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IoT Based Surveillance and Health Monitoring System for Elderly and Physically Challenged People

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Abstract

With the increase in global life expectancy and the advance of technology, the creation of age-friendlyenvironments is a priority in the design of new products for elderly people healthcare. This paper presents a proposal for a real-time health monitoring system of older adults living in geriatric residences. This system was developed to help caregivers to have a better control in monitoring the health of their patients and have closer communication with their patients' family members. To validate the feasibility and effectiveness of thisproposal, a prototype was built, using a biometric bracelet connected to a mobile application, which allows real-time visualization of all the information generated by the sensors (heart rate, body temperature, and bloodoxygenation) in the bracelet. Using these data, caregivers can make decisions about the health status of their patients. The evaluation found that the users perceived the system to be easy to learn and use, providing initialevidence that our proposal could improve the quality of the adult's healthcare.

Introduction

The usage of mobile and smart technology devices in the area of health has caused a great impact on the world. Health experts are increasingly taking advantage of the benefits this technology brings, generating a significant improvement in healthcare in a clinic setting. Likewise, countless ordinary users are benefiting from M-Health (mobile health) applications and E-Health (healthcare supported by IoT) to improve and assist their health.

The patient's health monitoring system using IoT is a technology that enables monitoring of patients. It is possible for such patients to be followed up continuously with wearable health devices while maintaining their daily lives in the social environment. These wearable devices continuously measure the patient's heart rate. Here, we designed a patient health monitoring system using ThingSpeak, an open-source IoT application that retrieves data from things using HTTP protocol over the internet or via a Local Area Network. This design could read pulse rate and measure it continuously, monitor the pulse rate, and update it to ThingSpeak.

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Literature Review

The literature review highlights the various aspects of IoT-based Surveillance and Health Monitoring Systems for elderly and physically challenged people. The wearable devices, sensors, communication protocols, and data analysis methods used in these systems have been widely studied in recent years. Further research is needed to improve the accuracy and reliability of the system and to ensure the privacy and security of the data collected and stored by the system.

D. Shiva Raman Krishan has worked on a number of assignments and research papers on the theme of wireless sensor methods for IoT-based patient health monitoring systems. One such project report was carried out by Tanupriya Chowdhary, where they developed a patient health monitoring system using an Arduino microcontroller with a wireless body sensor network. The sensors were utilized to monitor various body parts.

Proposed System

The proposed system, an IoT-based Surveillance and Health Monitoring System forElderly and Physically Challenged People, is designed and implemented for 24x7 human health monitoring. The system utilizes an Arduino Uno board for collecting and processingall the data, along with various sensors that measure different parameters. The collected data is uploaded to ThingSpeak for remote analysis, and an ESP32 module is used to connect to the internet. Additionally, a power system is provided to power all the sensors.

This process involves collecting real-time data that can be used to monitor the patient's health status or to obtain sensitive information for subsequent medical diagnosis. The data is then sent to the cloud for permanent storage or can be visualized in real-time bydirectly sending the data to a laptop or smartphone. Applications for both Apple and Android have been designed to facilitate the easy viewing of patient information.

Block Diagram

Transmitter:

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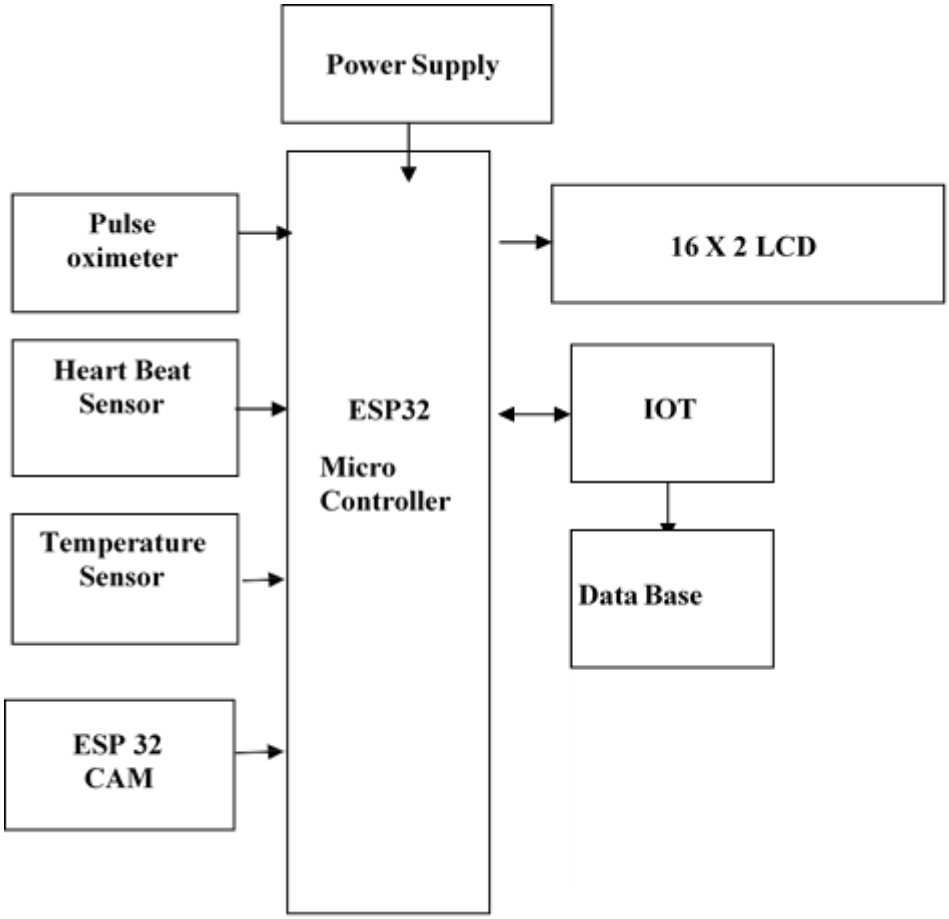

