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Activity Tracking System During Patient Treatment

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ABSTRACT

Cancer treatment often leads to significant physical and physiological changes in patients, including fatigue, reduced mobility, cardiovascular stress, and altered body temperature. Monitoring these changes is crucial for improving patient outcomes, but traditional medical equipment can be costly and inaccessible for continuous at- home use. In this context, Arduino-based activity trackers present a low-cost, customizable solution for tracking patients' health metrics during cancer treatment. These systems can be designed using an array of sensors to collect real-time data on physical activity, heart rate, body temperature, and oxygen saturation levels, which are critical parameters for cancer patients undergoing treatments like chemotherapy, radiation, or surgery. The study explores the feasibility, implementation, and potential benefits of such wearable technology in remote healthcare monitoring.

KEYWORDS: Activity Tracker, Cancer Treatment, Remote Monitoring, Arduino, Wearable Technology.

INTRODUCTION

Cancer remains one of the leading causes of mortality worldwide, with millions of new cases diagnosed annually. While advances in medical technology and treatment protocols have improved patient survival rates, managing the side effects of treatment continues to pose a significant challenge. Cancer patients undergoing chemotherapy, radiation therapy, or surgical procedures often experience fatigue, cardiovascular stress, fluctuations in body temperature, and reduced mobility. Monitoring these physiological changes is essential for ensuring timely medical intervention and improving patient outcomes.

Traditional healthcare monitoring systems primarily rely on hospital visits and expensive medical equipment, making continuous patient observation difficult, especially for those receiving treatment at home. With the rapid development of wearable technology and embedded systems, there is a growing opportunity to integrate low-cost, real-time monitoring solutions into cancer care. Wearable health monitoring devices, particularly those built using Arduino microcontrollers and biomedical sensors, provide an effective alternative to conventional monitoring methods by enabling real-time tracking of vital health parameters.

This paper presents the design and implementation of an Arduino-based activity tracker tailored for cancer patients. The proposed system utilizes various sensors to monitor key physiological parameters, including heart rate, oxygen saturation, body temperature, and physical activity. The collected data is processed and transmitted in real time to healthcare providers or caregivers, allowing early detection of anomalies and facilitating timely intervention. By leveraging affordable hardware components and wireless communication technologies, this system offers a cost- effective solution for remote patient monitoring, ultimately improving the quality of life for cancer patients.

LITERATURE REVIEW

Several studies have explored the use of wearable technology for remote patient monitoring. Researchers have investigated various sensor-based health tracking systems that provide real-time data on heart rate, oxygen saturation, and movement patterns. Recent advancements in IoT and machine learning have further enhanced the accuracy and efficiency of these systems. Previous works indicate that wearable devices improve patient engagement, enable early detection of complications, and reduce hospital visits. However, most existing studies focus on general health monitoring rather than specific applications for cancer patients, highlighting the need for specialized solutions tailored to their unique requirements.

EXISTING METHOD

Currently, cancer patients rely on traditional healthcare monitoring methods, including:

- Hospital Visits: Patients frequently visit hospitals for routine checkups, increasing inconvenience and costs.
- Medical Equipment: Expensive and bulky hospital-based devices such as ECG machines and temperature monitors are used for health tracking.
- Manual Symptom Reporting: Patients often rely on self-reporting symptoms, which can be inaccurate and inconsistent.
- Limited Remote Monitoring: Although some telemedicine solutions exist, they lack real- time, continuous tracking capabilities.
- Delayed Intervention: Health conditions may deteriorate between hospital visits, as there is no continuous monitoring system in place to detect early signs of complications.
- High Dependency on Caregivers: Many patients require assistance from family members or healthcare providers for daily health monitoring, increasing the burden on caregivers.

Challenges of the existing system include high costs, inaccessibility in remote areas, limited real-time monitoring, reliance on patient self-reporting, and a lack of early warning alerts. These limitations hinder timely medical intervention, increasing the risk of severe health complications and decreasing overall patient comfort.

PROPOSED SYSTEM

The proposed system addresses the limitations of the existing system by implementing a low-cost, real-time health monitoring solution using Arduino-based wearable technology. The key features of the proposed system include:

- Continuous Health Monitoring: The system tracks heart rate, body temperature, oxygen saturation, and activity levels in real-time, reducing the need for frequent hospital visits.
- Arduino-Based Wearable Device: A compact and affordable device that can be worn by the patient

at all times, ensuring continuous data collection.

