Vol.15, Issue No 1, 2025

PATIENT HEALTH MONITORING SYSTEM USING BLUETOOTH

Dr. B. N SRINIVASRAO, L. SWAMY DIVAKAR NAIDU, L. DINAKAR, N. ALEKHYA, C.ABHIRAM, Y. VENKATA RAMA BHARATH

Associate Professor, Dept. Of ECE, PRAGATI ENGINEERING COLLEGE

UG Students, Dept. Of ECE, PRAGATI ENGINEERING COLLEGE

ABSTRACT

Health monitoring is a major problem in today's world. Due to a lack of proper health monitoring, patients suffer from serious health issues. There are lots of IOT devices nowadays to monitor the health of patient over the Internet. Health experts are also taking advantage of these smart devices to keep an eye on their patients.

Here in this project, we will make a Patient Health Monitoring System that records the patient's heart beat rate and body temperature. Pulse rate and body temperature readings are recorded over Bluetooth software so that patient health can be monitored from anywhere in the world over the Internet.

INTRODUCTION

In recent years, the advancement of technology has significantly transformed the healthcare industry, providing innovative solutions for effective patient monitoring. One of the major challenges in modern healthcare is the timely and accurate monitoring of a patient's health status, particularly for individuals with chronic illnesses or those requiring continuous observation.

The Patient Health Monitoring System using Bluetooth addresses these challenges by leveraging modern technology to enable remote health tracking. This system is designed to measure vital health parameters, specifically heart rate and body temperature, using sensors integrated with a Bluetooth-enabled device.

This approach not only minimizes the need for physical hospital visits but also enhances the ability to respond to health anomalies promptly. The integration of Bluetooth technology makes the system cost-effective and accessible, particularly in areas where advanced healthcare infrastructure is limited. Additionally, the recorded data can be shared with doctors or stored for analysis, improving diagnostic accuracy and personalized treatment plans.

By combining the benefits of IoT and Bluetooth connectivity, this project provides a reliable and efficient solution for health monitoring. It aims to bridge the gap between patients and healthcare providers, ensuring that critical health information is always within reach. Such systems represent a significant step toward achieving a smarter, technology-driven healthcare ecosystem.

The Patient Health Monitoring System is particularly useful for individuals managing chronic diseases, elderly patients requiring constant supervision, and those recovering from surgery.

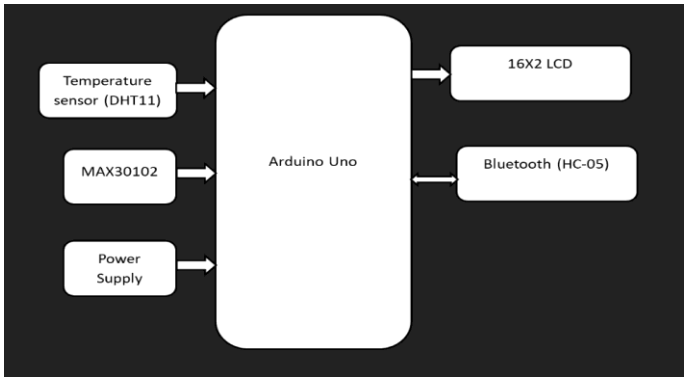

Figure.1: Block Diagram

LITERATURE SURVEY

- Bluetooth technology provides a viable short-range communication alternative, as Mishra and Sharma (2019) discussed. Bluetooth-enabled devices allow real-time data transmission to smartphones or computers, ensuring cost-effective and efficient health monitoring.
- For vital parameter measurement, sensors such as photoplethysmography (PPG) for heart rate and thermistors for temperature are commonly used. Smith et al. (2020) highlight the importance of these sensors in detecting early health anomalies. However, challenges such as calibration errors and signal noise require further attention. Additionally, Gupta and Kumar (2021) stress the value of data logging and trend analysis for better diagnosis and treatment planning. Despite these advancements, current systems often lack user-friendly interfaces and integration with Bluetooth for seamless data management.
- Singh and Mehta (2022) emphasize that the low energy consumption of Bluetooth devices extends the battery life of portable systems, ensuring long-term usability. Additionally, the compact size and ease of use of Bluetooth-enabled devices allow patients to monitor their health without professional assistance, empowering them with greater control over their wellness.
- The literature on patient health monitoring systems highlights the growing integration of technology in healthcare for tracking vital parameters such as heart rate and body temperature. Rajasekaran et al. (2018) emphasized the role of IoT-based systems in reducing hospital visits and improving patient outcomes, though their reliance on internet connectivity poses limitations in remote areas.
- Mishra and Sharma (2019) proposed Bluetooth technology as a cost-effective and energy-efficient alternative for short-range health data transmission, enabling real-time monitoring. Studies by Smith et al. (2020)

PROPOSED SYSTEM

The Patient Health Monitoring System operates by utilizing a combination of sensors and embedded technology to measure and transmit vital health parameters. The system uses the MAX30102 pulse oximeter sensor to detect the patient's heart rate through the principle of photoplethysmography. The sensor emits light into the fingertip and measures the variations in light absorption caused by blood flow, accurately calculating the pulse rate. Simultaneously, the DHT11 temperature sensor measures body temperature by detecting changes in its

thermistor's resistance, which varies with ambient heat. These raw sensor outputs are transmitted to the Arduino Uno for processing.

