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Available online at: www.jrrset.com
ISSN (Print) : 2347-6729
ISSN (Online) : 2348-3105
JIR IF : 2.54
SJIF IF : 4.334
Cosmos: 5.395
Volume 9, Issue 3 – March 2021 - Pages 19-26

IOT SMART HEALTH MONITORING SYSTEM

Gaddam Ludiya, Ch. Aravind Kumar, Dr. B. Persis Urbana Ivy
Department of Computer Science & Engineering
Vaagdevi College of Engineering

Abstract: The main concept of this project is to create a low-cost, affordable health monitoring system for people in remote locations where availability of specialist doctors is not possible. This system is portable, low-cost, and can be easily operated by anyone with limited knowledge. Also, this concept is developed using IoT so that we can send the data to a remote server from which it can be accessed by doctors. This project is designed using Arduino Mega 2560 microcontroller development board, ADS1292r ECG shield, LM35 industrial-grade temperature sensor, ESP8266 Wi-Fi controller chipset, and 16X2 LCD Display. The ECG shield and LM35 are generating analog output, so they are interfaced to the analog pins of Arduino Mega. Using the Pulseoximeter, we can get the Pulse rate and BP. All the above readings (ECG graph, Blood pressure, Heartbeat, temperature) are read through respective pins and are stored in various variables along with displaying on LCD locally. An account has to be created in any one of the IoT platforms like Allthingstalk, Thingspeak, Smartliving, IBM Bluemix, etc. The credentials of the IoT account like Username, Device-Id, Asset-Id, Secret key, etc., have to be noted down to be added in the Arduino program. In the Arduino program, the above credentials are added along with unique pin numbers for assets (Parameters) to be differentiated. The parametric readings from the above procedure which are stored in various variables along with their respective pin numbers (to identify them) are transmitted to the IoT account using ESP8266 Wi-Fi interface. Then the IoT platform processes them and adds to the previously stored values to log data. The logged parametric data can be accessed from anywhere by accessing our IoT account. Also, we can add multiple users to a single account to monitor data like remote specialist doctors, etc.

Keywords: "HTTP", "IOT", "Op-Amp", "LDR", "ECG"

1 INTRODUCTION

In recent years, wireless technology has increased for the need of upholding various sectors. In these recent years, IoT has grabbed the most of industrial area, especially automation and control. Biomedical is one of the recent trends to provide better healthcare. Not only in hospitals but also the personal health caring facilities are opened by IoT technology. So, having a smart system various parameters are observed that consume power, cost, and increase efficiency. In addition, Doctors play a very important role, but the process of check-up is quite lengthy like first a person needs to register then he/she will get the appointment and then later on the check-up reports are generated.

Due to this lengthy process, working people tend to ignore the checkups or postpone them. This modern approach reduces time consumption in the process. Medical scientists have been trying in the field of innovation and research for many decades to provide better health services and improve human lives. This contribution towards society will be very worthwhile because people can detect abnormal body practices before developing serious diseases. Loved ones can also take care and track their health from anywhere in

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the world with the help of IoT. Parameters such as body temperature, heart rate, blood pressure, and respiration rate are crucial for diagnosing diseases. This project provides temperature and heart rate values using IoT.

2. MOTIVATION

In rural areas, as per my survey, there is a lack of proper health treatment for the people, and they often do not receive quality treatment. Many people seek treatment only when the disease or fever becomes too critical. Additionally, considering the cost of treatment, many rural people cannot afford it. Therefore, this project is planned to make the first step of the treatment process easier.

As this project is designed to provide a prime parameter for diagnosing diseases, it addresses the lack of resources and management in reaching out to individuals' health problems in developing countries. A common man cannot afford expensive and daily health checkups. For this purpose, various systems that provide easy and assured healthcare units have been developed. This system reduces time with safely handled equipment. This contribution towards society will be very worthwhile because people can detect abnormal body practices before developing serious diseases. Loved ones can also take care and track their health from anywhere in the world with the help of IoT.

