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IOT-ENABLED HEALTH MONITORING SYSTEM: DESIGN AND IMPLEMENTATION FOR ENHANCED PATIENT CARE

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ABSTRACT

Every year, many people lose their lives due to a delay in the timely identification of medical conditions and the assessment of their health status during emergency transfers to hospitals. This is especially true for elderly and infirm individuals who require continuous monitoring of their physiological parameters and surrounding environmental conditions. Unfortunately, such patients are often unable to visit the hospital frequently. To address these challenges, a web-centric patient health surveillance system has been developed. This system uses an Arduino Uno microcontroller board to create a patient health monitoring system. The system is connected to the Thing-speak web server and designed to monitor various physiological parameters such as patient temperature and pulse. It also keeps track of the temperature, humidity, air quality, and the patient's movements to detect any incidents of falls. The health remarks of the individual, derived from various sensors, is regularly uploaded to the Thing-speak server. Physicians or caregivers can access this information to remotely monitor the patient. This system provides an efficient method for healthcare professionals to monitor the health status of patients in real-time while saving them the trouble of visiting the hospital frequently.

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INTRODUCTION

Every year, numerous individuals face fatal consequences due to delays in identifying and diagnosing illnesses during emergency transfers to hospitals. This is particularly challenging for elderly and ailing patients who require continuous monitoring of vital signs but may be unable to visit the hospital regularly.To address this issue, a patient health surveillance system has been developed using an Arduino Uno microcontroller board and a Thing-Speak web server. This system monitors various physiological parameters such as patient temperature and pulse, along with environmental factors like room temperature, humidity, air quality, andmovement pattern to detect instances of falls.The continuous monitoring of the patient's well-being is facilitated through an array of sensors, and the data collected is regularly uploaded to the Thing-Speak server. This innovative approach enables doctors or caretakers to remotely assess the patient's condition by accessing the web server, thus bridging the gap in timely healthcare interventions for those unable to visit the hospital frequently.

LITERATURE SURVEY

One significant application of IoT technology is the implementation of healthcare monitoring systems. This article focuses on the deployment and development of an efficient healthcare monitoring system based on IoT principles. The anticipated system monitors crucial health measurements and transmits the data wirelessly using a Wi-Fi module. The collected information is accessible at any time through the IoT platform, specifically Thing-Speak. In cases of abnormal behavior, immediate notifications are sent to both caregivers and physicians through a messaging service. Establishing a secure remote monitoring system is vital for its effectiveness. This is achieved through the utilization of cloud computing and a password-protected Wi-Fi module, ensuring verification, confidentiality, and security of individual information by permitting restricted access to the database.

Existing System: This sophisticated healthcare system operates within an Internet of Things (IoT) environment, focusing on real-time monitoring of a patient's vital health indicators and environmental conditions. The system is equipped with five detectors designed to collect data from the hospital surroundings, including a heartbeat detector, body temperature sensor, room temperature sensor, carbon monoxide detector, and carbon dioxide detector. Each data collection instance is subject to a specific threshold of 5% as the system's margin of error. Patient data is transmitted to medical professionals through a gateway, allowing them to analyze and assess the patient's current state.

Proposed Method: In this proposed arrangement, the Arduino microcontroller with ESP8266 is utilized to transmit data to the cloud. The microcontroller is beneficial for retrieving sensor details and

relaying them. Six detectors are utilized in this structure to gather data from the hospital surroundingsthe heartbeat sensor, the room temperature sensor, the carbon monoxide 4detector, the carbon dioxide detector, and the accelerometer sensor.The recommended health surveillance system is comprised of numerous sensors that are categorized into two sets. The initial is utilized to supervise the unconscious's vitals, while the latter is employed to recognize any physical variations that arise in the unconscious. Patient temperature and pulse, along with air quality, are documented and observed to evaluate the health condition of an unconscious individual. One sensor is a MEMS accelerometer sensor, which detects any physical adjustments that happen during paralysis. These information-providing signals are consistently seized and observed to comprehend how the body operates.

Hardware Description

Arduino Uno: The Arduino Uno stands as an open-source microcontroller board crafted for the simplicity of prototyping and educational endeavors. Originating from the collaborative efforts of the Arduino community, it relies on the ATmega328P microcontroller and boasts a straightforward yet potent architecture. Equipped with both digital and analog input/output pins, the board empowers users to connect with an array of sensors, actuators, and diverse electronic components. The programming language integral to Arduino, along with the Arduino Software (IDE), serves as the means to achieve these functionalities. For a visual depiction of the Arduino Software (IDE), please consult Figure 1.

