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SMART APPAREL 2.0: HUMAN CLOUD INTEGRATED HEALTH MONITORING SYSTEM

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Abstract: This paper presents the development of a wearable health monitoring device that utilizes Arduino, temperature sensor, pulse detector, and oximeter sensors to continuously monitor a patient's vital signs. The wearable device is designed to collect temperature, pulse rate, and blood oxygen saturation readings from the patient's body. The collected data is then transmitted to the cloud via Wi-Fi connectivity and visualized using ThingSpeak software. The primary objective of this project is to address the need for continuous and non-intrusive monitoring of patients' health. Traditional methods of health monitoring often require manual measurements, which can be inconvenient and may not provide real-time insights into the patient's health status. By integrating the sensors into a wearable device, continuous monitoring becomes possible, enabling healthcare professionals to have access to accurate and timely data. The use of Arduino microcontroller facilitates the seamless integration of the sensors into the wearable device. The temperature sensor measures the patient's body temperature, the pulse detector captures the pulse rate, and the oximeter sensors measure the blood oxygen saturation levels. These vital signs play a crucial role in assessing the patient's overall health and detecting any abnormalities or potential health issues. The collected data is securely transmitted to the cloud, where it is visualized using ThingSpeak software. This provides healthcare professionals with a clear and comprehensive overview of the patient's health parameters. Furthermore, the system incorporates a threshold-based alert mechanism. If the data exceeds predetermined threshold values, alerts are sent to the patient, prompting them to take necessary actions or seek medical attention. The development of this wearable health monitoring device holds great potential in revolutionizing healthcare monitoring and management.

Keywords: Wearable health monitoring, Arduino, temperature sensor, pulse detector, oximeter, cloud connectivity, real-time data visualization, threshold-based alerts.

I. INTRODUCTION

The advancements in wearable technology, along with the proliferation of Internet of Things (IoT) devices, have opened up new possibilities in healthcare monitoring and management. Wearable devices have the potential to revolutionize the way we track and monitor our health, providing continuous and real-time insights into vital signs and overall well-being. In this paper, we present the development of a wearable health monitoring device that utilizes Arduino, temperature sensor, pulse detector, and oximeter sensors to monitor a patient's temperature, pulse rate, and blood oxygen saturation levels. The need for continuous health monitoring has become increasingly important in modern healthcare. Traditional methods of monitoring often involve periodic manual measurements, which may not capture the complete picture of a patient's health status. Furthermore, such methods are intrusive and can disrupt the patient's daily activities. Wearable devices offer a non-intrusive solution by seamlessly integrating sensors into everyday clothing or accessories, allowing for continuous data collection without hindering the patient's mobility.

The wearable device developed in this project utilizes an Arduino microcontroller as the core component. Arduino provides a versatile platform for integrating various sensors and collecting data in a streamlined manner. The temperature sensor is employed to measure the patient's body temperature, providing valuable information about fever or hypothermia. The pulse detector captures the pulse rate, which is a fundamental indicator of cardiovascular health and overall fitness. This design allows for seamless data collection without imposing any restrictions on the patient's daily activities. The collected data is then transmitted to the cloud via Wi-Fi connectivity, leveraging the power of cloud computing for data storage and analysis. By utilizing cloud-based platforms, healthcare professionals can access the patient's health data remotely, enabling real-time monitoring and analysis. To visualize the collected data, we employ ThingSpeak software, which offers a user-friendly interface for data visualization and analytics. This visualization provides valuable insights into the patient's health status and allows for proactive intervention if necessary. Moreover, the system incorporates a threshold-based alert mechanism. If the collected data exceeds predetermined threshold values, alerts are sent to the patient, prompting them to take immediate action or seek medical attention. This feature ensures that timely notifications are delivered, enabling early detection of potential health issues and preventive care. The development of this wearable health monitoring device has significant implications for healthcare management. By leveraging the power of IoT, cloud computing, and wearable technology, the device offers a comprehensive solution for improving healthcare outcomes. This paper presents the development of a wearable health monitoring device that utilizes Arduino, temperature sensor, pulse detector, and oximeter sensors. The integration of these sensors into a wearable device allows for continuous data collection of temperature, pulse rate, and blood oxygen saturation levels. The data is transmitted to the cloud for real-time visualization using ThingSpeak software.

