Smart Healthcare Solutions

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***Abstract*—** An IoT-based healthcare system can significantly enhance the well-being of patients and improve their quality of life, particularly in remote areas where access to healthcare facilities is limited. By leveraging IoT technology, real-time monitoring of a patient's vital health parameters can be achieved, ensuring timely medical intervention when needed.

In this project, key health indicators such as body temperature, pulse rate, and oxygen saturation levels are continuously monitored using sensors like LM35 for temperature measurement and MAX30100 for pulse rate and oxygen saturation. These sensors collect real-time data, which is then transmitted to an IoT cloud platform for storage and analysis. The recorded data helps in tracking a patient's health history, allowing healthcare professionals to access and evaluate trends over time.

To make the system user-friendly and accessible, an Android application is developed to display the current health parameters.

Keyword — **Iot technology, LM35(Microcontroller), MAX30100, ARDUINO IDE**

I. INTRODUCTION

Internet of Things (IoT) can be defined as when "Things start to think". Here things in IoT can be any physical object or entity which has unique identifiers (UIDs). It is a system of interconnected devices (with UIDs) can sense, accumulate and transfer data over a network with less or without human intervention and can be utilize remotely. In healthcare sector IoT plays an important role as it is reliable, flexible and affordable system, it offers an optimizing technology to acquire the leading healthcare services and can meliorate the current medical services [4]. There are many vital signs for measurement of health parameter, out of which measurement of body temperature is used to determine that person is having fever or not. As the body temperature varies with the variation in the temperature of environment i.e., in dawn the temperature happened to be lowest while highest in the afternoon. 37 °C or 98.7 °F is considered as the normal body temperature of a person. As we know the about the temperature variation, both the variation of environment and body need to measure. Similarly, the pulse rate of a person plays an important role in the cardiovascular process. Pulse rate expressed in beats per minute (BPM) measured by beats of heart in per minute. About 72bpm – 100bpm is taken as normal, if it either exceed or decrease then prevention is needed. BPM depends on how a person is working

II. Temperature sensor

A temperature sensor is a device used to measure the temperature of an object or environment. It typically converts temperature values into an electrical signal that can be read and is commonly used in applications such as thermometers, refrigerators, and air-conditioners. Types of temperature sensors include thermocouples and resistance temperature detectors, which are utilized in various fields to monitor and control temperature accurately.

A temperature is objective comparative measure of a hot and cold. It is measured in 0 c or 0. Sensors used to measure temperature is called thermometer. They may be contact or non-contact type sensors.

precession Integrated circuit Temperature sensor, whose output voltage varies, based on the temperature around it. It is a small and cheap IC which can be used to measure temperature anywhere between -55°C to 150°C.There will be rise of 0.01V (10mV) for every degree Celsius rise in temperature.

III. Arduino IDE

The Arduino integrated development environment (IDE) is a cross-platform application (for Windows, macOS, Linux) that is written in the programming language Java. It is used to write and upload programs to Arduino board. The source code for the IDE is released under the GNU General Public License, version. The Arduino IDE supports the languages C and C++ using special rules of code structuring. The Arduino IDE supplies a software library from the Wiring project, which provides many common input and output procedures. User-written code only requires two basic functions, for starting the sketch and the main program loop, that are compiled and linked with a program stub main () into an executable cyclic executive program with the GNU tool chain, also included with the IDE distribution. The Arduino IDE employs the program argued to convert the executable

code into a text file in hexadecimal encoding that is loaded into the Arduino board by a loader program in the board's firmware.

Arduino IDE Setup:

- Install Arduino 1.6.8 from the Arduino website
- Start Arduino and open Preferences window
- Enter

http arduino esp8266 com stable package_esp8266com_in dex json into Additional Board Manager URLs field You can add multiple URLs, separating them with commas

- Open Boards Manager from Tools > Board menu and install esp8266 platform (and don't forget to select your ESP8266 board from Tools > Board menu after installation)
- Select the board (Tools->Board->Node Mcu
- Install libraries for esp8266 and DHT11
- Now we can load program to ESP8266 using Arduino IDE 1.6.5
- We can also View the Status on serial window of Arduino

IV. Uploading in Thingspeak

According to its developers, "ThingSpeak is an open-source Internet of Things (IoT) application and API to store and retrieve data from things using the HTTP and MQTT protocol over the Internet or via a Local Area Network. ThingSpeak enables the creation of sensor logging applications, location tracking applications, and a social network of things with status updates". ThingSpeak was originally launched by ioBridge in 2010 as a service in support of IoT applications. ThingSpeak has integrated support from the numerical computing software MATLAB from MathWorks, allowing ThingSpeak users to analyze and visualize uploaded data using MATLAB without requiring the purchase of a MATLAB license from MathWorks. ThingSpeak has a close relationship with MathWorks, Inc. In fact, all the ThingSpeak documentation is incorporated into the MathWorks' MATLAB documentation site and even enabling registered MathWorks user accounts as valid login credentials on the ThingSpeak website. The terms of service and privacy policy of ThingSpeak.com are between the agreeing user and MathWorks, Inc. ThingSpeak has been the subject of articles in specialized "Maker" websites like Instructables, Codeproject, and Channel 9.

- Sign In to ThingSpeak™ using either your MathWorks Account or ThingSpeak account, or create a new ThingSpeak account
- Click Channels > MyChannels
- On the Channels page, click New Channel
- Check the boxes next to Fields 1-3. Enter this channel setting values
- Name: Temperature Humidity Measurement
- Field 1. Temperature (F) Field
- Click Save Channel at the bottom of the settings.

V. Code:

```
 void setup () {
//initialize the digital pin as an output.
//Pin 13 has an LED connected on most Arduino boards:
pinMode (13. OUTPUT);
}

void loop () {
digitalWrite(13, HIGH);       // set the LED on
delay(1000);                   //wait for a second
digitalWrite(13, LOW);        // set the LED off
de Lay (1000);                 //wait for a second
}
```

VI. Result:

Figure 1: Thingspeak sensors graph

VII. CONCLUSION

The IoT-based healthcare system provides an efficient and real-time solution for monitoring vital health parameters such as body temperature, pulse rate, and oxygen saturation. By integrating sensors with an ESP32 microcontroller and cloud-based data storage, the system ensures continuous health tracking, particularly in remote and underserved areas. The inclusion of a mobile application enhances accessibility, allowing patients, caregivers, and healthcare professionals to monitor health conditions from anywhere. The system's ability to generate automatic alerts in case of abnormal readings ensures timely medical intervention, reducing the risk of severe health complications.

This model is designed to be non-invasive, cost-effective, and

scalable, making it suitable for various applications such as hospitals, home healthcare, workplaces, and public spaces. By reducing the need for frequent hospital visits, it alleviates the burden on healthcare facilities while improving patient outcomes. However, challenges such as data security and internet dependency must be addressed to enhance its reliability.

In summary, this IoT-based healthcare system has the potential to revolutionize patient care by providing proactive and remote health monitoring. Its implementation can significantly contribute to improving healthcare accessibility, early disease detection, and overall well-being, particularly in resource-limited settings.

VIII. REFERENCES:

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