IOT BASED HEALTH MONITORING SYSTEM

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***Abstract*- The Internet of Things (IOT) has enabled the development of health monitoring systems that can remotely monitor patients and provide real-time information to healthcare professionals. In this paper, we explore the use of ESP32-based devices for the development of IOT-based health monitoring systems. We discuss the advantages of using ESP32-based devices, such as low power consumption and high processing power, and provide an overview of the architecture of IOT-based health monitoring systems. We also discuss the various sensors and data collection techniques used in these systems, including heart rate sensors, blood pressure monitors, and temperature sensors. Finally, we present a case study of an IOT-based health monitoring system using ESP32-based devices, which demonstrates the feasibility and effectiveness of these systems in real-world applications. Overall, our paper highlights the potential of ESP32-based devices for the development of IOT-based health monitoring systems, which can improve the quality of healthcare and reduce costs.**

Keywords: **IOT, ESP 32, Heart beat sensor, Ds18b20, Voltage regulator 5v.**

INTRODUCTION

Many patient's loss their lives due to unawareness and negligence of the doctor about the critical condition of the patients. This is because doctor cannot keep on monitoring the patient continuously. Even if they are monitored with utmost care particularly for those patients that need continuous monitoring, situations arise when doctor needs to be away even for a second and at that moment the patient's condition shows variation that lead to an emergency situation and the time the doctor come back to treat his patients, the patients already losses their life due to delay in his treatment. So there is an immediate need of an system that keeps on checking the status of the patients continuously and the doctor is updated and if there is any variation in his condition i.e. if the condition becomes critical, the doctor is alerted so that he can treat his/her patient immediately. This will avoid loss of many lives and will save doctor's time.

This paper presents a proposed project which uses temperature sensor and pulse rate sensor to measure temperature and pulse rate, which is an important parameter for a patient so that the doctor will monitor and can take immediate actions without delay if he finds any abnormality in the patient's heart beat and temperature. In the proposed system, the node from the temperature sensors and heart beat sensors are attached to the patient's body that finds the temperature and heartbeat of the patient and is fed to the microcontroller. The microcontroller used is ESP 32.

RELATED WORK

Vivek Pardheshi, Saurabh Sagar, Swapnil Murmurwar, Pankaj Hage, Health monitoring system using Raspberry Pi.
Now-a-days health problems like cardiac failure, lung failures & heart related diseases are arising day by day at a very high rate. Due to these problems time to time health monitoring is very essential. A modern concept is health monitoring of a patient wirelessly. It is a major development in medical arena. Thus paper based on the monitoring of the patient that is done by the doctor continuously without actually visiting the patient. Health professionals have developed a brilliant and inexpensive health monitoring system for providing more comfortable living to the people suffering from various diseases using leading technologies like wireless communications, wearable and portable remote health monitoring device. As a result, visits of doctors to the patients constantly are decreased as the information regarding patient's health directly reaches to doctor's monitor screen from anywhere the patient resides. Also, based on this doctors can save many lives by imparting them a quick & valuable service. In this, IoT is becoming a major platform for many services & applications, also using Raspberry Pi not just as a sensor node but also a controller here. Paper propose a generic health monitoring system as a step forward to the progress made in this department till now.

DESCRIPTION:

In present days, with the expansion of innovations, specialists are always looking for innovative electronic devices for easier identification of irregularities within the body. IoT-enabled technologies enable the possibility of developing novel and noninvasive clinical support systems. This paper presents a health care monitoring system. In particular, COVID-19 patients, high blood pressure patients, diabetic patients, etc., in a rural area in a developing country, such as Bangladesh, do not have instant access to health or emergency clinics for testing. Buying individual instruments or continuous visitation to hospitals is also expensive for the regular population. The system we developed will measure a patient's body temperature, heartbeat, and oxygen saturation (SpO2) levels in the blood and send the data to a mobile application using Bluetooth. The mobile application was created via the Massachusetts Institute of Technology (MIT) inventor app and will receive the data from the device over Bluetooth. The physical, logical, and application layers are the three layers that make up the system. The logical layer processes the data collected by the sensors in the physical layer. Media access management and inter sensor communications are handled by the logical layer. Depending on the logical layer's processed data, the application layer makes decisions. The main objective is to increase affordability for regular people. Besides sustainability in the context of finance, patients will have easy access to personal healthcare. This paper presents

an IOT-based system that will simplify the utilization of an otherwise complicated medical device at a minimum cost while sitting at home. A 95 percent confidence interval with a 5 percent maximum relative error is applied to all measurements related to determining the patient's health parameters. The use of these devices as support tools by the general public in a certain situation could have a big impact on their own lives.