II. ORGANIZATION

The 1st section of this paper gives the introduction about the technological trends and need for IoT in field of health monitoring system. In the 3rd section we discuss about the survey on various related works. 4th section provides problem statement.5th section hardware, various tools and the libraries used for implementing. 6th section provides the design and implementation of the system followed by the conclusion and future enhancements and references used.

III. LITERATURE SURVEY

A. Jigar Chouhan and Sachin Bojewar talks about E-Health, Telemedicine and DBMS is the Methodology which is used for health monitoring system. This application uses telemedicine to provide healthcare in remote areas so that the gaps between patient and doctor is reduced and the major thigs is that the sensors provide different format of data so we need to use DBMS to process it.

B. Fortino and Guerrieri proposed a \ methodology of Arduino and LCD Display has been used in order to track user information. This system would make the life easier for all patients as they were able to measure different parameters themselves were inputs are processed by the Arduino and outputs can be seen in LCD display and on Mobile Phone app

C. Lohr and Sadeghi talks about the methodology of Biosensor, Body Temperature sensor and Humidity Sensor and Arduino and the main advantage of this This model can track the patients remotely and we can collect and three major data in human body.

D. Vikas Vikalapalli helps us to find the different mechanisms which has been enabled using them they are Manual mechanism and automated mechanism, Alert mechanism. Here the System will provide more security in order to prevent at the time of hazard and helps to give alert message quickly to the concerned person is the most highly concentrated factor of this paper.

E. Shahid Raja mainly focuses on the Wearable sensors, authentication, security and thing speak Methodologies such that through this ideology they can provide security to the data while uploading to cloud and also the cloud and IOT can be included to work on a single operation. This proposed system t uses ROR Model to provide authentication and it is used to collect heart rate and temperature and uploads it into Cloud

IV. PROBLEM STATEMENT

The problem statement revolves around the need for an efficient and reliable wearable device that can monitor the health of patients. The current solution involves the integration of an Arduino microcontroller, temperature sensor, pulse detector, and oximeter sensors into a wearable device. The primary challenge addressed by this project is the need for continuous health monitoring. Traditional methods often involve manual measurements, which can be inconvenient and may not provide a comprehensive understanding of the patient's health status. Therefore, a wearable device that can continuously collect data in real-time is essential for accurate and timely health monitoring., Another problem tackled by this project is the effective transmission and storage of the collected health data. By utilizing Wi-Fi connectivity, the wearable device securely sends the data to the cloud for storage and analysis. This ensures that the data is easily accessible to healthcare professionals, allowing them to monitor the patient's health remotely and make informed decisions based on the collected data.

Additionally, the project addresses the challenge of data visualization. The utilization of ThingSpeak software enables the data to be visualized in a user-friendly manner.

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A. To design and establish IoT based monitoring system

B. To design and develop an IoT based wearable that monitors temperature, blood oxygen levels and pulse

V.REQUIREMENTS

A. Arduino UNO:

TABLE I : TECHNICAL SPECIFICATIONS

Microcontroller	Arduino UNO
NodeMCU Model	Amica
NodeMCU Size	49mm x 26mm
Carrier Board Size	n/a
Pin Spacing	0.9" (22.86mm)
Clock Speed	80 MHz
USB to Serial	CP2102
USB Connector	Micro USB
Operating Voltage	3.3V
Input Voltage	4.5V-10V
Flash Memory/SRAM	4MB/64KB
Digital I/O Pins	11
Analog In Pins	1
ADC Range	0-3.3V
UART/SPI/I2C	1/1/1
Wi-Fi Built-In	802.11 b/g/n
Temperature Range	-40C - 125C

B. Sensors:

TABLE II : SENSOR REQUIREMENTS

S No	Name	Description
1	DHT11	To sense the temperature and humidity
2	Pulse Rate Sensor	To detect pulse rate
3	Pulse Oximeter R sensor	To detect blood oxygen levels
4	Pulse Oximeter IR Sensor	To detect blood oxygen levels

