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Health Monitoring System

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ABSTRACT
In recent years, the demand for real-time health monitoring systems has surged due to increased awareness of health issues and the necessity for remote health management. The primary objective of the work present in this paper is to create an integrated health monitoring system utilizing Raspberry Pi Pico w and cloud connectivity. The system will monitor essential health parameters such as heart rate and oxygen level, alcohol level, and body temperature. The system architecture integrates three primary sensors: heart rate, alcohol, and temperature sensor, all linked to a Raspberry Pi Pico w. Acting as the central processing unit, the Raspberry Pi Pico w collects, processes, and transmits sensor data to the cloud server. Cloud connectivity facilitates remote monitoring and data access. Sensor data is securely transmitted to the cloud server using HTTP protocols. A webpage will present real-time health data from the cloud server, enabling users to conveniently monitor their health status remotelyfrom any internet-connected device.

KEYWORDS: Raspberry Pi Pico w, Heart rate,alcohol, Temperature, HTTP.

I. INTRODUCTION

The integration of IoT and advanced sensor technology has significantly impacted healthcare, leading to innovative health monitoring systems. These systems utilize state-of-the-art sensors to track essential health parameters like heart rate, oxygen level, alcohol level, and body temperature in real time.MAX30102 sensor used for measurement of heart rate and oxygen level, MQ-3 sensor is used for Alcohol measurement, DS18B20 sensor is used body temperature measurement. The data collected by these sensors is sent to the cloud for storage and analysis, with the processed information displayed on a webpage accessible from any internet- connected device. This approach offers a comprehensive solution for continuous and remote health monitoring, addressing the growing demand for accurate and convenient health metric tracking. The integration of cloud connectivity enhances the system's accessibility, enabling seamless data sharing and analysis. The webpage provides users with an intuitive platform for real-time health status monitoring, supporting proactive health management and facilitating timely interventions when necessary. This paper represents a significant step towards developing cost-effective, scalable, and user-friendly health monitoring systems, with the potential to transform healthcare delivery and empower individuals to take charge of their well- being. the rising reliance on remote healthcare and telemedicine mandates robust remote monitoring solutions. By integrating Raspberry Pi pico w and cloud connectivity, this system facilitates remote data collection, storage, and analysis, catering to individuals requiring continuous monitoring but lacking frequent in-person medical access. Additionally, the data's presentation on a webpage improves accessibility, enabling users and healthcare providers to access real-time health information from anywhere. This fosters timely interventions and personalized healthcaremanagement strategies.

II. METHODOLOGY

A. Block diagram

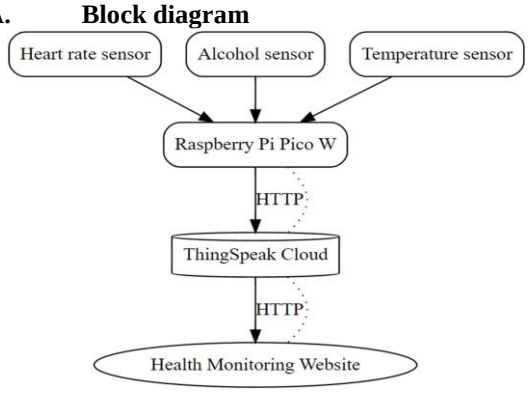

Fig.1 System block diagram

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The above block diagram illustrates a system where various sensors like heart rate and oxygen level Alcohol, and Body temperature sensor is connected to raspberry Pi Pico w, and the sensed data is sent on ThingSpeak cloud and the data is fetched and displayed on health monitoring webpage.

B. Working

A health monitoring system using Raspberry Pi Pico w involves connecting sensors like a heart rate sensor, alcohol sensor, and temperature sensor to the Raspberry Pi Pico w. The sensors capture data related to heart rate and oxygen level, alcohol levels, and temperature. The Raspberry Pi Pico w processes this data and sends it to the ThingSpeak cloud platform using its internet connectivity capabilities. ThingSpeak then stores and manages the data received from the Raspberry Pi Pico w. A website can be set up to retrieve this data from ThingSpeak and display it in a user-friendly format, allowing users to monitor their health parameters remotely and in real-time.

III. DESIGN

The design of the system involves integrating several sensors to raspberry pi pico w to fetch and process data on ThingSpeak cloud and data is displayed on Health Monitoring Webpage.

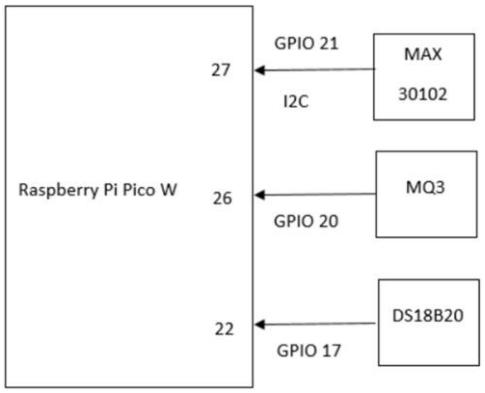

Fig.2 Design of the system

Raspberry pi pico w: The raspberry pi pico acts as a central processing unit. The sensors are connected to Raspberry pi pico. We have used in built wifi module to connect to the cloud.

DS18B20(Temperature sensor): The DS18B20 is used for human body temperature measurement. This sensor sends digital data. The temperature sensor is connected to raspberyypi pico w at pin 22(GP17).The pin 22 is the general purpose pin.