Description:

With the commencement of the COVID-19 pandemic, social distancing and quarantine are becoming essential practices in the world. IOT health monitoring systems prevent frequent visits to doctors and meetings between patients and medical professionals. However, many individuals require regular health monitoring and observation through medical staff. In this proposed work, we have taken advantage of the technology to make patients life easier for earlier diagnosis and treatment. A smart health monitoring system is being developed using Internet of Things (I0T) technology which is capable of monitoring blood pressure, heart rate, oxygen level, and temperature of a person. This system is helpful for rural areas or villages where nearby clinics can be in touch with city hospitals about their patient health conditions. However, if any changes occur in a patient's health based on standard values, then the IOT system will alert the physician or doctor accordingly. The maximum relative error ($\%\epsilon_r$) in the measurement of heart rate, patient body temperature and SPO_2 was found to be 2.89%, 3.03%, 1.05%, respectively, which was comparable to the commercials health monitoring system. This health monitoring system based on IoT helps out doctors to collect real-time data effortlessly. The availability of high-speed internet allows the system to monitor the parameters at regular intervals. Furthermore, the cloud platform allows data storage so that previous measurements could be retrieved in the near future. This system would help in identifying and early treatment of COVID-19 individual patients.

Description:

Monitoring your beloved ones becomes a difficult task in the modern day life. Keeping track of the health status of the patient at home is a difficult task. Especially old aged patients should be periodically monitored and their loved ones need to be informed about their health status from time to time while at work. So we propose an innovative system that automated this task with ease. Our system puts forward a smart patient health tracking system that uses Sensors to track patient health and uses internet to inform their loved ones in case of any issues. Our system uses temperature as well as heartbeat sensing to keep track of patient health. The sensors are connected to a microcontroller to track the status which is in turn interfaced to an LCD display as well as Wi-Fi connection in order to transmit alerts. If system detects any abrupt changes in patient heartbeat or body temperature, the system automatically alerts the user about the patient's status over IOT and also shows details of heartbeat and temperature of patient live over the internet. Thus IOT based patient health tracking system effectively uses internet to monitor patient health stats and save lives on time.

EXISTING SYSTEM

In existing system, Pulse oximetry is a commonly used technique used to determine arterial oxygen saturation (SpO2) and heart rate. This method uses photoplethysmography (PPG) signals to estimate SpO2. The effects of temperature on PPG signal quality was investigated for a group of 20 adult volunteers. Raw PPG data was obtained using a custom pulse oximeter (PO) system. Three tests were performed with the subject's hand maintained at baseline, cold, and warm temperatures. The results is show in the GSM and Display unit present the processor board .

DRAWBACKS

- Too expensive.
- Limiting processing power.
- Limited memory.
- Limited connectivity options.
- Limited sensor compatibility.
- Limited user interface.

PROPOSED SYSTEM

- ESP32-based IoT device: The ESP32-based IoT device serves as the primary interface between the patient and the healthcare professional. The device consists of various sensors for measuring vital signs such as heart rate, blood pressure, temperature, and oxygen saturation. It also has Wi-Fi or Bluetooth connectivity to transmit the data to a cloud-based platform.
- Cloud-based platform: The cloud-based platform receives the data transmitted by the IOT device and stores it in a secure database. The platform can also process the data using machine learning algorithms to detect abnormalities in the vital signs and generate alerts if necessary.
- Healthcare provider interface: The healthcare provider interface is a web or mobile application that allows healthcare professionals to access patient data, view trends in vital signs, and receive alerts if abnormalities are detected. The interface also allows for remote patient monitoring and communication between patients and healthcare providers.
- Patient interface: The patient interface is a web or mobile application that allows patients to view their vital signs, track their health progress, and communicate with their healthcare provider. Patients can also receive reminders for medication, appointments, and other health-related activities.
- Overall, the proposed system enables continuous and remote monitoring of patients' vital signs, allowing healthcare providers to detect and address health issues in a timely manner. It also provides patients with a convenient way to monitor their health

and communicate with their healthcare provider. The use of ESP32-based IoT devices makes the system cost-effective, scalable, and easily deployable in various healthcare settings.