C. Arduino IDE:

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The Arduino Integrated Development Environment (IDE) is a software tool for writing, compiling and sending code to the Arduino development board. It provides a user-friendly interface that simplifies the process of creating and running Arduino projects. The IDE supports the Arduino programming language, which is a simplified version of C/C++. It provides various functions and libraries for easy communication with Arduino hardware such as sensors, actuators, and instructions. The IDE also includes scripts with features such as keywords and initialization to make coding more efficient. It provides a compiler that translates the code into machine language and a boot loader that allows the code to be uploaded to the Arduino board via a USB connection. In addition, the IDE provides an interface for debugging and monitoring the data exchange between the Arduino board and the computer. Overall, the Arduino IDE is a powerful tool that allows both beginners and experienced users to create and distribute projects on Arduino boards.

D. ThingSpeak:

ThingSpeak is a versatile IoT platform that enables users to collect, store, analyze, and visualize data from connected devices. It provides a user-friendly interface for creating channels to securely store data in the cloud. ThingSpeak offers powerful data visualization tools, allowing users to create customized graphs and charts to represent their data. It also supports data analysis through built-in MATLAB integration, enabling advanced processing and algorithms. Additionally, ThingSpeak features alerting capabilities, notifying users when specific conditions or thresholds are met. With its interoperability and open API, ThingSpeak facilitates seamless integration with other IoT platforms and services, making it a popular choice for IoT developers seeking to manage and leverage their data effectively.