2.1 EXISTING SYSTEM

In a hospital, either the nurse or the doctor has to physically move from one person to another for a health check, which may not be possible to monitor their conditions continuously. Thus, any critical situation cannot be found easily unless the nurse or doctor checks the person’s health at that moment. This may be a strain for the doctors who have to take care of a lot of people in the hospital. Also, when medical emergencies happen to the patient, they are often unconscious and unable to press an Emergency Alert Button.

One of the application protocols that is being used to transfer data is Hyper Text Transfer Protocol (HTTP) for general communication over the Internet. However, when HTTP is applied to communication in IoT, protocol overhead and resulting performance degradation are serious problems. Moreover, IP addressing depends on physical location, which causes the problem of complexity of network control.

2.2 PROPOSED SYSTEM

Our system continuously monitors patients' vital signs and detects abnormalities. The monitored data is then delivered to medical staff. Upon encountering abnormalities, the system alerts the medical staff about the abnormal parameters. This reduces the need for manual monitoring by medical staff. Our proposed system uses Arduino with ESP8266 to send data from sensors to the cloud platform. Arduino has been programmed with the ESP8266 module, which includes the API key provided by the Thingspeak site. Any number of users can view the medical records recorded on Thingspeak using the Thingspeak access key.

3. Software Specifications

- Operating System: Windows 7 or higher

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- Platform: IoT Cloud
- ID

4. TEMPERATURE SENSOR

A temperature sensor is a device designed specifically to measure the hotness or coldness of an object. The LM35 is a precision IC temperature sensor with its output proportional to the temperature (in °C). With the LM35, temperature can be measured more accurately than with a thermistor. It also has low self-heating and does not cause more than a 0.1 °C temperature rise in still air. The operating temperature range is from -55°C to 150°C. The LM35's low output impedance, linear output, and precise inherent calibration make interfacing with readout or control circuitry especially easy.

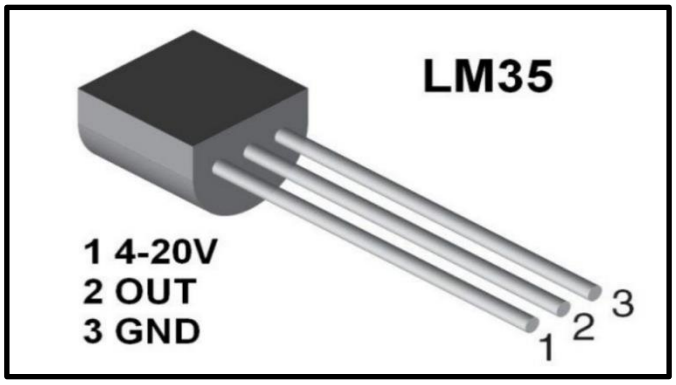

Fig. 1: Temperature Sensor

LM35 Working:

- The LM35 has an output voltage that is proportional to the Celsius temperature.
- The scale factor is 0.01V/°C.
- It does not require any external calibration or trimming and maintains an accuracy of +/- 0.4°C at room temperature and +/- 0.8°C over a range of 0°C to +100°C.
- The output voltage is measured from the middle pin to ground.

Pulse Sensor: The heartbeat sensor provides a simple way to study the function of the heart, which can be measured based on the principle of psycho-physiological signal used as a stimulus for the virtual reality system. The amount of blood in the finger changes with respect to time. The sensor shines a small, very bright LED light through the ear and measures the light that gets transmitted to the Light Dependent Resistor. The amplified signal gets inverted and filtered in the circuit. To calculate the heart rate based on the

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blood flow to the fingertip, a heart rate sensor is assembled with the help of the LM358 OP-AMP for monitoring the heartbeat pulses.

