IOT Based Health Monitoring System For Real Time Analysis

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ABSTRACT

This paper presents the design and implementation of an ambulance-based Health Monitoring System for continuous tracking of patient vital parameters during transport. The system measures physiological signals such as heart rate and body temperature using biomedical sensors interfaced with a microcontroller unit. The acquired data is displayed locally on an onboard LCD screen for immediate observation by the caretaker inside the ambulance.

In addition, the system hosts a dedicated web interface accessible through a unique device-specific URL, enabling real-time monitoring of patient data by hospital staff. This facilitates early preparation for medical intervention prior to the patient's arrival. A threshold-based alert mechanism is incorporated, wherein abnormal vital readings trigger a buzzer within the ambulance to notify the caretaker. Furthermore, a Telegram-based notification system is implemented to provide continuous remote alerts to authorized personnel when abnormal conditions are detected.

The proposed system offers a practical and cost-effective solution for pre-hospital patient monitoring, enhancing communication between ambulance staff and healthcare providers. The implementation demonstrates reliable real-time data transmission under standard network conditions, while limitations include dependency on network availability and sensor accuracy.

1. INTRODUCTION:

The timely monitoring of patient health conditions during emergency transportation plays a critical role in improving treatment outcomes. In many cases, the condition of a patient can change rapidly while being transported to a hospital, and the lack of continuous monitoring or communication with medical staff may delay necessary medical intervention. Conventional ambulance systems primarily focus on transportation and basic first aid, with limited capability for real-time data sharing with hospitals.

With the advancement of embedded systems and Internet of Things (IoT) technologies, it has become feasible to design systems that enable continuous monitoring and remote accessibility of patient health data. This project proposes an ambulance-based Health Monitoring System that measures essential physiological parameters such as heart rate and body temperature using appropriate sensors. The collected data is processed using a microcontroller and displayed locally on an onboard LCD screen, allowing the caretaker inside the ambulance to observe the patient's condition in real time.

In addition to local monitoring, the system provides a web-based interface accessible through a dedicated device-specific URL. This enables hospital staff to remotely monitor the patient's vital signs while the ambulance is in transit, allowing them to

prepare necessary medical resources in advance. To further enhance responsiveness, the system incorporates a threshold-based alert mechanism. When abnormal vital readings are detected, a buzzer is activated within the ambulance to alert the caretaker. Simultaneously, notifications are sent through a Telegram-based alert system to ensure that concerned personnel are informed even if they are not actively monitoring the webpage.

The proposed system aims to bridge the communication gap between ambulance services and hospitals by providing a simple, cost-effective, and reliable solution for continuous health monitoring during patient transport. While the system improves real-time awareness and preparedness, it operates within practical constraints such as sensor accuracy and network availability. Overall, this work demonstrates the applicability of embedded and IoT-based solutions in enhancing pre-hospital emergency care

2. LITERATURESURVEY:

Pantelopoulos and Bourbakis (2010) [1] They presented wearable health monitoring systems that continuously measure physiological parameters such as heart rate and body temperature using body sensor networks. The main advantage is continuous and real-time patient monitoring. However, limitations include power consumption issues, limited processing capability, and lack of efficient real-time communication with healthcare providers..

Gubbi et al. (2013) [2] This work discusses the role of Internet of Things (IoT) in healthcare applications, where sensors and smart devices are used for remote monitoring and data transmission. The key benefit is improved accessibility of patient data and enhanced decision-making through connectivity. However, the system depends heavily on network reliability and raises concerns regarding data security and privacy.

Kumar et al. (2016) [3] They developed an IoT-based patient health monitoring system using sensors integrated with microcontrollers to measure parameters such as heart rate and temperature. The system transmits data to a cloud platform for remote monitoring. The main advantage is real-time data availability to doctors. The limitation is the absence of immediate alert mechanisms and lack of local display for on-site monitoring.

