GSM Based Health Monitoring System

Dr. Bhanumathi K S Dharithri K V, Sagar P, Shreya Metri

Department of Electronics &Instrumentation JSS Academy of Technical Education, Bengaluru

Abstract **: The evolution of health monitoring systems has led to the proposal of smart solutions for real-time patient health monitoring. Rapid and accurate decision- making is crucial in caring for critically ill patients ensure timely life-saving interventions. Globally, the frequency of lives lost each minute leads to the urgency for improved health care. Specifically, heart attacks heavily impact lives in India daily. Recent advancements in mobile phone technology have facilitated innovative applications beyond conventional voice data transfer. This study primarily targets monitoring a patient's pulse rate, body temperature, oxygen saturation levels, and ECG in real-time, emphasizing the significance of tracking these vital parameters. Hypertensive heart disease's statistics over the past decade highlight high blood pressure as a critical risk factor, necessitating preventive measures. The GSM-based Health Monitoring System aims to transmit patient data wirelessly via GSM technology, enabling remote real-time monitoring by medical professionals. This breakthrough provides continuous monitoring of vital signs without confining patients to medical facilities, offering newfound independence whileensuring their health is vigilantly observed**

1. INTRODUCTION

In rural India, healthcare faces a significant crisis due to a severe shortage of medical professionals, with 74% of doctors concentrated in urban areas serving only 28% of the population. This scarcity compels rural citizens to resort to unqualified practitioners, exacerbating healthcare issues. Factors like inadequate infrastructure, housing, education, and essential amenities dissuade doctors from working in rural regions.

The stark contrast between urban and rural healthcare is evident in resource allocation; urban public hospitals boast double the bed capacity of rural facilities, leading to disparities in healthcare services. Studies reveal higher mortality rates among children under five in certain rural areas, reflecting limited access to healthcare and lower immunization coverage compared to urban regions.

Amid these challenges, GSM-based health monitoring utilizing 2G networks presents a potential solution by facilitating remote patient monitoring and data transmission, offering a promising avenue for improving healthcare accessibility in both rural and urban areas

Urban areas also grapple with healthcare inadequacies, including fewer service options, organizational deficiencies, and disparities rooted in residence, socio economic status, and discrimination against unlisted slums. Additionally, health disparities impact treatment adherence, where various healthcare quality factors directly influenceadherence to treatment plans.

2. RELATED WORK

Aziz, K., Tarapiah, S., Ismail, S. H., & Atalla, S.

[1] " Health Care Monitoring And Tracking System", This paper aimed at measuring the temperature and heart rate of the patient and sending the data through an SMS. Though this design is already available somechanges could be made in the parameters that are being measured

PP Singh titled"zigbee and GSM Baesd Patient Hea;th Monitoring System" [2] proposed a system where the controller used is ATMEGA328. They have temperature sensor, ECG Driver circuit, Heartbeat driver circuit and RF encoder.

SM Fati, Muneer [3]Integrated Health Monitoring System using GSM and IOT titled " In a paper was published by Smart Real-time Healthcare Monitoring and Tracking System using GSM/GPS Technologies". This paper aimed at measuring Temperature and pulse rate of the patient body and send those data to the doctor through an SMS and also along with the data the GPS location of the patient would also be sent.

S chaudary and D Pauk [4]titled "Internet Of Thing and GSM Monitoring System". This research aimed at measuring Temperature, pulse rate and the ECG of the patient. The measured parameters were sent to the mobile phone of the doctor as an SMS through a GSM module.However this design used a CRO to display the output of the ECG. We looked upon otherpossibilities to avoid this CRO

Tarapiah, S., Daadoo, M., & Atalla, S [5] titled " Andriod Based Real Time Healthcare System". This research aimed at providing a local network using zigbee technology and the arameters (Temperature, pulse rate, ECG

3. PROPOSED SYSTEM

The system calculates the heartbeats and body temperature of patient and if it goes above certain limit then immediate informative alert message will be sent to the registered number. For this system we used Arduino which is interfaced with LCD display, heartbeat sensor, etc.

The process begins by understanding what healthcare needs are present and what's required for monitoring people's health using GSM technology. This includes figuring out what health factors to measure, like heart rate, temperature, and so on. Once we know what's needed, we design the system

like planning out the different parts needed, such as sensors to measure health signs, a way to send this information using GSM (like how phones use networks), and a system to collect and understand this health data.

Next, we put these sensors together with a device that can send this health information using GSM technology. Then, we work on creating a method to send this data securely and in real-time to a central place, maybe a hospital or clinic. Once the information reaches there, we set up a way to look at it and understand if anything is wrong - like creating software that can tell if someone's health is in danger based on this data.