- Wireless Data Transmission: Data is transmitted via Bluetooth or Wi-Fi to caregivers, healthcare providers, or a cloud- based platform for analysis.
- Early Warning System: The system triggers automatic alerts in case of abnormal health readings, allowing for timely medical intervention and reducing the risk of complications.
- Integration with Mobile Application: A dedicated mobile application provides real-time visualization of patient health data, offering patients and doctors an intuitive way to monitor health conditions.
- Data Logging for Trend Analysis: The system stores historical health data, enabling trend analysis that can be used for personalized treatment planning and identifying potential health risks before they escalate.
- Reduced Caregiver Burden: By automating health monitoring and providing real-time alerts, the system reduces the dependency on caregivers and allows patients to maintain greater independence.

This proposed system leverages advancements in wearable technology and the Internet of Medical Things (IoMT) to offer an efficient, cost-effective, and user- friendly solution for cancer patients. By continuously monitoring vital parameters and providing real-time alerts, the system ensures timely medical interventions, ultimately improving patient outcomes and quality of life.

HARDWARE COMPONENTS

Node MCU

NodeMCU is an open-source IoT development board based on the ESP8266 Wi-Fi module, used for smart devices, automation, and sensor-based projects. It has a total of 12 GPIO pins, 1 analog pin (A0), and power/control pins like Vin, 3V3, GND, RST, and EN. The GPIO pins support PWM, I²C, SPI, and UART communication, making it easy to interface with sensors and modules. The built-in LED is connected to GPIO2 (D4), and the analog pin (A0) reads voltage levels from 0 to 3.3V.

Temperature Sensor

The LM35 is a precision temperature sensor that provides an analog output proportional to temperature in Celsius (°C). It operates from -55°C to +150°C with an accuracy of ±0.5°C at room temperature. The output voltage increases by 10mV per °C, making it easy to interface with microcontrollers like Arduino, NodeMCU, and Raspberry Pi. It requires a 4V to 30V power supply, consumes low power, and does not require external calibration. Due to its reliability and ease of use, it is widely used in weather stations, medical devices, and industrial temperature monitoring.

MAX 30100

The MAX30100 is a pulse oximeter and heart rate sensor that measures blood oxygen levels (SpO_2) and heart rate using infrared and red LEDs. It operates with low power consumption, making it ideal for wearable health devices and fitness monitoring. The sensor communicates via I^2C, allowing easy integration with microcontrollers like Arduino and NodeMCU. It is widely used in medical applications, smartwatches, and fitness trackers for real-time health monitoring.

LCD (16x2)

The 16x2 LCD display is a commonly used alphanumeric display that can show 16 characters per line on 2 rows. It is based on the HD44780 controller and can be interfaced with microcontrollers like Arduino, NodeMCU, and Raspberry Pi using 4-bit or 8- bit parallel communication. The display supports custom characters, backlight options, and contrast adjustment. It is widely used in embedded systems, IoT projects, and electronic circuits for displaying sensor readings, messages, and real-time data.

Buzzer

A piezo buzzer is an electronic component that produces sound or beep tones using piezoelectric vibrations when an electric signal is applied. It operates on low power and can generate different frequencies based on the input signal. Piezo buzzers are commonly used in alarm systems, timers, notification alerts, and electronic devices. They are easy to interface with microcontrollers like Arduino and NodeMCU, making them popular for IoT and embedded system projects.

Block Diagram

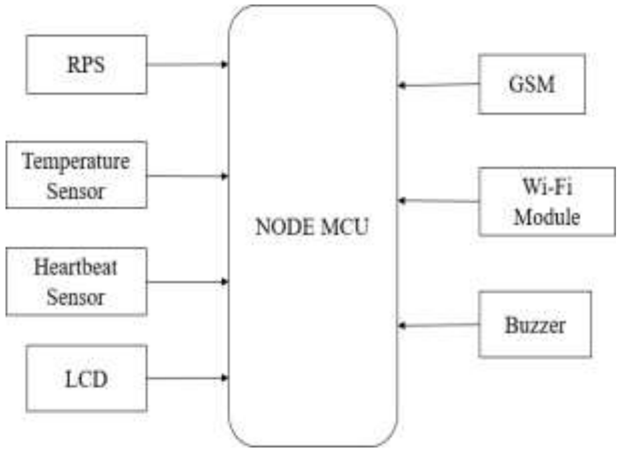


Fig: Block Diagram of Activity Tracking SystemDuring Treatment

SOFTWARE

1. Set Up Development Environment

- Install the Arduino IDE and necessary libraries for the sensors (e.g., heart rate, temperature, accelerometer).
- Configure the Arduino board (e.g., Arduino Uno, ESP32) and ensure you can communicate with the sensors.

2. Sensor Initialization and Data Collection

- Initialize the required sensors (e.g., MAX30100 for heart rate, LM35 for temperature) in the software.
- Continuously collect data from these sensors (e.g., heart rate, temperature, activity) using a loop.