Islam et al. (2015) [4] This study proposed a cloud-based healthcare monitoring system that collects patient data through sensors and stores it for analysis and remote access. The system improves long-term health tracking and data management. However, it lacks instant alert systems for emergency conditions and is dependent on continuous internet connectivity.

Reddy et al. (2019) [5] They introduced an IoT-based ambulance monitoring system that tracks patient vital signs during transportation and shares data with hospitals. The main advantage is enabling hospitals to prepare in advance before patient arrival. However, limitations include system complexity, dependency on stable communication networks, and lack of

multi-channel alert mechanisms.

3. PROBLEM STATEMENT

In emergency medical scenarios, continuous monitoring of a patient's vital signs during ambulance transport is essential for timely medical intervention. However, many existing ambulance systems rely on basic monitoring methods or standalone devices that only display readings locally, without enabling real-time communication with hospitals. This lack of integration creates a gap between the ambulance staff and healthcare providers, preventing hospitals from preparing necessary medical resources in advance. Additionally, existing systems often do not combine both local and remote monitoring, and in critical situations, abnormal conditions may go unnoticed due to the absence of immediate and continuous alert mechanisms. Furthermore, if medical personnel are not actively observing the monitoring interface, important updates may be missed. Therefore, there is a need for a system that ensures continuous monitoring, provides real-time data both inside the ambulance and to hospital staff through a web interface, and incorporates reliable alert mechanisms. This project addresses these challenges by developing an integrated Health Monitoring System that enhances communication, ensures timely alerts, and supports better pre-hospital patient care.

4. PROPOSED SYSTEM

The proposed system is an ambulance-based Health Monitoring System designed to continuously track and transmit a patient's vital parameters during transportation. The system integrates biomedical sensors with a microcontroller unit to measure physiological signals such as heart rate and body temperature in real time. The acquired data is processed by the controller and displayed locally on an onboard LCD screen, enabling the caretaker inside the ambulance to monitor the patient's condition continuously.

In addition to local monitoring, the system provides remote accessibility through a dedicated web interface. A unique device-specific URL is generated, which can be accessed via a web browser to view real-time patient data. This webpage is shared with the corresponding hospital, allowing medical staff to monitor the patient's condition while the ambulance is en route. This enables early preparation of required medical facilities and reduces response time upon arrival.

To enhance system responsiveness, a threshold-based alert mechanism is incorporated. When the measured vital parameters exceed predefined safe limits, a buzzer is activated within the ambulance to immediately alert the caretaker. Furthermore, a Telegram-based chatbot notification system is implemented to ensure that alerts are continuously delivered to authorized personnel, even if the webpage is not actively monitored.

The proposed system thus provides a dual-mode monitoring approach—local display within the ambulance and remote monitoring via a web interface—along with multi-level alert mechanisms. This integrated design improves communication between ambulance staff and hospital authorities, supports timely medical intervention, and offers a practical and cost-effective solution for pre-hospital patient care.

5.METHODOLOGY:

The proposed Health Monitoring System is an IoT-based real-time patient monitoring system designed for ambulance use.

a. Data Collection

The physiological data is collected using biomedical sensors attached to the patient. The data includes parameters such as heart rate and body temperature. These sensors continuously capture real-time data and send it to the microcontroller (ESP32/ESP8266) for further processing.

b. Data Monitoring

The microcontroller continuously monitors the incoming sensor data. It ensures that all vital parameters are tracked in real time and updated at regular intervals to maintain continuous observation of the patient's condition inside the ambulance.

c. Data Processing and Analysis

The collected data is processed by the microcontroller and converted into meaningful values. These values are then compared with predefined threshold limits to determine whether the patient's condition is normal or abnormal.

d. Decision Making (Alert Mechanism)

Based on the analysis, the system takes necessary actions. If any vital parameter exceeds or falls below the safe threshold range, the system identifies it as an abnormal condition and triggers alert mechanisms.