The Arduino Uno serves as the core processing unit, converting the analog data from the sensors into digital values that can be easily interpreted. This processed data is then displayed on a 16x2 LCD, providing real-time information on the patient's pulse rate and body temperature. Additionally, the system features a Bluetooth module (HC-05) to enable wireless data transmission. Through this module, the recorded health data is sent to paired Bluetooth devices, such as smartphones or computers, for remote monitoring and analysis.

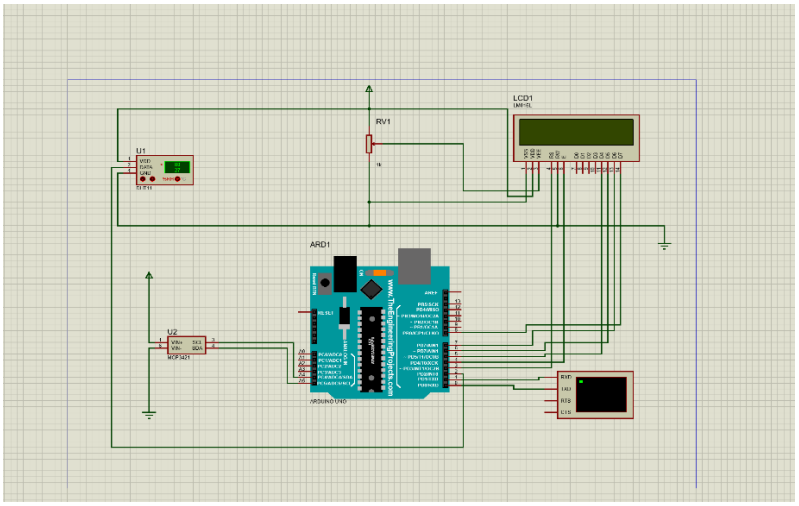

Figure.2: Schematic Diagram

This integration of sensors, a microcontroller, and wireless communication ensures a seamless and user-friendly health monitoring experience. The system's ability to monitor vital signs in real-time and transmit the data remotely makes it an effective solution for home healthcare, telemedicine, and emergency scenarios. It eliminates the need for complex infrastructure, relying solely on Bluetooth connectivity, and offers a portable, cost-effective tool to address modern health monitoring challenges.

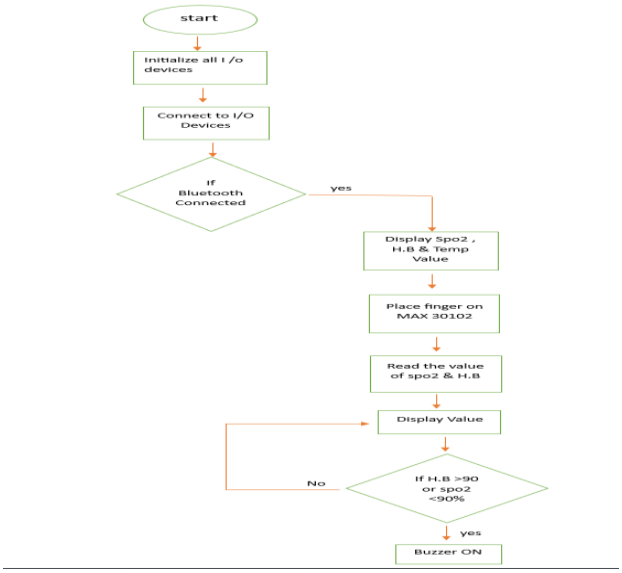

Figure.3: Flow Chart

ADVANTAGES

- **Real-Time Monitoring:** Enables continuous tracking of vital signs, ensuring immediate detection of abnormalities.
- **Remote Monitoring:** Facilitates patient monitoring from a distance using Bluetooth technology, enhancing convenience.
- **Cost-Effective:** Reduces the need for expensive medical equipment and hospital visits.
- **User-Friendly:** Simple design and operation make it accessible to non-technical users.
- **Compact and Portable:** Lightweight hardware setup allows for easy portability and usage in various locations.
- **Low Power Consumption:** Efficient design ensures minimal power usage, making it suitable for extended monitoring.
- **Real-Time Alerts:** Instantaneous updates enable caregivers to take timely action during emergencies.

