are several fatal diseases like heart disease, diabetes, breast cancer, liver disorder, etc. in medical sector but the main concern of our developed system is to monitor the fundamental signs of all types of patients and the patient's room environment. This paper proposes a customized healthcare system that monitors the pulse and body temperature of patients as well as room humidity, CO, and CO₂ gas level of patient's room via sensors and transmits the data through Wi-Fi that enables the medical staffs to get data from the server. The developed system also provides a solution for the problem of maintaining a single database of patients in hospitals using a web server, apart from the personalisation of critical health-related criteria. In this system, the gas sensor is used to identify an unexpected occurrence that contrasts the performance with the threshold and produces a PPM signal if the output value crosses the threshold.

OBJECTIVES

- To design and implementation of a smart patient health tracking system that uses Sensors to track patient health and uses internet to inform their loved ones in case of any issues.
- To develop monitoring systems is to reduce health care costs by reducing physical office visits, hospitalizations, and diagnostic testing procedure.
- Each of our bodies utilises temperature and also pulse acknowledging to pursue understanding wellbeing. The sensors are linked to a microcontroller to track the status which is thus interfaced to a LCD screen and additionally remote association with the capacity to alert the concerned.
- To design a framework which finds any sudden changes in understanding heart beat or body temperature, the framework can consequently alarm the client about the patient's status over IOT and furthermore indicates subtle elements of pulse and temperature of patient live on the web.

LITERATURE SURVEY

1. **Tamilselvi et al.** developed a health monitoring system which is able to monitor basic symptoms of a patient like pulse, percentage of oxygen saturation, temperature, and eye movement in IoT network. For this purpose, the system used Heartbeat, SpO2, Temperature, and response sensors as capturing elements and Arduino-UNO as a processing device. The developed system was implemented but no performance measures are described for any patient Acharya et al. introduced a healthcare monitoring kit in IoT environment. The developed system monitored some basic parameters of human health like Heartbeat, ECG, temperature of body, and Respiration. The key hardware components which are used here are pulse sensor, temperature sensor, BP sensor, ECG sensor, and raspberry pi. The information were collected from sensors and sent it to raspberry pi for processing and again transmitted it to IoT network. The foremost important drawback of the system is that no interfaces for data visualisation are developed. Banerjee et al. proposed an important sign detection system supported a noninvasive technique. The proposed system used plethysmography process and correspondingly displayed the output digitally that made it a real-time monitor. The tactic has proved as reliable for the patient compared to other invasive techniques.
2. **Gregoski et al.** Introduced a smartphone-based heart monitoring system. The system used a mobile light and camera to trace finger blood flow and calculated blood flow-based rate of flow. The developed system described an integrated device that wirelessly transmitted a person's pulse to a computer, empowering people to check their sign by merely viewing at their phones instead using hands on every occasion. this can be often an wonderful design but it's isn't feasible if continuous heart monitoring is require.
3. **Oresko et al.** mentioned a completely upset sensing system for smartphones, identifying a tool that's is developed to be the identical given sufficient time and monetary resources. The developed prototype only tracked coronary rhythm in real-time, didn't track surrender time, and may not detect any upset.
4. **Trivedi et al.** suggested a mobile device regulated Arduino-based health parameter surveillance framework. The collected sensor data are analog and sent it to the board of Arduino Uno. By the integrated analog to digital converter, the recorded analog values are converted into digital data. Bluetooth transmitted the physical qualities to the developed device. The Bluetooth device used a module not covering a decent area.

5. **Kathikamani R et al.** designed monitoring system for patients using wireless technology. The data collected are stored on the cloud and are analysed. The drawback was not using web service application peripheral interface, it was on localhost. Using the above literature papers as a base, a design is proposed which fulfils the drawbacks of all the systems and was implemented.