e. Control and Notification System

Once an abnormal condition is detected, the microcontroller activates a buzzer to alert the caretaker inside the ambulance. Simultaneously, the system updates the real-time data on a dedicated webpage accessible through a unique device URL, allowing hospital staff to monitor the patient remotely. Additionally, a Telegram chatbot sends continuous alert notifications to authorized personnel until the condition is acknowledged. The entire process runs continuously in a loop, ensuring uninterrupted monitoring and timely response during patient transpor

6. ALGORITHM:

1. **Start the system**
2. **Initialize components**
   - Initialize microcontroller (ESP32/ESP8266)
   - Initialize sensors (heart rate, temperature)
   - Initialize LCD display
   - Initialize Wi-Fi connection
   - Initialize buzzer and Telegram bot
3. **Check network connection**
   - If Wi-Fi is not connected, attempt to reconnect
   - If connected, proceed to next step
4. **Read sensor data**
   - Read heart rate value
   - Read body temperature value
5. **Process data**
   - Convert sensor readings into meaningful units
   - Store the values for display and transmission
6. **Display data locally**

- Show heart rate and temperature on LCD screen

7. Update webpage

- Send current readings to the web server
- Update data on the device-specific URL webpage

8. Compare with threshold values

- Check if readings are within normal range
- If normal → continue monitoring
- If abnormal → go to alert step

9. Trigger alert mechanisms (if abnormal)

- Activate buzzer inside ambulance
- Send alert message through Telegram bot
- Continue sending notifications until acknowledged

10. Repeat process

- Wait for a short interval
- Go back to Step 4 for continuous monitoring

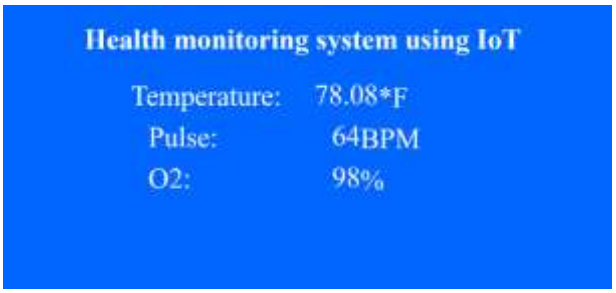
11. Stop (only when system is turned off)

7. RESULTS:

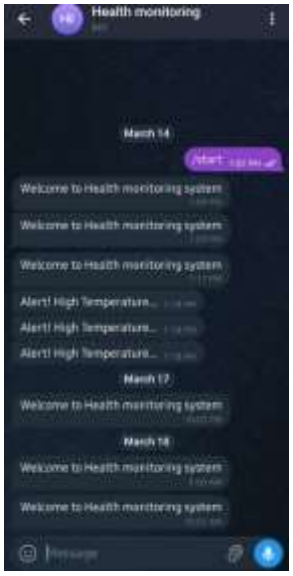
The results of the developed Health Monitoring System are validated through the observed outputs from the webpage interface, Telegram alert system, and LCD display.

The LCD display output shows the real-time values of the patient's vital signs inside the ambulance. The display presents temperature (98.5°F), pulse rate (59 BPM), and SpO_2 (96%), indicating slight variation due to continuous sensor updates. The clear visibility of parameters on the LCD confirms that the system provides
effective
local

monitoring for the caretaker..



The system successfully displays real-time values of temperature, pulse rate, and SpO_2 on a dedicated webpage. The webpage is accessible through a device-specific URL and updates continuously as new sensor data is received. This enables hospital staff to monitor patient conditions remotely during ambulance transit. The interface is simple and clearly presents the vital parameters, ensuring ease of interpretation**.**



The Telegram chatbot integration was tested for alert generation. When abnormal conditions such as high temperature were detected, the system successfully sent continuous alert messages to the registered user. This ensures that even if the webpage is not actively monitored, critical alerts are still received. The repeated notification mechanism proved effective in drawing immediate attention to emergency conditions.