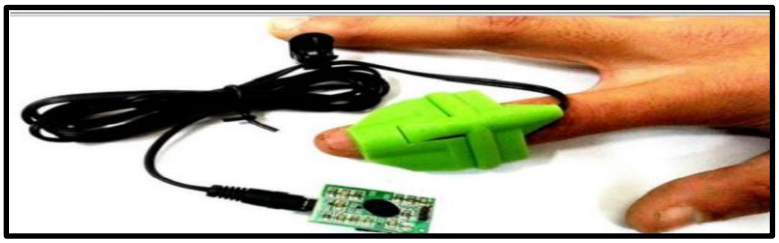

Fig 2: Pulse Sensor

LCD: LCD stands for Liquid Crystal Display. LCDs are increasingly being used to replace LEDs (such as seven-segment LEDs or other multi-segment LEDs) due to several reasons:

1. **Declining Prices:** LCD prices have been decreasing, making them more affordable.
2. **Versatility:** LCDs can display numbers, characters, and graphics, unlike LEDs, which are limited to displaying numbers and a few characters.
3. **Built-in Controller:** LCDs often come with a built-in refreshing controller, which reduces the workload on the CPU. In contrast, LEDs require constant refreshing by the CPU to maintain the display.
4. **Ease of Programming:** LCDs are easier to program for displaying characters and graphics compared to LEDs.

These components are specialized for use with microcontrollers, meaning they cannot be directly activated by standard IC circuits. They are commonly used for displaying various messages on a miniature LCD screen.

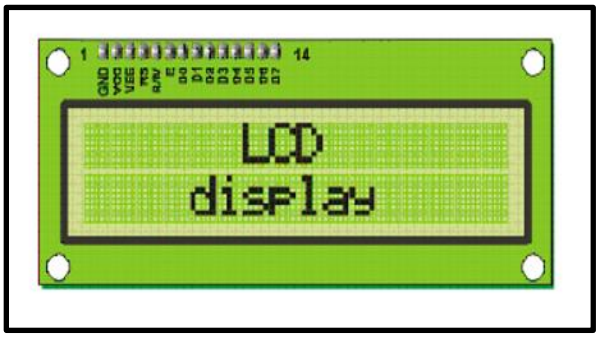

Fig 3: LCD Display

The model shown in Figure 6.3 is commonly used in practice due to its low price and versatility. It is based on the HD44780 microcontroller by Hitachi and can display messages in two lines with 16 characters each.

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This display can show all alphabets, Greek letters, punctuation marks, mathematical symbols, and more. Additionally, it offers the capability to display various graphical elements.

7. USB Cable

An Arduino typically only requires a USB cable for power and connecting to a computer for programming. The most popular Arduino model, Uno, uses a USB Type B cable, while other Arduino boards may utilize Type B-mini or micro connectors.

Fig 4: USB Cable

Setting Up ThingSpeak:

ThingSpeak provides a useful tool for IoT-based projects. By using the ThingSpeak site, users can monitor data and control systems over the internet through channels and web pages provided by ThingSpeak. To get started, users need to sign up for ThingSpeak by visiting https://thingspeak.com and creating an account.

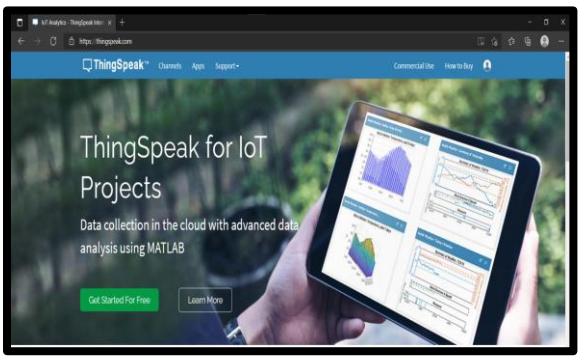

Fig 5: ThingSpeak Signup

Create an Account By creating an account, users can access up to 4 channels and 8 fields. Data for each patient can be stored indefinitely until it's deleted. Users can choose between private or public views, and share the data through a website linked to their channel.