MERITS

- Real time monitoring.
- Cost effective.
- Improved patient outcomes.
- Remote monitoring.
- Data Analysis.

MODULE DESCRIPTION

A module is a Hardware and software component or part of a program that contain one or more routines.

ESP32 PROCESSOR

ESP32 is one of the main IOT learning tools. This offers a full Linux system on a small platform at a very low price. ESP32 connects device sensors and actuators through GPIO pins. ESP32 and IOT merge to be a new technology for creativity in the healthcare system. ESP32 is designed extremely with integrated antenna switches, control amplification, low-noise amplifier, and filters as well as power management modules. It can function as a complete stand-alone scheme or as a slave to a host MCU, decreasing overhead interaction within the main application processor. EPS32 can communicate with other Wi-Fi and Bluetooth devices via its SPI/SDIO, or I2C/UART interfaces.

SENSORS

A sensor is a device, module, machine, or subsystem whose purpose is to detect events or changes depends upon transducer in its environment and send the information to other electronics, frequently a microcontroller. A sensor is always used with other electronics.

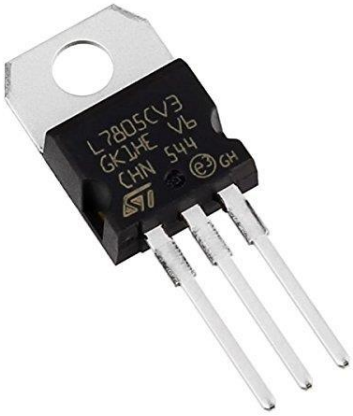
HEART BEAT SENSOR(MAX30100)

The MAX30100 is a complete pulse oximetry and heart rate sensor system solution designed for the demanding requirements of wearable devices. The MAX30100 provides very small total solution size without sacrificing optical or electrical performance. Minimal external hardware components are needed for integration into a wearable device. The MAX30100 is fully configurable through software registers, and the digital output data is stored in a 16-deep FIFO within the device. The FIFO allows the MAX30100 to be connected to a microcontroller or microprocessor on a shared bus, where the data is not being read continuously from the device's registers.

TEMPERATURE SENSOR (ds18b20)

The DS18B20 digital thermometer provides 9-bit to 12-bit Celsius temperature measurements and has an alarm function with non volatile user-programmable upper and lower trigger points. The DS18B20 communicates over a 1-Wire bus that by definition requires only one data line (and ground) for communication with a central microprocessor. In addition, the DS18B20 can derive power directly from the data line ("parasite power"), eliminating the need for an external power supply. Each DS18B20 has a unique 64-bit serial code, which allows multiple DS18B20s to function on the same 1-Wire bus. Thus, it is simple to use one microprocessor to control many DS18B20s distributed over a large area. Applications that can benefit from this feature include HVAC environmental controls, temperature monitoring systems inside buildings, equipment, or machinery, and process monitoring and control systems.

VOLTAGE REGULATOR(5V)



A voltage regulator 5V is an electronic device that is designed to maintain a constant output voltage of 5 volts DC (direct current) from a varying input voltage source, such as a battery or a power supply. The voltage regulator ensures that the output voltage remains at a stable 5V, regardless of fluctuations or changes in the input voltage There are different types of voltage regulators, but the most common ones used to regulate 5V are linear regulators and switching regulators. Linear regulators use a voltage reference and a series pass element (typically a transistor) to maintain a constant output voltage. Switching regulators use a switch (typically a transistor) that rapidly switches the input voltage on and off to maintain a constant output voltage The 5V voltage regulator is commonly used in electronic circuits, such as microcontrollers, sensors, and other digital components that require a stable and reliable power supply. It is also used in power banks, USB chargers, and other devices that require a 5V DC power supply.