VI. METHODOLOGY

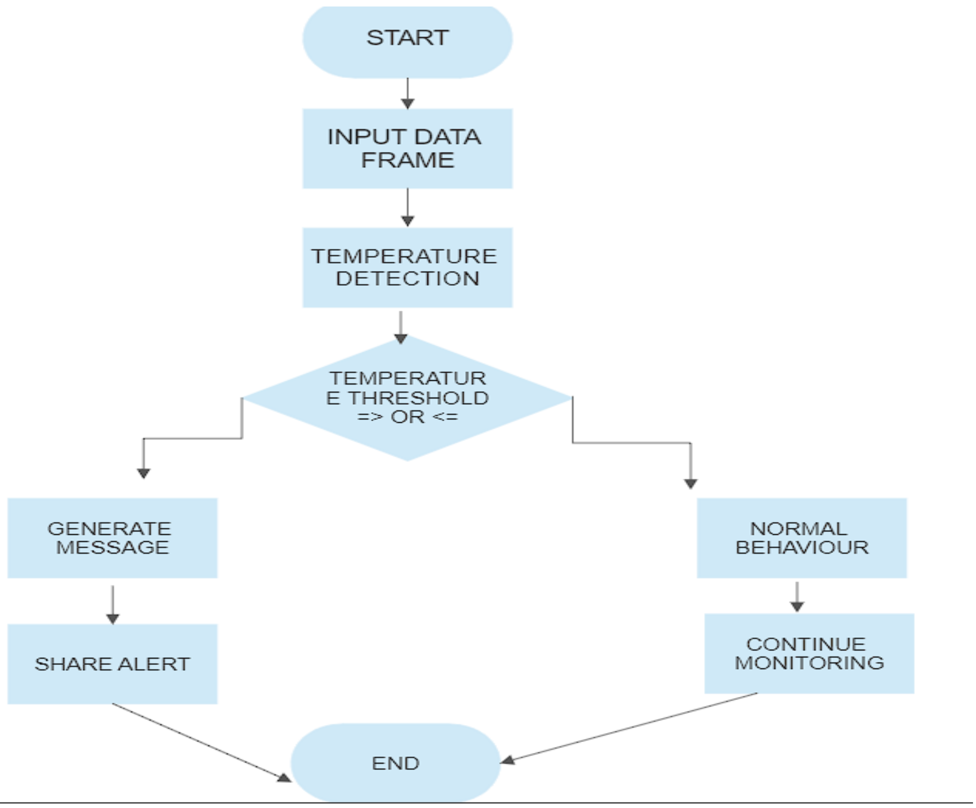

Fig 1.Block Diagram of Proposed System for IoT enabled Smart Wearable

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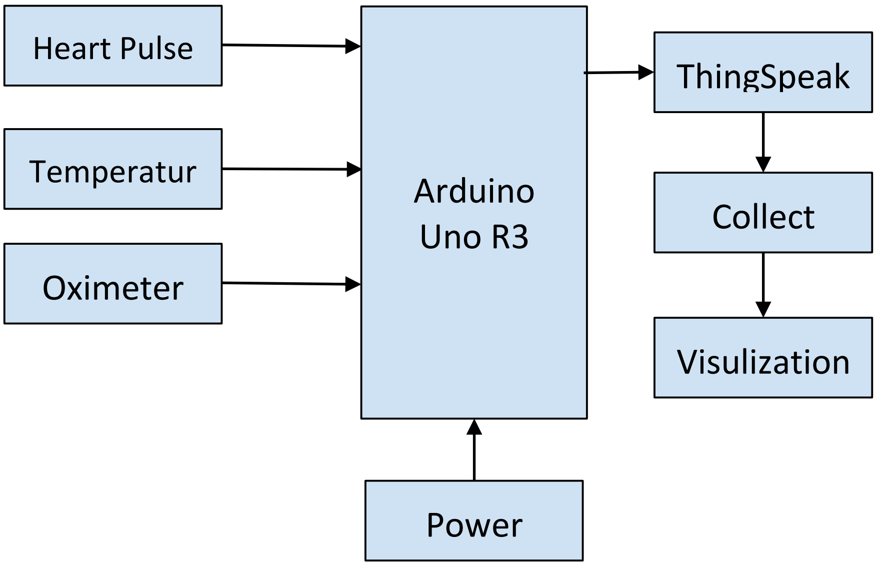

Fig 2.Block Diagram for Smart Apparel 2.0

Working Principle:

The wearable health monitoring device developed in this study utilizes an Arduino microcontroller along with a temperature sensor, pulse detector, and oximeter sensors to continuously monitor the health parameters of a patient. The device is designed to be worn on the patient's body, enabling non-intrusive and continuous data collection for effective health monitoring. The working principle of the wearable device starts with the Arduino microcontroller, which serves as the central processing unit. It is responsible for controlling and coordinating the various components of the device. The temperature sensor measures the patient's body temperature, providing valuable information about their health status. The pulse detector captures the pulse rate, while the oximeter sensors measure the blood oxygen saturation levels.

The temperature sensor incorporates a thermistor, which detects changes in temperature and converts them into electrical signals. These signals are then processed by the Arduino microcontroller, which converts the analog signals into digital temperature readings. The obtained temperature data offers insights into the patient's health condition, such as the presence of fever or hypothermia. The pulse detector utilizes optical sensors to measure the blood flow and determine the pulse rate. It emits infrared light onto the patient's skin and measures the intensity of the reflected light. The variations in the intensity are caused by changes in blood volume with each heartbeat. By analyzing these variations, the Arduino calculates the pulse rate, providing information about the patient's cardiovascular health.

The oximeter sensors employed in the wearable device utilize light-emitting diodes (LEDs) and photodiodes to measure the blood oxygen saturation levels. The LEDs emit both red and infrared light, which passes through the patient's skin and is received by the photodiodes. The absorption of these lights by oxygenated and deoxygenated blood allows the Arduino microcontroller to calculate the blood oxygen saturation levels, indicating the patient's respiratory health and oxygenation status. Once the temperature, pulse rate, and blood oxygen saturation data are collected by the sensors, the Arduino microcontroller processes and stores the information. The wearable device is equipped with Wi-Fi connectivity, enabling it to transmit the collected data to the cloud for further analysis and storage. The data transmission is facilitated using a software platform called ThingSpeak.