Before making it available for use, we check that this system works well by testing it under different conditions. After confirming it works properly, we teach healthcare workers and users how to use it.

While also making sure we follow rules about keeping information safe and private. This whole process involves understanding healthcare needs, making a system to measure and send health data using GSM, checking that it works, teaching people how to use it, and then putting it where it's needed, while also following the rules about keeping information safe.
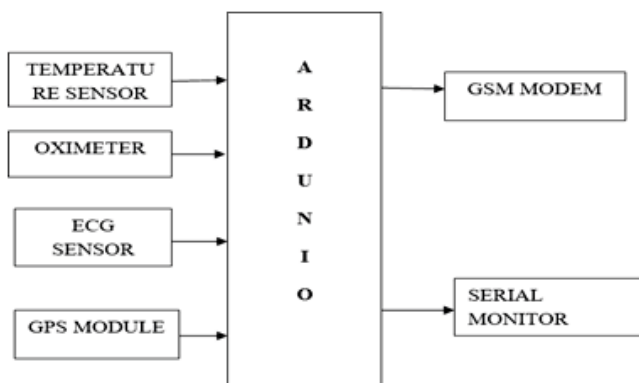

Figure 1: Block Diagram of basic GSM monitoring system

Once the device is started the sensors get turned on and starts reading the data. The data thus obtained is displayed on the serial monitor and also given to the microcontroller which will compare it with the standard values. When the obtained data is not in range an SMS would besent along with the exact location of the patient which would be obtained by the GPS module.If the data is in range the device would continue to monitor.
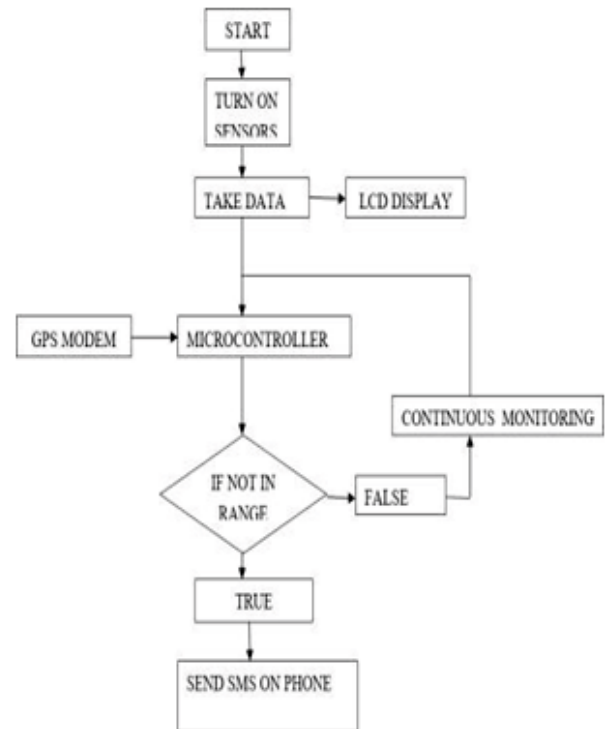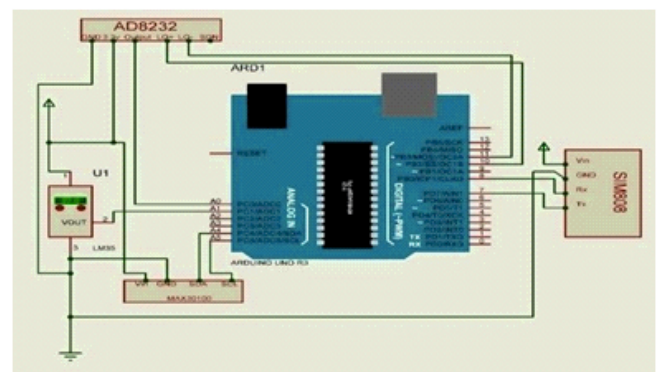

Figure 2 : Flowchart Implementation

Figure 3: Circuit Diagram

4. HARDWARE DESCRIPTION

A. Arduino Uno R3:

Figure 4: Arduino Uno

An open-source platform called Arduino is used to construct electronics projects. The Arduino system comprises a programmable circuit board, often known as a microcontroller, and an IDE (Integrated Development Environment) software that is used to develop and upload computer code to the board. The software runs on our computer. For good reason, the Arduino platform has grown in popularity among those who are just getting into electronics.