8. CONCLUSION:

The The proposed Health Monitoring System successfully demonstrates a practical approach for continuous monitoring of patient vital parameters during ambulance transport. The system integrates biomedical sensors with a microcontroller to measure key physiological signals such as heart rate, body temperature, and oxygen saturation (SpO_2), and provides real-time data through both local and remote interfaces.

The implementation confirms that the system is capable of displaying live readings on an onboard LCD screen for immediate observation by the caretaker, while simultaneously updating the data on a web-based platform accessible via a dedicated device URL. This dual-mode monitoring ensures that both ambulance staff and hospital authorities have continuous access to patient information. Additionally, the incorporation of alert mechanisms, including a buzzer and Telegram-based notifications, enhances the system's ability to respond promptly to abnormal conditions.

The results indicate that the system operates reliably under normal conditions, providing continuous data acquisition, real-time updates, and effective alert generation. Although the performance is dependent on sensor accuracy and network stability, the system achieves its objective of improving communication and preparedness during patient transport.

Overall, the proposed system offers a cost-effective, user-friendly, and efficient solution for pre-hospital patient monitoring, contributing to improved emergency healthcare support and timely medical intervention.

9. FUTURESCOPE:

The proposed Health Monitoring System can be further enhanced by incorporating advanced technologies and additional features to improve its functionality, reliability, and scalability. Future improvements may include the integration of more biomedical sensors such as blood pressure, ECG, and respiratory rate sensors to provide a more comprehensive assessment of the patient's health condition.

The system can be extended by incorporating Artificial Intelligence (AI) and Machine Learning (ML) techniques for predictive analysis, enabling early detection of critical conditions based on historical data patterns. This would assist healthcare professionals in making more informed decisions before the patient reaches the hospital.

Further development can include the design of a dedicated mobile application to replace or complement the web interface, providing a more user-friendly and accessible platform for real-time monitoring. Additionally, GPS integration can be added to track the ambulance location and share real-time updates with the hospital, improving coordination and response time.

To enhance reliability, the system can be improved with better network management techniques and offline data storage mechanisms to ensure uninterrupted operation during network failures. Security features such as data encryption and secure authentication can also be implemented to protect sensitive patient information.

Moreover, the system can be scaled for integration with hospital management systems and emergency services, enabling automated preparation of medical resources based on incoming patient data. These enhancements would make the system more robust and suitable for real-world healthcare deployment.

10.REFERENCS:

[1] A. Pantelopoulos and N. G. Bourbakis, "A survey on wearable sensor-based systems for health monitoring and prognosis," *IEEE Transactions on Systems, Man, and Cybernetics*, vol. 40, no. 1, pp. 1–12, 2010.

[2] S. M. R. Islam, D. Kwak, M. H. Kabir, M. Hossain, and K.-S. Kwak, "The Internet of Things for health care: A comprehensive survey," *IEEE Access*, vol. 3, pp. 678–708, 2015.

[3] M. Gubbi, R. Buyya, S. Marusic, and M. Palaniswami, "Internet of Things (IoT): A vision, architectural elements, and future directions," *Future Generation Computer Systems*, vol. 29, no. 7, pp. 1645–1660, 2013.

[4] Espressif Systems, "ESP8266/ESP32 Technical Reference Manual," [Online]. Available: https://www.espressif.com

[5] Arduino, "Arduino IDE and Microcontroller Programming Documentation," [Online]. Available: https://www.arduino.cc

[6] Telegram, "Telegram Bot API Documentation," [Online]. Available: https://core.telegram.org/bots/api

[7] Maxim Integrated, "MAX30100/MAX30102 Pulse Oximeter and Heart-Rate Sensor Datasheet,"

[8] National Semiconductor, "LM35 Temperature Sensor Datasheet,"

[12] A. Hasib *et al.*, "HydroSense: IoT Framework for Real-Time Environmental Monitoring with ESP32," *[9] Espressif Systems, "ESP32 Web Server Documentation," Available: https://randomnerdtutorials.com/esp32-web-server-arduino-ide/*