OLED display

OLED (Organic Light Emitting Diode) display is a type of display technology that is used in electronic devices such as televisions, smart phones, and smart watches. Unlike traditional LCD displays that require a backlight to function, OLED displays emit light on their own, resulting in better contrast, richer colors, and deeper blacks. OLED displays are made up of organic materials that are sandwiched between two electrodes. When an electric current is applied to the electrodes, the organic materials emit light, creating a display. OLED displays are self-illuminating, meaning each pixel emits its own light, which can be individually turned on or off, resulting in true blacks and improved contrast ratios. OLED displays have several advantages over traditional LCD displays. They are thinner and lighter, consume less power, offer wider viewing angles, and are more flexible, allowing them to be used in curved or foldable devices. OLED displays also have faster response times, resulting in smoother motion and reduced motion blur.

BUZZER

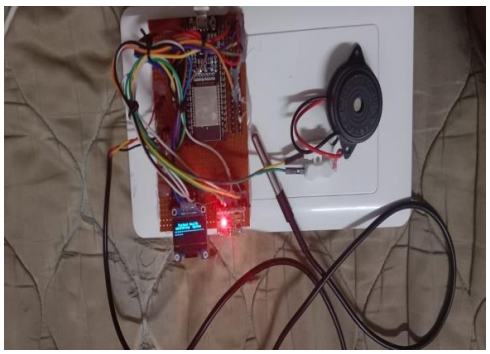
A buzzer is an electronic device that is designed to produce an audible sound when activated. The sound produced by a buzzer is usually a loud, buzzing or humming sound that is used to provide an audible warning or alert. There are several types of buzzers available, including mechanical buzzers and electronic buzzers. Mechanical buzzers typically rely on a physical mechanism to vibrate and produce sound, while electronic buzzers use a piezoelectric element or a speaker to generate sound. Electronic buzzers, on the other hand, are smaller and more compact than mechanical buzzers, making them suitable for use in a wider range of applications. They can be found in devices such as alarm clocks, timers, and electronic games. Buzzers can be activated in a variety of ways, including by an electrical signal from a switch or sensor, or by a microcontroller or other electronic circuit. The sound produced by a buzzer can also be adjusted by changing the frequency or amplitude of the electrical signal that activates it. Overall, buzzers are versatile and reliable devices that are used in a wide range of applications to provide an audible warning or alert.

CLOUD STORAGE

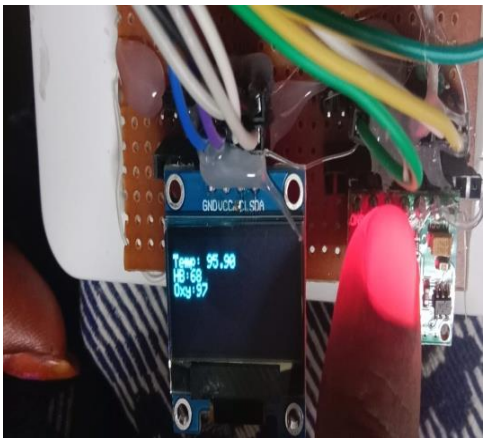
Cloud storage is a service offered by cloud computing providers that allows users to store, access and manage their data over the internet. Instead of storing data on local hard drives or servers, cloud storage enables users to store their data on remote servers hosted by third-party providers. Cloud storage provides several benefits, including accessibility, scalability, and cost-effectiveness. Users can access their data from anywhere in the world, as long as they have an internet connection. This makes it easier to collaborate on projects and share files with others. Cloud storage is also scalable, which means users can increase or decrease their storage capacity based on their needs. This makes it easier for businesses to manage their data and avoid the costs associated with maintaining their own servers. In terms of cost-effectiveness, cloud storage can be more affordable than traditional storage methods. Users typically pay for the amount of storage they need on a monthly or yearly basis, which eliminates the need for upfront costs associated with buying hardware and software. Security is also an important consideration when it comes to cloud storage. Cloud storage providers typically offer a range of security measures, including data encryption, access controls, and backup and recovery options, to ensure that user data is protected from unauthorized access or loss. Overall, cloud storage is a convenient and cost-effective way to store and manage data. It offers users greater flexibility, scalability, and security than traditional storage methods.