The Arduino, in contrast to the majority of earlier programmable circuit boards, may be updated with new code using a USB cable rather than a separate piece of hardware known as a programmer.It comes with everything required to support the microcontroller; all you have to do is use an AC-to- DC adapter or a USB cable to connect it to a computer.

The ATmega328 microcontroller belongs to the Atmel family and is a single chip microcontroller. Its processor code is eight bits long. It includes registers, I/O lines, SPI serial ports, memory (SRAM, EEPROM, and Flash), oscillator, timer, and external and internal interrupts. ICSP pin:

The Arduino board's firmware can be programmed by the user through the In-Circuit Serial Programming pin. Power LED Indicator: When an LED is in the ON state, it indicates that power is on. The input voltage is changed to 5V by the voltage regulator. GND: Pins on the ground. The ground pin functions as a zero-voltage pin. Vin: The input voltage is what it is. Pins that are analog:

A. Temperature Sensor

A temperature sensor detect the hotness and the coldness of the environment. The sensing of the temperature can be done with the directly contact or an indirect contact. The temperature sensor DHT11 is used to measure the temperature of the environment accurately. DHT11 sensor is an integrated circuit in which the voltage output is directly proportional to the temperature Celsius. Water level:
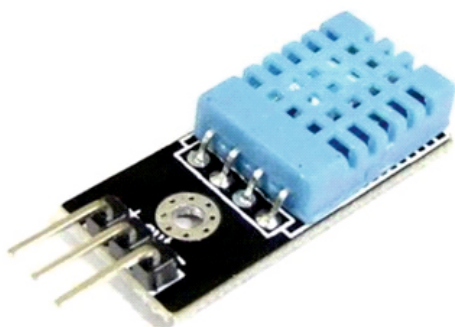

Figure 5 :Temperature Sensor DHT11

A. LCD :

LCD (Liquid Crystal Display) is a type of flat panel display which uses liquid crystals in its primary form of operation. LEDs have a large and varying set of use cases for consumers and businesses, as they can be commonly found in smart phones, televisions, computer monitors and instrument panels.
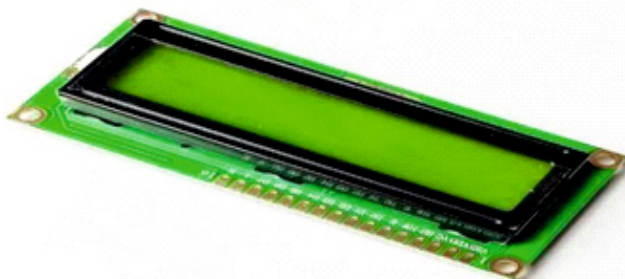

Figure 6: LCD Display

LCDs were a big leap in terms of the technology they replaced, which include light-emitting diode (LED) and gas-plasma displays. LCDs allowed displays to be much thinner than cathode ray tube (CRT) technology. LCDs consume much less power than LED and gas-display displays because theywork on the principle of blocking light rather than emitting it. Where an LED emits light, the liquidcrystals in an LCD produces an image using a backlight

D. Pulse oximeter:

MAX30100	Arduino UNO
VIN	5V
GND	GND
SCL	A5
SDA	A4

Figure 7:Oximeter

An integrated sensor system for heart rate monitoring and pulse oximetry is the MAX30100. To detect pulse oximetry and heart-rate signals, it includes two LEDs, a photo detector, improved optics, and low-noise analog signal processing. The voltage range for the MAX30100 breakout is 1.8V to 5.5V. The gadget is equipped with two LEDs, one

of which emits red light and the other infrared light. All that is required for pulserate is the infrared light. Blood oxygen levels are measured using both red and infrared light.Because there is more blood as the heart pumps, the amount of oxygenated blood increases. The amount of blood that is oxygenated drops when the heart relaxes.

The pulse rate can be calculated by measuring the interval between an increase and a fall in oxygenated blood. It turns out that red light is absorbed and passed more by oxygenated blood, while infrared light is absorbed and passed more by deoxygenated blood. The primary purpose of the MAX30100 is to read the absorption levels from each light source and store them in an I2C-readable buffer.

E. SIM808 GSM/GPS/GPRS Module:

This board, which is based on the most recent SIMCOM SIM808 GSM/GPS module, provides GPS technology for satellite navigation in addition to cellular GSM and GPRS data. With 22 tracking and 66 acquisition channels, the GPS receiver is extremely sensitive. It also supports assisted-GPS (A-GPS) for indoor localization. The board supports 3.3V and 5V logical levels and is controlled by AT commands via UART. It has a small GPS and GSM antenna built in, however a battery is not required. The board makes use of GSM networks that are 2G, not 3G or LTE.