MAX30102(Heart rate sensor): The MAX30102 is a pulse oxymetry which is used for heart rate measurement. The pulse oxymetry uses I2C interface for communication so it is connected to raspberry pi pico w at pin 27(GP21). The I2C interface is used for serial communication.

MQ-3(Alcohol sensor): The MQ-3 sensor is the alcohol sensor which is used for measurement of Alcohol concentration. The MQ-3 is connected to raspberry pi pico w at pin 26(GP20).The pin 26 is the general purpose pin.

IV. RESULTS

The implemented health monitoring system has proven effective in collecting and transmitting real- time data. It accurately captured and transmitted heart rate, alcohol levels, and body temperature readings to a cloud server. Using a web-based interface, users can easily access and visualize this health data, enabling remote monitoring and timely interventions. These results indicate the feasibility and functionality of the integrated system in supporting proactive health management and remotehealthcare services.

Below image shows the Hardware implementation of project which includes various sensors like heart rate, alcohol, temperature sensors are connected to raspberry pi pico:

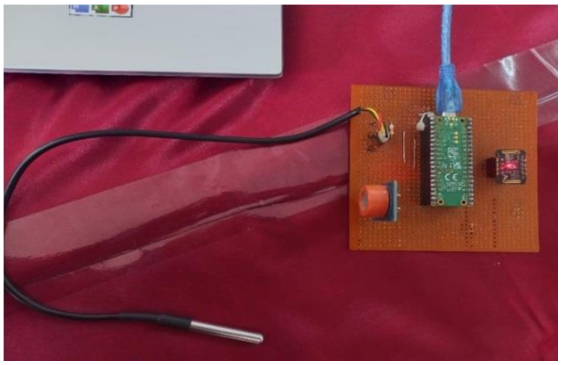

Fig.3 Hardware implementation of a system

Below image shows the sensed data from raspberry pi pico and visualize and stored on Thing Speak Cloud.

This visualized chart includes data of various sensors like Temperature, Heart rate, Alcohol sensor.

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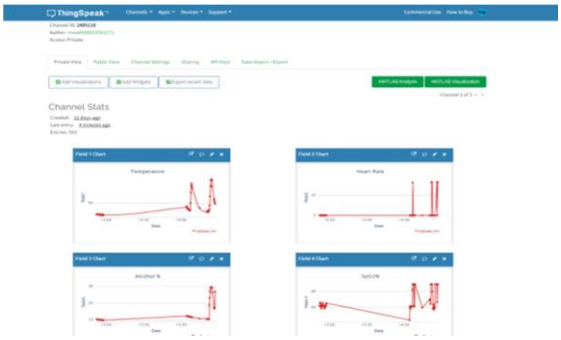

Fig.4 ThingSpeak Cloud integration with Raspberrypi pico w

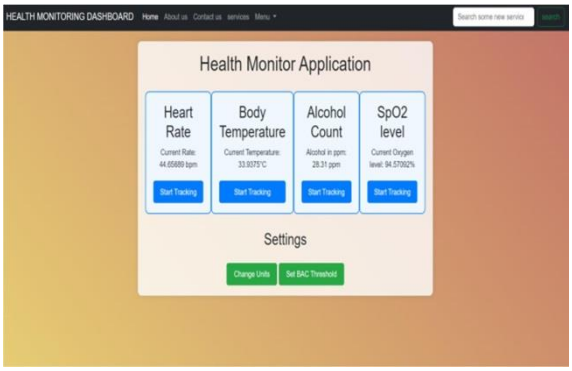

Fig.5 Health Monitoring Webpage where ThingSpeak data is displayed.

Below image shows the Health Monitoring Webpage where the data which is fetched from ThingSpeak Cloud which was sent by Raspberry Pi Pico To Thing Speak.

SOURCE CODE FOR CONNECTINGSENSORS TO RASPBERRYPI PICO W:

```
import machine, timeimport onewire import
ds18x20 import network import urequests
def read_alcohol_level():
"""
Function to read alcohol level from MQ-3 sensor
Returns:
Alcohol concentration in parts per million (ppm)"""
# Read analog value from sensorsensor_value =
adc.read_u16()
# Convert analog value to alcohol concentration
(ppm)
alcohol_ppm = sensor_value *
CALIBRATION_FACTOR
return alcohol_ppmwhile True:
alcohol_ppm = read_alcohol_level()
print("Alcohol Concentration: {:.2f}
ppm".format(alcohol_ppm))
ds_sensor.convert_temp()
time.sleep_ms(750) max_IRQ = adc1.read_u16()
print("max_IRQ: {:.2f} ".format(max_IRQ))
heart_rate = random.uniform(60, 100) #Random
Number between 20 and 25
heart_rate = round(heart_rate, 0)if max_IRQ >
42000:
heart_rate=heart_rate

else:
heart_rate=0
print("heart_rate: {:.2f} ".format(heart_rate))for
rom in roms:
tempC = ds_sensor.read_temp(rom)
print('temperature :', "{:.2f} ºC".format(tempC))
print()
```

V. CONCLUSION

The efficacy of the health monitoring system, as shown by the results obtained, lays in its real-time data collection and transmission capabilities. Accurate readings of heart rate, alcohol levels, and body temperature were successfully captured and transmitted to the cloud server. Accessing and visualizing this health data is made easy through a user-friendly web-based interface, enabling remote monitoring and timely interventions. These findings highlight the feasibility and functionality of the integrated system in supporting proactive health management and remote healthcare services.

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