3. Data Processing and Filtering

- Process and filter the collected data to ensure accuracy (e.g., smooth out fluctuations or remove outliers).
- Apply any necessary calibration for sensors to improve reading accuracy.

4. Data Storage or Transmission

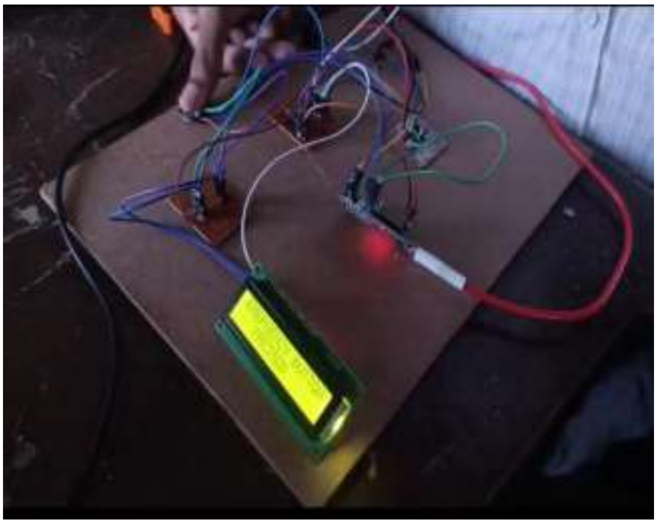
- Store the data locally (e.g., on an SD card) or send it remotely via Wi-Fi (e.g., to platforms like ThingSpeak or Firebase) for real-time monitoring.

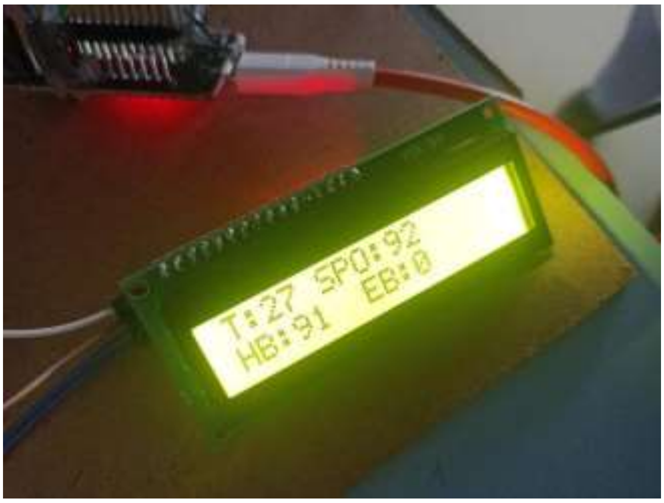
5. Real-time Monitoring and Alerts

- Implement a method for visualizing the data (e.g., on a cloud dashboard) or display it on an LCD screen.
- Set up alerts for abnormal readings (e.g., low oxygen saturation or high temperature) for immediate action.

EXPERIMENTAL RESULTS

The result of the project shows that whenever the patient place the finger on the sensor, then the sensor detect the health parameters of the patient and display on the LCD screen. The tracked parameters will sent to the caregivers or doctor through an app. The project Results will be shown in below…





FUTURE SCOPE

The proposed Arduino-based patient tracking system has the potential for significant advancements in healthcare. By integrating AI for predictive analysis, cloud-based data storage for real-time monitoring, and enhanced wearable technology for continuous tracking, the system can revolutionize remote patient care. With further improvements, it could become a cost-effective and essential tool for cancer treatment monitoring.

1. AI & Machine Learning Integration – Predict health risks based on sensor data trends for early

intervention.
2. Cloud-Based Data Storage – Enable real-time data access and remote monitoring by healthcare providers.
3. Wearable Technology Enhancement – Improve comfort and accuracy with lightweight, compact, and non-invasive sensors.
4. Telemedicine Connectivity – Facilitate virtual consultations and automated emergency alerts.
5. Battery Optimization – Enhance power efficiency for long-term, uninterrupted usage.
6. Integration with Electronic Health Records (EHRs) – Synchronize data with hospital management systems for better healthcare coordination.

CONCLUSION

This paper presents an innovative, low-cost Arduino- based patient tracking system for cancer treatment monitoring. The system effectively collects and transmits critical health data, allowing remote healthcare providers to monitor patients in real-time. While the prototype demonstrated promising results, future enhancements are necessary to improve sensor accuracy, power efficiency, and AI-driven predictive capabilities. With continued research and development, this system has the potential to revolutionize patient monitoring by making healthcare more accessible, efficient, and data-driven.

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