RB Journal of Lib & Information Science ISSN: 0972-2750
(UGC Care Group I Listed Journal) Vol-13 Issue-04 No.04 2024

Design and Implementation of Smart Health Monitoring with Arduino and IoT

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***Abstract*—** This project presents the design and implementation of a smart health monitoring system that integrates Arduino microcontroller technology with Internet of Things (IoT) capabilities. The system continuously measures key physiological parameters such as body temperature, heart rate, and blood oxygen levels using appropriate biomedical sensors. Data collected by the Arduino is processed and transmitted wirelessly to a cloud-based IoT platform, enabling real-time remote monitoring and analysis. Healthcare professionals or caregivers can access the data via web or mobile interfaces, receive instant alerts if abnormal readings are detected, and maintain historical records for further assessment. The proposed system aims to improve patient care, facilitate early diagnosis, and support continuous health tracking, particularly for elderly patients and individuals with chronic conditions. This solution demonstrates a cost-effective, scalable, and user-friendly approach to modern health monitoring using open-source hardware and IoT technologies.

Keywords—Thing-speak ,IoT, sensors, and Arduino Nano

I. INTRODUCTION

The internet of things, therefore, is a dual component, including the internet and things. The internet refers to the network using established protocols connecting people across the globe. items that list the gadgets that are attached toit.TheIoTmarketinthehealthcareindustryhasexpanded In recent years, the use of the Internet in healthcare has grown rapidly, enabling patients to easily access, track, and monitor their health information. The healthcare sector has seen a significant quantitative increase in response to the expansion of the Internet of Things (IoT). The rapid adoption of IoT has provided a tremendous opportunity for healthcare providers to reduce costs. Nowadays, various diseases and health disorders, such as high blood pressure and accelerated heartbeat, are becoming increasingly common, especially among the elderly. Therefore, to deliver proper medical treatment, a device for continuous health monitoring is essential. This paper presents a prototype device capable of remotely monitoring a patient's condition. The advantages of using an Arduino-based system for patient health monitoring are explored in this project. The results are based on sensor data collected and transmitted to the Arduino, which then displays the information on both an LCD screen near the patient and the ThingSpeak webpage.

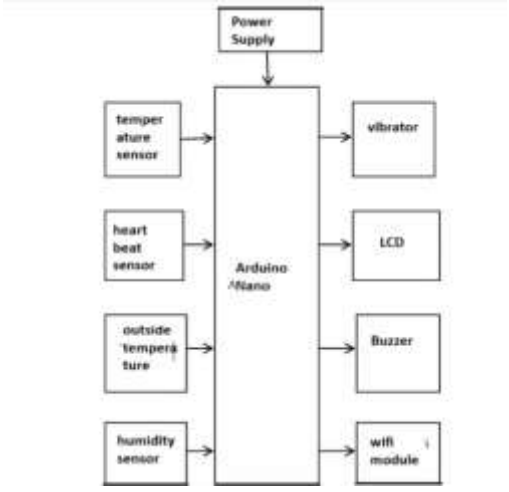
EASEOF USE

Puttinginplaceanautomaticwearablesystemthatkeeps an eye on vital indicators could be a great improvement and support for the quality of life of people, especially for the elderly who have demonstrated a desire to remain freely at home over the past decades. Above is a block diagram despite our health monitoring system, which uses a temperature sensor to assess body temperature and a Spo2 sensortomeasurethequantityofoxygeninhemoglobin.

DataTransmission:TheWi-FimoduleutilizesHTTP protocols for sending the data to the ThingSpeak cloud.

Visualized.Thedoctorswillvisualizethisdatafrom anywhere while connected using ThingSpeak.

II. BLOCKDAIGRAM



The block diagram exhibits the operation of the wearable health monitoring system. At the very outset, there exists a set of sensors where the data from the patients and the environment, be it temperature, heart rates, or humiditysensors is obtained. These sensors gather data, which are interpreted by the Arduino microcontroller. The data is then transmitted via a Wi-Fi module (ESP8266) from Arduino to an internet site named ThingSpeak, where it might be saved and displayed. The system will be supplied by a battery or a power source. To continuously monitor the health of a patient, the doctor could access the data on ThingSpeak remotely.

III. HARDWARECOMPONENTS

A. ArduinoNano

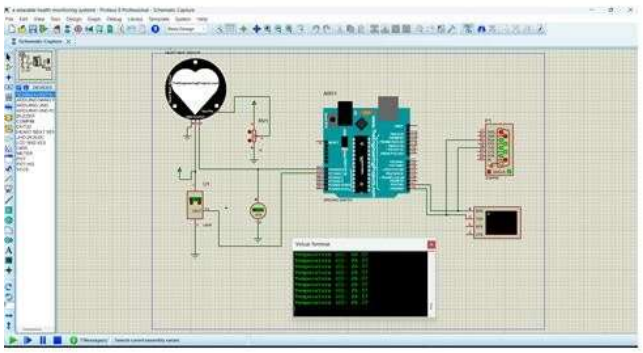
The Arduino Nano is a small, multipurpose microcontroller board designed for projects with limited space, based on the ATmega328P.Ithaseightanaloginputpins,fourteendigital I/O pins (six of which are PWM capable), runs at 5V, and it operates at a clock speed of 16 MHz. It has a mini-USB connector and 32KB of flash memory, which can be programmed using the Arduino IDE. It is ideal for wearable technology, IoT applications, and other embedded systems because of its compact size, low cost, and interoperability with a wide range of sensors. continuously monitor the health of a patient, the doctor could access the data on ThingSpeak remotely.

B. TemperatureSensor

Microcontrollers like Arduino can read and process the electricalsignalthatthesesensorsproducefromtemperature. Because of their precision and simplicity of integration, temperature sensors are frequently utilized in applications including industrial automation, medical devices, and weather monitoring.

C. Heartbeatsensor

A heartbeat sensor is a gadget that uses blood flow through the fingers or other parts of the body to determine the heart rate. Popular sensors include MAX30100 or MAX30102, which utilize PPG technology, whereby photodetection detects the change in light intensity brought about by blood flow when an LED generates light. After processing the data, the sensor calculates the heart rate, which is then transmitted to an Arduino or other microcontroller for real-time monitoring. These sensors are used in fitness trackers, wearable health gadgets, and medical applications due to their ease of use and efficiency.



SIMULATIONOUTPUT

I. RESULT

UsingsensorslikethePulseSensor,LM35,andMAX30100, a wearable health monitoring system using Arduino and the Internet of Things collects data on vital indicators in real time, including blood pressure, oxygen levels, body temperature, and heart rate. After processing this data, the Arduino sends it to a cloud platform like ThingSpeak or Firebase for remote monitoring via a Wi-Fi module such as the ESP8266. After that, all this information is represented on a web interface or mobile application by which the consumer or health providers can constantly monitor the indices related to health. To assist in proper health management the system has an alert mechanism which informs if the critical indicators are being crossed and the users or

medical practitioners need to do something accordingly. In this posting, we have monitored patient health using sensors such as temperature, heart rate, spo2 levels,andhumidity.Thebuzzersavesthepatientfromdeath in case of any emergency by warning the doctor if the patient's temperature goes beyond the 99 degree Fahrenheit limit.

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