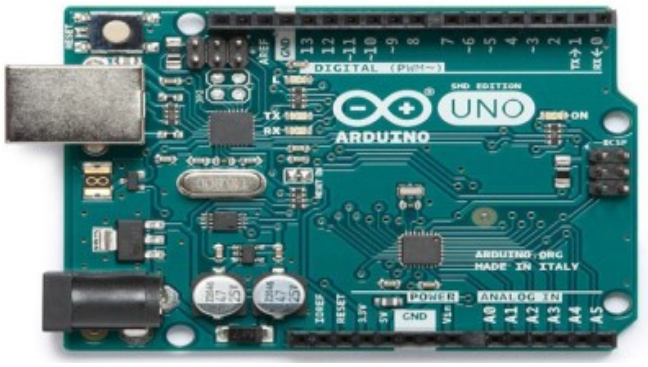

Fig. 1. Characterizes the Arduino UNO which is the main component for both input and output

Power Supply: This is a simple technique for acquiring a 12V and 5V DC power origin from a singular circuit. To generate the necessary voltages, the circuit utilizes two integrated circuits 7812 and 7805. The transformer will decrease the AC mains voltage, rectify it exploiting a bridge, and strain it with a capacitor to provide a uniform DC level. The 7812 adjusts this voltage to accomplish a unwavering 12V DC. The 7805 will manage the IC1's output to sustain a consistent 5V DC at its output. By implementing this, both 12V and 5V DC are attained.

Dht11 Sensor: The DHT11 stands out as an economical digital sensor widely employed in electronics projects and various applications. Developed by Aosong, this sensor adeptly gauges ambient temperature within the 0 to 50 degrees Celsius range. Its straightforward single-wire digital protocol simplifies interfacing with microcontrollers. The sensor features a calibrated digital signal output, encoding temperature and humidity values in 8-bit and 16-bit formats, respectively.

Mq135 Sensor: It is a Gas Detector which are deployed in air quality regulation systems and have the capability to sense or gauge NH3, CO, Alcohol, Benzene, Smoke, and CO2. The detector module contains a Digital Pin, enabling it to function without a microcontroller, which is beneficial when merely endeavoring to detect a single gas. If you wish to measure the gases in PPM, you must deploy the analog pin. The analog pin is TTL powered and operates on a 5V power, rendering it congruent with most prevalent microcontrollers. If you necessitate a detector to perceive or measure prevailing air quality substances such as CO2, smoke, NH3, CO, alcohol, or benzene, this is the detector to acquire.

Pulse Sensor: It generates a digital output of the pulse of the heart when any finger of the both hands are placed on it. This output is used to measure the rate of Beats Per Minute (BPM) by connecting it directly to a microcontroller. When the heartbeat detector is triggered, the pulse LED blinks with every heartbeat. This detector works by modulating light through blood circulation in the finger at each pulse.

Accelerometer Sensor: An accelerometer is a sensor that measures the acceleration of an object, typically in three-dimensional space. It is commonly used in various electronic devices to detect changes in velocity or movement. They operate on the principle of inertia, where the sensor detects changes in the force applied to it and translates them into electrical signals. They play aimportant role in allowing features such as screen orientation changes, gesture recognition, step countingin electronic devices.

Lcd Display: Enthusiasts utilize an assortment of exhibit devices. LCD screens are amid the most cutting-edge display devices that they employ. Once you comprehend how to link it, it will be the most straightforward and most reliable output device you will ever deploy. Moreover, not every debugger can be applied for microcontroller-based projects. Consequently, LCD screens can be used to assess the outputs.

GSM Module: It is essentially a GSM modem that is connected to a PCB (printed circuit board) and produces different types of outputs from this board, including TTL output for microcontrollers such as Arduino and 8051, and RS232 output for direct communication with a personal computer. The board will also feature pins and connectors for connecting a speaker, extracting power, and ground connections. The specific provisions may vary between different modules.

Wifi Module: A pivotal element in contemporary communication systems is the Wireless Fidelity (Wi-Fi) module, which enables wireless connectivity among devices within a local area network (LAN). Adhering to the IEEE 802.11 standards, this module facilitates the seamless exchange of data across diverse devices such as computers, smartphones, and IoT devices. Comprising a transceiver, the Wi-Fi module facilitates the bidirectional transmission and reception of data through radio frequency signals. To ensure the efficiency and reliability of data transfer, it employs protocols such as TCP/IP. The IEEE 802.11 standard plays a crucial role in delineating various aspects of Wi-Fi communication, encompassing considerations like frequency bands, modulation techniques, and security protocols.