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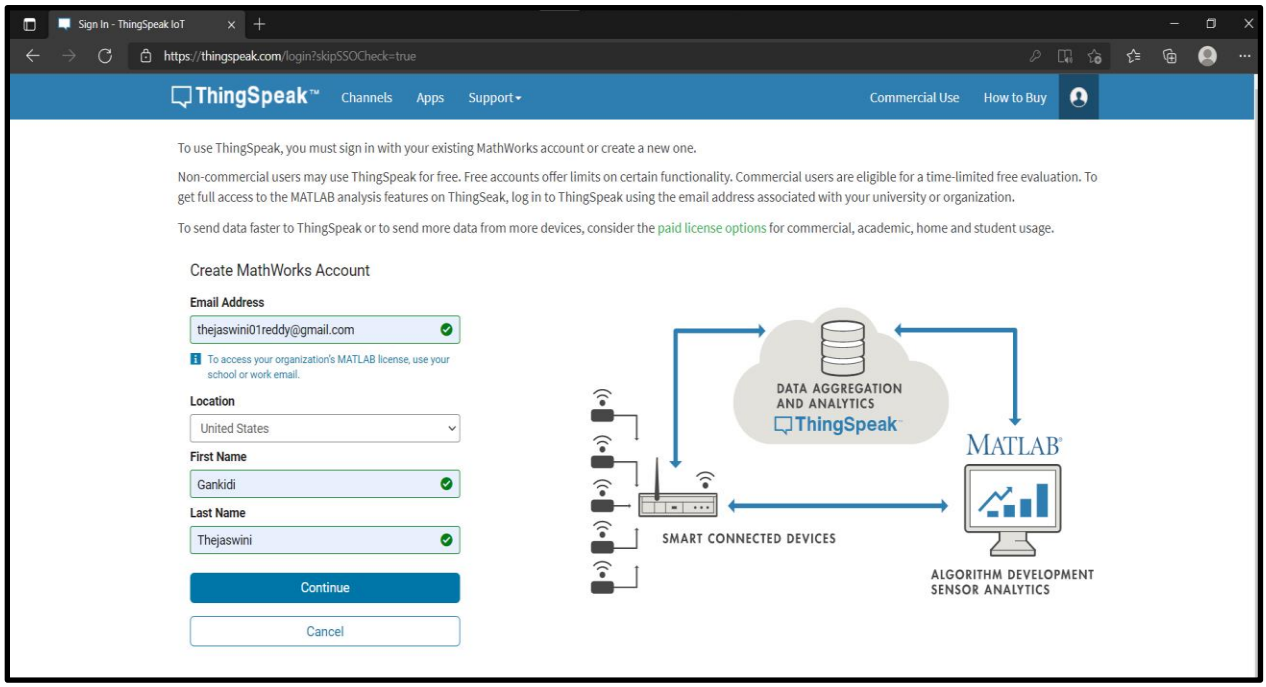