Receiver:

Figure 1. Block Diagram of IoT based smart health monitoring system for elderly and physically challenged people

Hardware Components

Power Supply

The power supply section is the section which provides +5V for the components to work. IC LM7805 is used for providing a constant power of +5V.The ac voltage, typically 220V, is connected to a transformer, which steps down the ac voltage down to the level of the desired dc output. A diode rectifier then provides a full-wave rectified voltage that is initially filtered

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by a simple capacitor filter to produce a dc voltage. This resulting dc voltage usually has some ripple or ac voltage variation.A regulator circuit removes the ripples and also retains the same dc value even if the input dc voltage varies, or the load connected to the output dc voltage changes. This voltage regulation is usually obtained using one of the popular voltage regulator IC units.

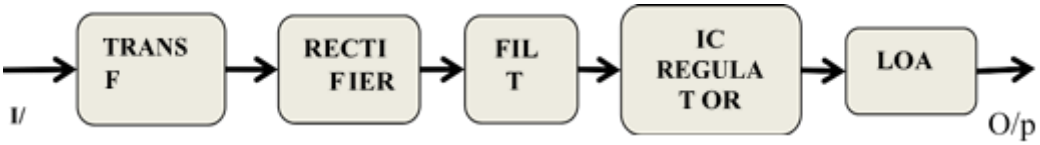

Figure 2. Block Diagram of Power Supply

Esp32 Module

The ESP32 module is a low-cost, low-power system-on-chip (SoC) microcontroller with integrated Wi-Fi and Bluetooth capabilities. It is manufactured by Espressif Systems, and is designed for use in a variety of applications, including Internet of Things (IoT) devices, wearable electronics, and other embedded systems. The ESP32 module features dual-core processors running at up to 240 MHz, as well as a variety of built-in peripherals, including touch sensors, analog-to-digital converters, and pulse width modulation (PWM) controllers. It also includes support for a wide range of communication protocols, including Wi-Fi, Bluetooth, and Ethernet.

Figure 3. Esp32 Module

LCD (liquid crystal display)

The most commonly used Character based LCDs are based on Hitachi's HD44780 controller or other which are compatible with HD44580. The most commonly used LCDs found in the market today are 1 Line, 2 Line or 4 Line LCDs which have only 1 controller and support at most of 80 characters, whereas LCDs supporting more than 80 characters make use of 2 HD44780 controllers. Most LCDs with 1 controller have 14 Pins and LCDs with 2 controllers has 16 Pins (two pins are extra in both for back-light LED connections).

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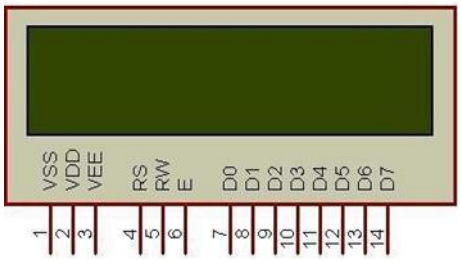

Figure 4.LCD type HD44780 pin diagram

Temperature Sensor

A temperature sensor is a device that detects and measures hotness and coolness and converts it into an electrical signal.

Figure 5. Temperature Sensor

Oximeter Sensor

An oximeter sensor is a device used to measure the oxygen saturation level in a person's blood. It is a non-invasive device that clips onto a person's fingertip, and uses lightto measure the amount of oxygen present in the blood.

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Figure 6. Oximeter Sensor

Heartbeat Sensor

Heart beat sensors are designed to give digital output heart beat when a finger is placed on it. When the heart beat detector starts working, the light emitting detector (LED) blinks simultaneously for every heartbeat. The output of this LED flash is in digital form, which can be processed by the microcontroller to measure beats per minute (BPM) rate.