DC Motor: A simple current motor is any motor in a category of electrical machinery that transforms normal current electrical power into mechanical power. This variety of motor regularly depends on the forces generated by magnetic fields. DC motors, irrespective of kind, encompass some variety of internal mechanism, which can be electrical or electromechanical. In both instances, the orientation of current flow in a fragment of the motor is modified periodically.

Motor Driver: A motor driver is an electronic device or circuit that controls the movement and speed of an electric motor. They are designed to handle the high current and voltage requirements of motors, ensuring efficient and precise motor control, it works based on the H-bridge principle. Motor drivers typically include features such as current sensing, overcurrent protection, thermal protection, and speed control options. They play a critical role in optimizing motor performance, enhancing energy efficiency, and protecting the motor from potential damage due to various factors like overloading or overheating.

Buzzer: A buzzer or beeper, is a device that produces sound to signal something. It can be mechanical, electromechanical, or piezoelectric.

Buzzers are commonly used as warning devices, timers, and to confirm user input like mouse clicks or keystrokes. They are made up of electronic transducers and a DC power supply and are found in many electronic devices. The Active Buzzer of a 5V can be directly connected to produce a continuous sound which makes it ideal for sensor expansion modules and simple circuit designs. It can be used for "plug and play" purposes when combined with a board.

Block Diagram

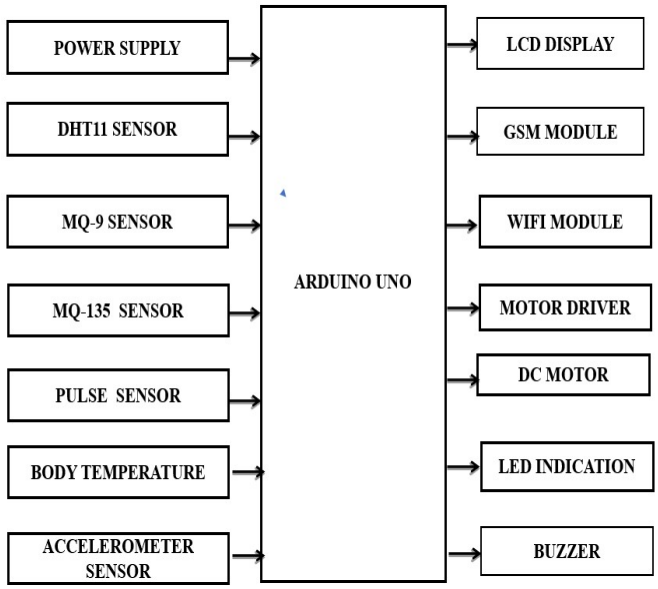

Fig. 2. Represents the main Block Diagram for the arduino uno

Circuit Diagram

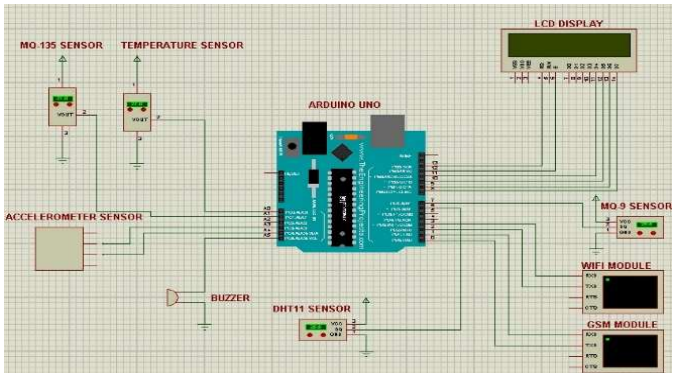

Fig. 3. Represents the circuit diagram of the Arduino uno and the components used in the system

Conclusion: We can save health metrics in a database in a patient monitoring system based on the Internet of Things. This allows clinicians to quickly identify changes in a patient's health indicators or history when prescribing therapies or medications. Remote patient monitoring reduces hospital stays and routine check-up hospitalizations. Patient health conditionsdetails are stored in the cloud, which is more easy than maintaining records on paper or in digital devices where there's a risk of data loss. In the case ofIoT, the data is stored in the cloud, where there's minimal risk of data loss. Treatment can be administered in the early stages, and even if the patient cannot provide any details, the doctor is notified in the event of a critical situation.

RESULTS

Real-time data is collected and transmitted to a central platform, enabling the generation of a graph that provides insights into the fluctuating levels of parameters.