Fig 6: Creating a ThingSpeak Account

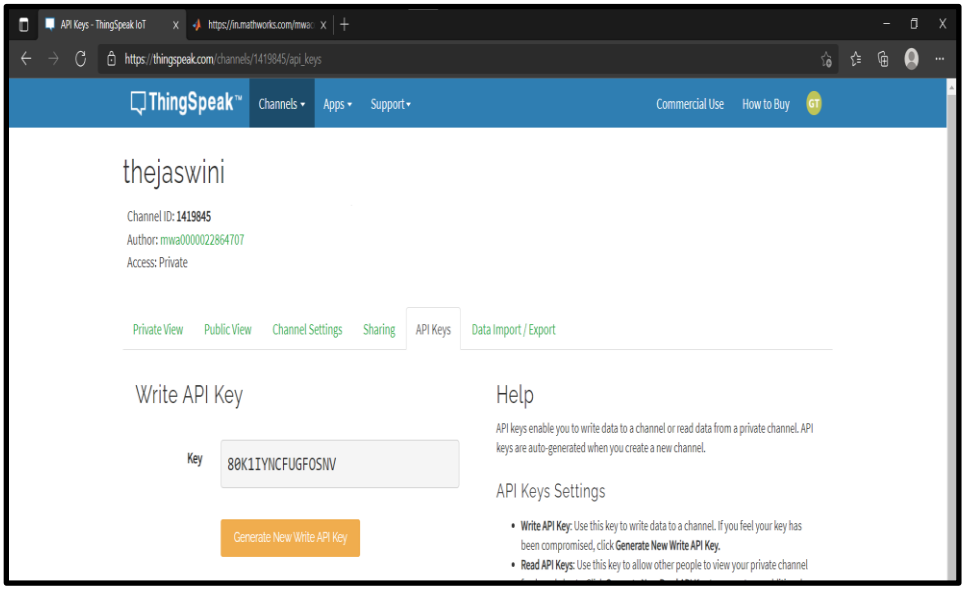

Fig 7: Generating an API Key

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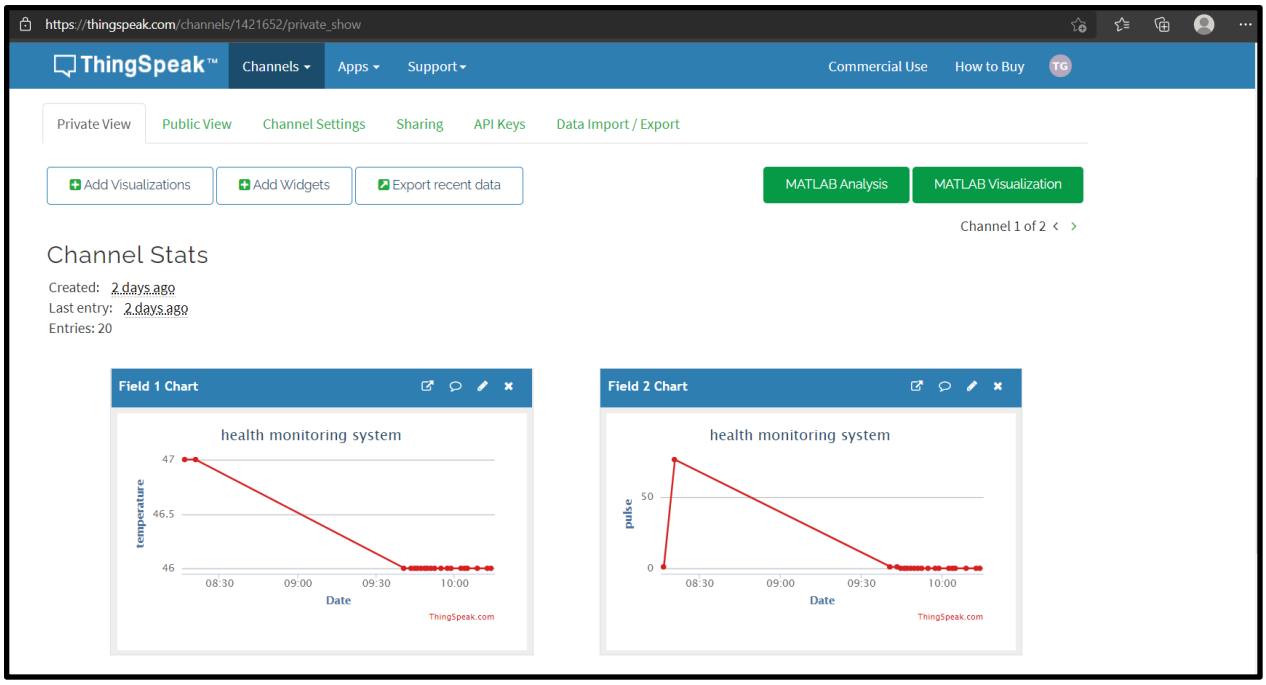

Fig 8: Result Screen

(Note: Please insert the actual result screen image here.)

Recommendations for Future Work:

a) Physiological data collection:

1. Implementing Home Ultrasound.
2. Exploring Brain signal monitoring.

b) Remote viewing of data:

1. Addressing problems associated with online data, including Distributed Denial of Service (DDoS) attacks, and ensuring data privacy/security, especially in medical systems.

c) Enhancing IoT-based Remote Patient Monitoring System:

- Detecting and collecting data on various anomalies for monitoring purposes, such as home ultrasound, brain signal monitoring, and tumor detection.

d) Research on online data-related issues:

- Conducting further research on problems related to online data storage and privacy. This includes investigating security algorithms and user precautions to mitigate security threats in IoT networks.

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e) Customizable sensor control interface:

- Designing an interface that allows users to control which sensors are utilized based on their specific needs.

f) Enhancement of Web UI functionality:

- Improving the web user interface to enable various activities, including hardware control, real-time graph display, and historical and analytical graph generation for anomaly observation.

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