ThingSpeak provides a user-friendly interface and secure cloud storage for IoT data. It allows users to create channels to store and retrieve the collected health data. The collected data can be visualized using the built-in data visualization tools offered by ThingSpeak, which include customizable graphs, charts, and gauges. This visualization helps healthcare professionals to monitor the patient's health parameters in real-time and identify any anomalies or trends. In addition, the wearable device incorporates a threshold-based alert system. If the collected data exceeds predetermined threshold values, such as a high temperature or irregular pulse rate, alerts are triggered. These alerts can be sent to the patient through various communication channels, such as email or SMS, informing them about the abnormal readings and prompting them to take appropriate actions or seek medical attention.

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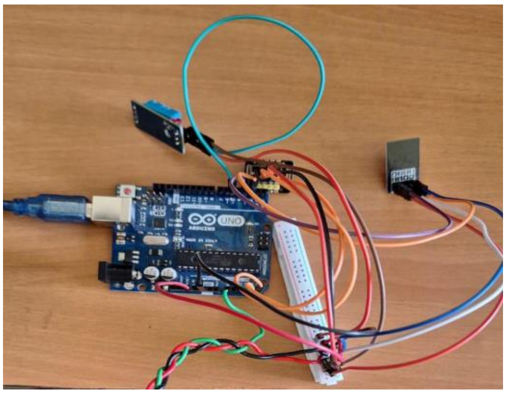
Overall, the working principle of the wearable health monitoring device involves the integration of Arduino, temperature sensor, pulse detector, and oximeter sensors. The device collects the vital health data from the patient's body, transmits it to the cloud via Wi-Fi and ThingSpeak, visualizes the data for real-time monitoring, and triggers alerts if the data reaches threshold values. This comprehensive approach enables continuous and remote monitoring of the patient's health, facilitating effective healthcare management and improved patient outcomes.

VII. RESULTS



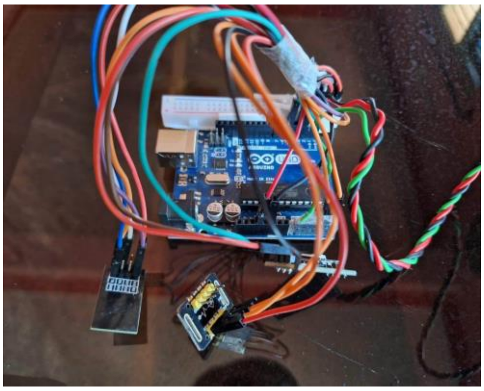


Fig 3a: Components before joining Fig 3b: Components after joining

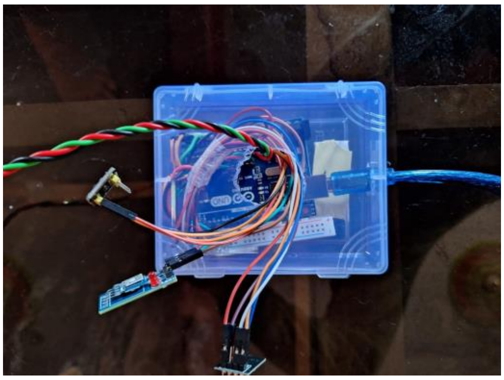


Fig 4: Components after embedding to Apparel

VIII. CONCLUSION

In conclusion, the developed wearable health monitoring device utilizing Arduino, temperature sensor, pulse detector, and oximeter sensors offers a comprehensive and efficient solution for continuous patient health monitoring. The integration of these sensors, along with the use of ThingSpeak software for data visualization and cloud connectivity, enables real-time monitoring, analysis, and alerting based on threshold values. This device has the potential to enhance healthcare management, provide early detection of health abnormalities, and improve patient outcomes through timely interventions and personalized care.

IX. FUTURE ENHANCEMENT

Future enhancements for the wearable health monitoring device include incorporating additional sensors to capture more comprehensive health data, such as respiration rate and ECG measurements. Integration with machine learning algorithms can enable the device to provide more intelligent and personalized health insights. Enhancements in data security and privacy measures should also be considered to ensure the protection of sensitive patient information. Furthermore, exploring options for wireless charging and improving battery life can enhance the device's usability and convenience. These enhancements will contribute to the development of a more advanced and effective wearable health monitoring system with improved functionality and user experience.

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