Figure 8: SIM808/GPS/GPRS

A commercial board called the AD8232 ECG sensor is used to measure the electrical activity of the human heart. An analog reading is the result of this process, which can be shown as a chart similar to an electrocardiogram. The AD8232 chip can be used to lessen noise from electrocardiograms, which can be highly noisy.
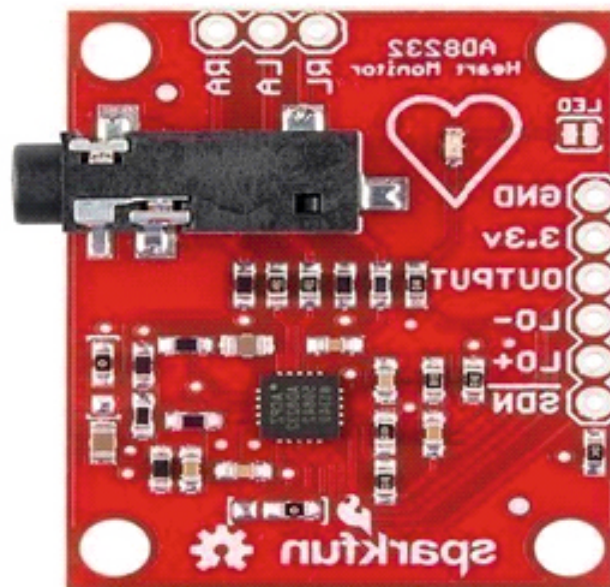

Figure 9 :ECG Monitor

The ECG sensor functions similarly to an operational amplifier in order to facilitate the simple extraction of a clear signal from the intervals.Fast application and discrete single-lead ECG data gathering are made possible by our low-noise ECG local differential triode arrangement (however customized electrode cable configurations are available).

5. RESULTS AND DISCUSSION

In this project we propose a device which performs automated medical checkups of some of the important Biological parameters, Temperature, pulse rate and more. The received data can be used to analyze the recent fluctuations in the health of the individual and send it to the doctor without physically meeting the doctor.
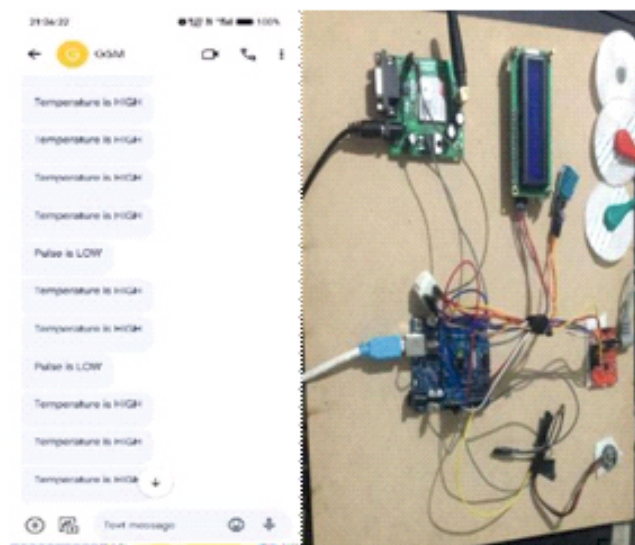

Figure 10: Practical Implementation

Any variation in the nominal value the alert message will be sent user through the integrated module of SIM808 which consists if both GSM and GPS module Finally, we realize a system of wireless health monitoring system We've used a Arduino interface with the GSM module , On body sensors monitor the vital parameters (blood pressure, ECG, temperature and heart beat rate) and transmits the data to doctor's end via wireless communication network.

6. CONCLUSION

Increase in aging population, surging healthcare expenses and the occurrence of chronic diseases is driving healthcare stakeholders to follow remote health management and patient monitoring seriously.

Arduino is found to be more compact, user-friendly and less complex, which could readily be used in order to perform several tedious and repetitive tasks. Healthcare field is one of the most delicate and important fields to be developed and enhanced by smart systems designed to present sustainable medical interventions at manner time where the smart system should be simple, low-energy consumption and real time feedback .In recent times, the Health care Monitoring Systems have improved itself in terms of versatility and mobility.

SMS is the most appropriate way to transmit data in criticalsituations in rural areas where broadband communication are rare These types of Devices can be used in mass numbers which will help in self evaluation and remote assessment, emerging advancements in the medical engineering can also aid in updated versions of these devices.

FUTURE SCOPE:All the parameters that are recorded can be sent to a website over the internet whichwill help in real time monitoring of the patient by the doctor from faraway location

In future the other vital parameters such as blood glucose levels ,blood pressurering can be measured

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