BLOCK DIAGRAM

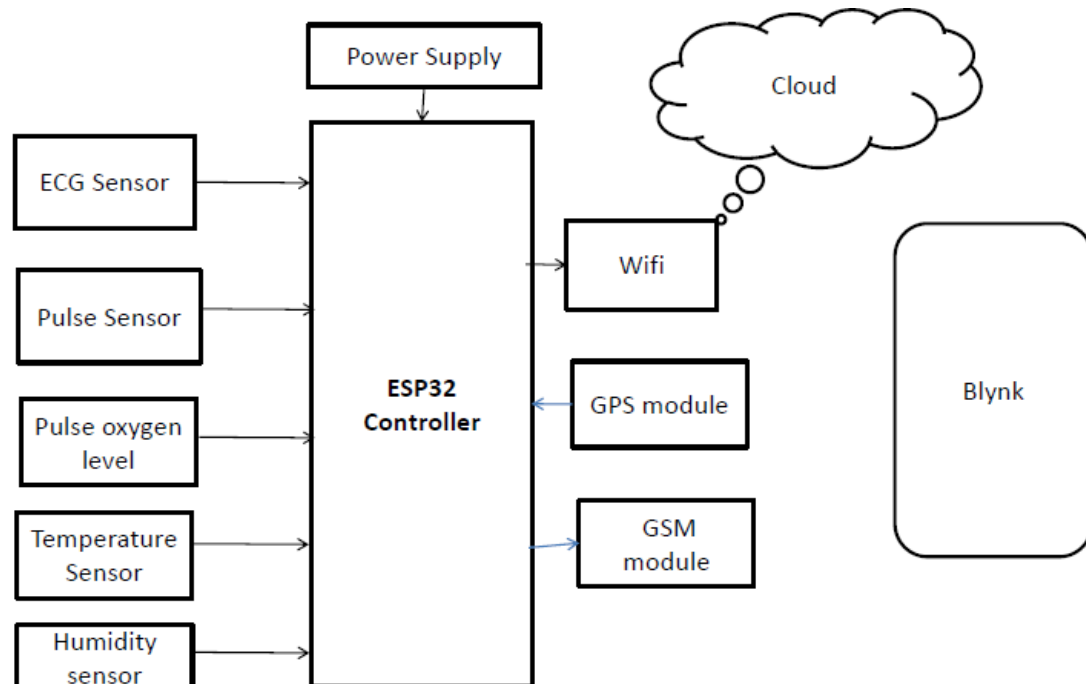


Fig: - Block diagram

Pulse sensor:

It measures the heart rate. It has circuitry for noise cancellation. A finger is placed on the sensor; it calculates the amount of blood in the capillary tube based on the amount of light reflected. The difference in the amount of light transmission and reflection is the result of the sensor.

Temperature sensor:

The sensor measures the body temperature from -55 degree celsius to +150 degree Celsius. For every 10 degrees rise in temperature, the output changes by 10mv.

SpO2 sensor:

This sensor measures the oxygen content in the blood. A little beam of light passed through the blood within a finger. It measures the amount of change in light absorption.

GSM module:

It's a GSM modem with TTL output. It's a standard for the mobile telephones. This module sends the message to the mobile if there is a sensor value crosses the threshold.

Humidity sensor:

The humidity sensor is a device that senses, measures, and reports the relative humidity (RH) of air or determines the amount of water vapour present in gas mixture (air) or pure gas.

ECG (Electrocardiogram) sensor:

It records the pathway of electrical impulses through the heart muscle, and can be recorded on resting and ambulatory subjects, or during exercise to provide information on the heart's response to physical exertion.

Wi-Fi module:

This module allows connectivity of the internet with the embedded applications. It uses the communication protocol. It transmits the values of sensors to the mobile application.

ESP32 controller:

ESP32 is a low power WiFi enabled microcontroller created and developed by Espressif Systems. The ESP32 is an advanced IoT microcontroller board possessing WiFi and Bluetooth Low Energy capabilities, as well as limited compatibility with the Arduino Core.

GSM modem:

A GSM modem or GSM module is a hardware device that uses GSM mobile telephone technology to provide a data link to a remote network.

GPS module:

GPS modules contain tiny processors and antennas that directly receive data sent by satellites through dedicated RF frequencies. From there, it'll receive timestamp from each visible satellites, along with other pieces of data.

Blynk app:

Blynk is a Platform with IOS and Android apps to control Arduino, Raspberry Pi and the likes over the Internet. It's a digital dashboard where you can build a graphic interface for your project by simply dragging and dropping widgets.

HARDWARE AND SOFTWARE REQUIRED

Hardware Requirement:

- ESP 32
- ECG sensor
- Temperature sensor
- Heartbeat sensor
- Pulse oxygen level
- GPS
- GSM module
- Humidity sensor
- Jumper wires

Software Requirements:

- Blynk app
- Arduino IDE
- Embedded C

APPLICATIONS

- Remote areas which are inaccessible to health care facilities, if educated can take care of their health with this tool.
- Health monitoring purposes for analytics.
- Targeting a fail proof system as the health care data can be accessed remotely from the end-user as well as government's side.
- Helps in securing life of the survivors who lost their loved ones in these hard times.

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