APPLICATIONS

- **Home Healthcare:** Used for monitoring elderly or chronically ill patients in the comfort of their homes.
- **Telemedicine:** Supports remote healthcare consultations by providing real-time patient data.
- **Fitness Tracking:** Helps individuals monitor their pulse rate and body temperature during workouts.
- **Clinical Monitoring:** Assists in basic health tracking in clinics or small healthcare facilities.
- **Ambulance Care:** Monitors patient vitals during transport to medical facilities.
- **Remote Areas:** Useful in rural or remote locations with limited access to healthcare facilities.
- **Post-Surgical Recovery:** Tracks vital signs of patients recovering from surgeries to ensure stability.

RESULTS

The sensors continuously monitor vital parameters from the patient. For instance, the MAX30100 sensor measures heart rate and SPO2 levels, while the LM35 captures body temperature. These sensors are connected to the microcontroller, which periodically reads the data. This step ensures accurate and reliable data acquisition from the patient in real-time.

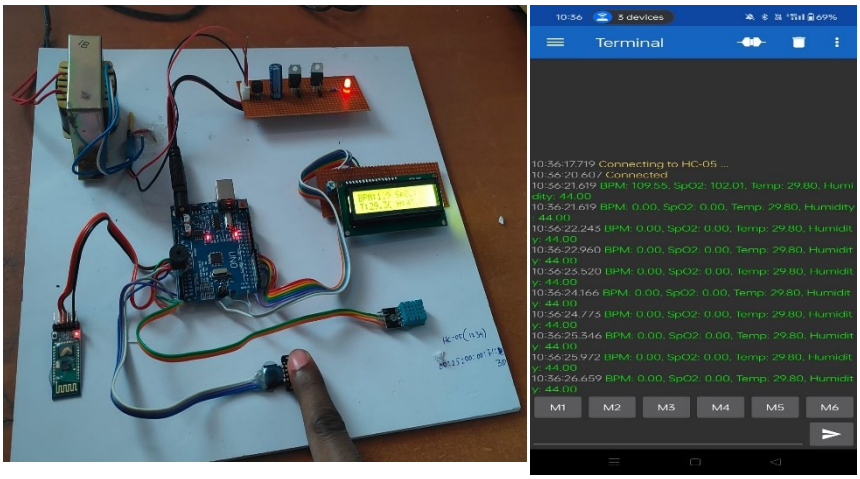

Figure.4: Collecting data from the Sensors

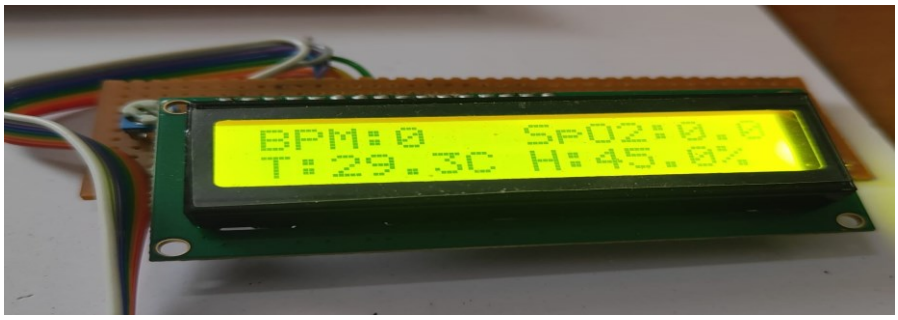

Figure.5: Displaying data on lcd

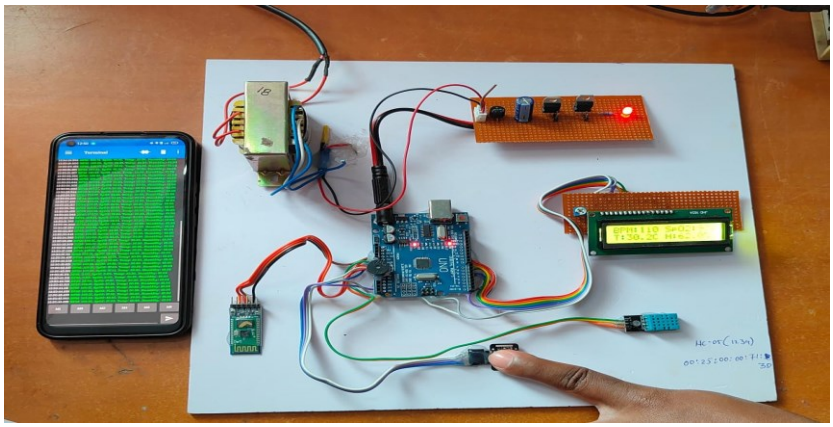

Figure.6: Data Transmission via Bluetooth

The formatted data is transmitted to a connected smartphone or PC via a Bluetooth module. Using a compatible mobile application, such as one built with MIT App Inventor or Flutter, the user receives real-time updates on the patient's vitals. The Bluetooth connection ensures secure and reliable communication, enabling continuous monitoring.