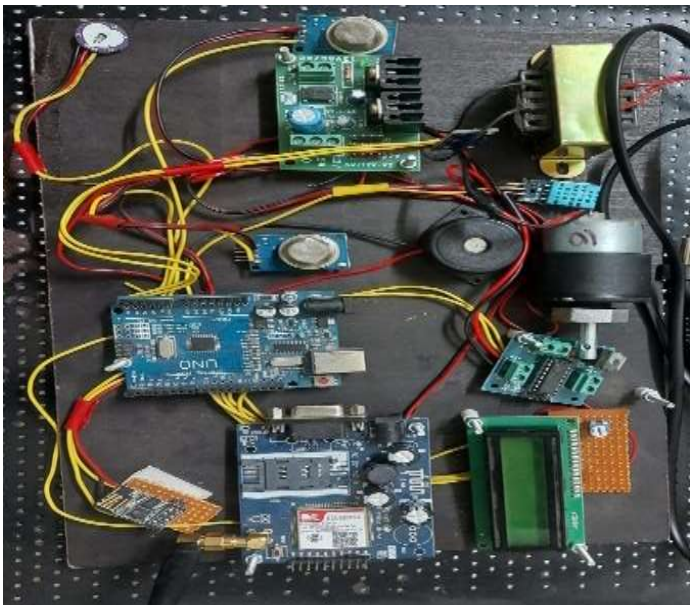

Figure 4. Connection Setup of Proposed System

Figure 4 explains the proposed method connection set up. The Arudino uno, Wi-Fi module, GSM module, buzzer, and various sensors are being connected.

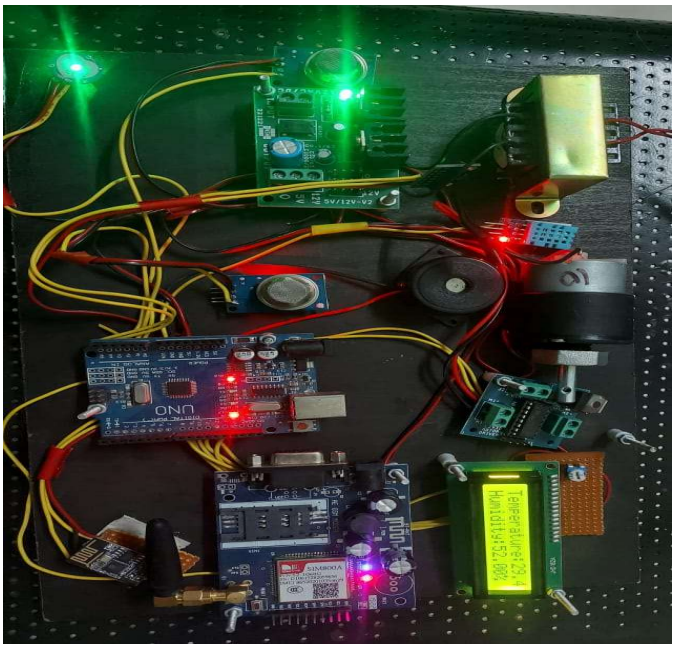

Figure 5. Displays the final setup of the proposed system

Figure 5 explains the details of the Temperature and the Humidity on the LED display and sends alert notification to the mobile.

Fig. 6. Temperature Analysis using proposed system

Fig. 7. Humidity Analysis using proposed system

Fig. 8. Pollution Analysis using proposed system

Fig. 9. Pulse Analysis using proposed system

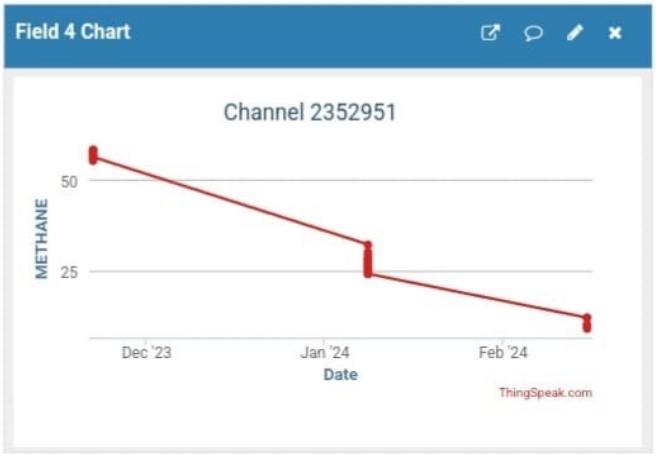

Fig.10. Methane Analysis using proposed system

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