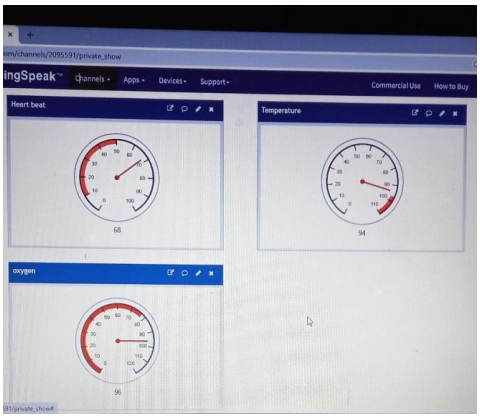
RESULTS AND CONCLUSION

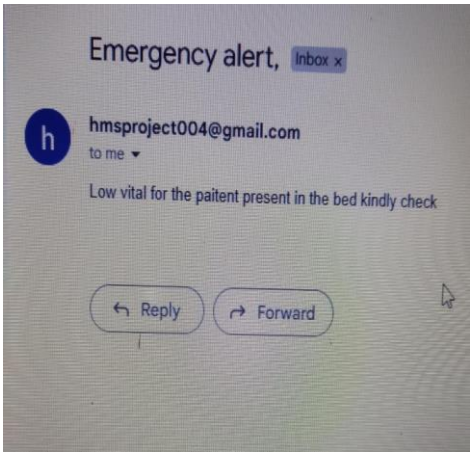
Before kit connected to Patient



The results of patients after connected







An IoT-based health monitoring system using ESP32 is a system that allows individuals to monitor and track their health parameters using an ESP32 module, which is a microcontroller that can communicate over Wi-Fi. This system uses sensors like heart rate, temperature, and oxygen level sensors to measure various health parameters and transmit the data over the internet to a cloud-based service.

CONCLUSION AND FUTURE WORK

In conclusion, IoT health monitoring using ESP32 is a promising technology that has the potential to revolutionize the healthcare industry. With its ability to collect and transmit data in real-time, it can help doctors and other healthcare professionals make more informed decisions about patient care.

The ESP32 is an excellent platform for IoT health monitoring due to its low power consumption, high processing power, and wireless connectivity capabilities. It can be used to monitor a wide range of vital signs, such as heart rate, blood pressure, and oxygen saturation, and can be easily integrated with other IOT devices and cloud services.

However, there are also some challenges associated with IOT health monitoring using ESP32, such as data security, privacy, and reliability issues. Therefore, it is essential to address these challenges and ensure that the technology is used in a safe and effective manner.

Overall, IoT health monitoring using ESP32 has the potential to improve patient outcomes, reduce healthcare costs, and enhance the quality of care provided to patients. As technology continues to evolve, we can expect to see even more innovative solutions that leverage the power of IoT for healthcare.

FUTURE WORK

Development of more advanced sensors: The accuracy and reliability of IoT health monitoring systems depend on the quality of the sensors used to collect data. Therefore, the development of more advanced sensors that can collect a wider range of health data could improve the accuracy and reliability of IoT health monitoring systems.

Machine learning algorithms: The integration of machine learning algorithms with IoT health monitoring systems could enable the detection of patterns and trends in health data that could be used to predict and prevent health problems before they occur.

Cloud integration: The integration of IoT health monitoring systems with cloud services could enable real-time monitoring and analysis of health data, allowing healthcare professionals to make more informed decisions about patient care.

Data privacy and security: As with all IoT devices, data privacy and security are critical concerns. Future work should focus on developing robust security protocols to protect health data and ensure patient privacy.

User-friendly interfaces: IoT health monitoring systems should be designed with user-friendly interfaces that are easy to use and understand, particularly for elderly or technologically challenged patients.

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