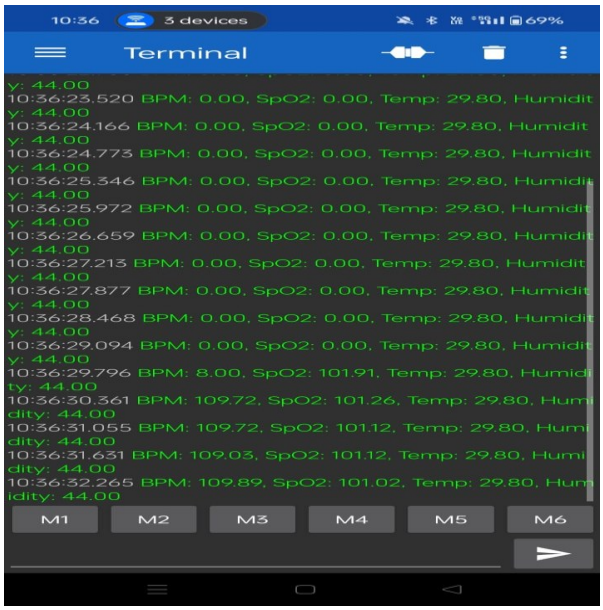

Figure.7: Real-Time Data Display and Alerts

CONCLUSION

The Bluetooth-based patient health monitoring system is an innovative and efficient solution for real-time health tracking. By integrating sensors to measure vital parameters such as heart rate, SPO2, and body temperature with a microcontroller and Bluetooth module, the system ensures seamless data acquisition and transmission to a smartphone or PC. This approach enhances the accessibility and convenience of monitoring, enabling healthcare providers to oversee patients' conditions remotely and in real time.

The system's intuitive design, combining hardware and software components, delivers a user-friendly experience. Continuous data updates and real-time alerts for abnormal readings ensure timely medical intervention, reducing the risk of severe health complications. Additionally, the integration of a mobile application provides an efficient and organised way to visualise and analyse patient data, making it an indispensable tool for both patients and healthcare professionals.

One of the standouts features of the system is its balance between security and reliability. The use of Bluetooth technology ensures secure and short-range communication, making it suitable for home or clinical environments. Furthermore, the potential for scalability allows for the integration of additional sensors and features, such as cloud-based storage and AI-driven predictive analytics, expanding its utility in advanced healthcare applications.

In conclusion, the Bluetooth-based patient health monitoring system addresses the pressing need for real-time, remote health tracking. It not only empowers healthcare providers with accurate and actionable insights but also promotes better patient outcomes by ensuring timely care. This system serves as a stepping stone toward more connected and intelligent healthcare solutions, paving the way for a healthier and more technology-driven future.

Future Scope:

1. Advanced Data Security: Incorporating end-to-end encryption for Bluetooth communication to ensure secure transmission of sensitive health data, preventing unauthorised access or data breaches.
2. Mobile Application Enhancement: Development of a dedicated mobile application with advanced features such as personalized health dashboards, trend analysis, and push notifications for critical health alerts.
3. Cloud Integration: Integration with cloud platforms for storing and managing patient health data, enabling remote access for healthcare professionals and facilitating longitudinal analysis of patient health trends.
4. AI-Powered Analytics: Incorporation of artificial intelligence and machine learning algorithms for predictive health insights, anomaly detection, and proactive healthcare recommendations.
5. Multi-Parameter Monitoring: Expanding the system to support additional sensors for monitoring blood glucose, ECG, or respiratory rate, providing a comprehensive view of a patient’s health.

REFERENCES

1. "Embedded Systems: Architecture, Programming, and Design"//Author: Raj Kamal//Year of Publication: 2015

2. "Biomedical Instrumentation and Measurements"//Authors: Leslie Cromwell, Fred J. Weibell, and Erich A. Pfeiffer//Year of Publication: 2011.

3. "Wireless Communication: Principles and Practice"//Author: Theodore S. Rappaport//Year of Publication: 2010

4. "Programming Arduino: Getting Started with Sketches"//Author: Simon Monk//Year of Publication: 2012

5. "The Art of Electronics"//Authors: Paul Horowitz and Winfield Hill//Year of Publication: 2015

6. "Practical Electronics for Inventors"//Authors: Paul Scherz and Simon Monk//Year of Publication: 2016

7."Internet of Things with Arduino and Bluetooth Low Energy"//Author: Marco Schwartz//Year of Publication: 2020

8."Introduction to Biomedical Engineering"//Authors: John Enderle and Joseph Bronzino//Year of Publication: 2012