Figure 7. Heartbeat Sensor

Esp-32 Cam

The ESP32-CAM is a small size, low power consumption camera module based on ESP32. It comes with an OV2640 camera and provides onboard TF card slot. The ESP32-CAM can be widely used in intelligent IoT applications such as wireless video monitoring, Wi-Fi image upload, QR identification, and so on.

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Figure 8. Esp-32 Cam

Result

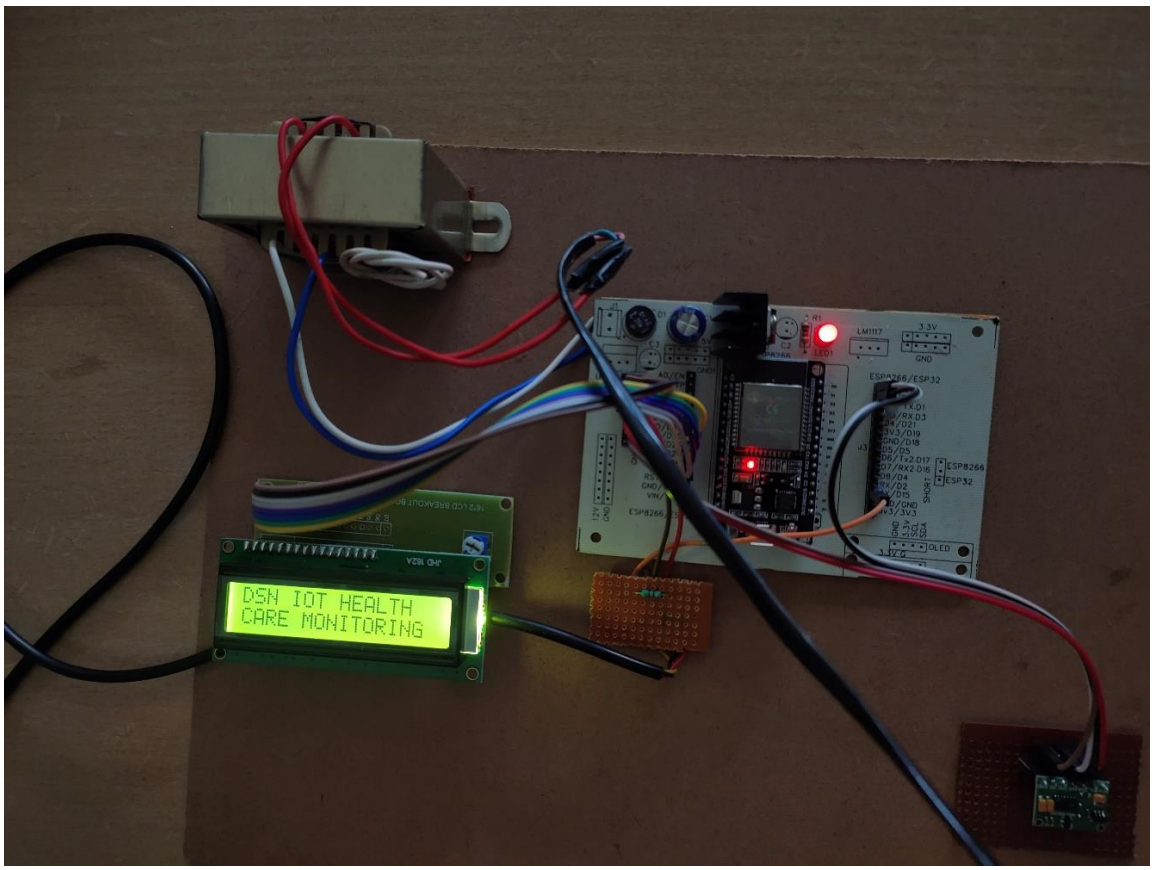

Figure 8. Hardware kit

Conclusion

The IoT-based surveillance and health monitoring system can significantly benefit elderly and physically challenged individuals by providing real-time monitoring and alerting healthcare professionals in case of emergencies. This system can remotely monitor vital signs and activity

levels of patients, reducing the need for frequent visits to healthcare centers, and enabling early intervention in case of deteriorating health conditions.

The integration of various sensors such as temperature, oximeter, pulse sensor, and camera, makes the system versatile and capable of capturing a more comprehensive set of vital signs. This system can also help caregivers or family members monitor their loved ones' health conditions, providing peace of mind and improving patient satisfaction.

The proposed system has the potential to revolutionize the healthcare industry by reducing healthcare costs, improving patient outcomes, and enhancing the overall quality of life for elderly and physically challenged individuals. Future research should focus on optimizing the system's performance, increasing its user-friendliness, and evaluating its effectiveness in real-world settings. With continuous advancements in IoT technology, we can expect even more innovative solutions to address the healthcare needs of our aging population.

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