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Healthcare Monitoring in IOT using WBAN

Mrs. G. Annapoorani[1], Prudhvi Inja[2], Pallab Medhi[2], Varun Thapliyal[2], M. Sai Kaushik[2]

[1]Asst. Professor, SRMIST
[2]ECE Dept, SRMIST

Abstract: **Internet of Things (IoT) has been gaining a lot of development in the past few years which allows us to connect things from various fields through the Internet. For the IoT connected healthcare applications, the wireless body area network (WBAN) is gaining popularity as wearable devices spring into the market. This paper proposes a collection of wearable sensor and Wi-Fi Module aided transmission that enables the implementation of remote monitoring of various health related parameters. A body area network, also referred to as a wireless body area network (WBAN), is a wireless network of wearable computing devices. These sensors are attached to the patient's body in a fixed position. These can also be made available in smart wearable devices.**

Keywords: **IoT, WBAN, MQTT, HTTP, RPi, ADC.**

I. INTRODUCTION

An embedded system can be considered as a small processing unit comparable to computers which are dedicated to perform small and specific functions only. In this project we used a Raspberry Pi to take the role of a CPU of an embedded system. In contrary, a computer, such as a personal computer, has a large domain of applications which can be implemented depending upon the programming. This project is aimed to monitor the various health parameters of the patient using various sensors. these sensors are attached to the patient's body and collect data in analog form. This analog data is converted into digital form using an ADC present in the RPi. The raspberry pi acts as a processing unit which processes the digital data and sends this computed data to the cloud. In this way the raspberry pi is used to implement internet of things with the help of various sensors and Wi-Fi module. Whenever there is a discrepancy in the readings of the sensors which might be above or below the safety threshold of the patient, an alarm message is sent to the registered mobile number which is usually of both the doctor and the patient.

Embedded systems being such flexible systems employing programming can be used in endless situations in any field makes them a really good alternative to costly computers.

Raspberry pi provides several functions

- Supervise the environment; raspberry pi apprehends the data from input sensors. This apprehended data is then handled and then the results are shown in some format to an end user.
- bridle the environment; raspberry pi accomplishes and addresses commands for actuators and help in monitoring.
- Mutate the information to be used for additional consumption; raspberry pi metamorphoses the data possessed in some meaningful way, such as data compression/decompression which may be used for better applications.

II. LITERATURE SURVEY

1. Service Virtualization of Internet-of-Things Devices:

Service virtualization is an approach that uses virtualized environments to automatically test enterprise services in production-like conditions. Many techniques have been proposed to provide such a realistic environment for enterprise services. The Internet-of-Things (IoT) is an emerging field which connects a diverse set of devices over different transport layers, using a variety of protocols.

Drawback:

- IoT developers in enabling them to continuously test their IoT applications in an automated fashion without requiring access to the physical devices.

2. Design and Simulation of Energy Efficiency in Node Based on MQTT Protocol in Internet of Things:

Internet of Things define a global environment where entities are able uniquely diagnosed and allowing systems to administer, footmark and supervise them. Systems have plausibleness with self-configuring based on secure standard communication protocol, so that unauthorized users can't access the data. MQTT components help different software applications to interact with each other so that they can act in a connected manner.

Drawback:

- MQTT is one the critical protocol which can be ideal for interconnecting the physical world to the real work.

3. A Technique for convalescent MPPT Performances of Double-Stage Grid-Connected Photovoltaic Systems:

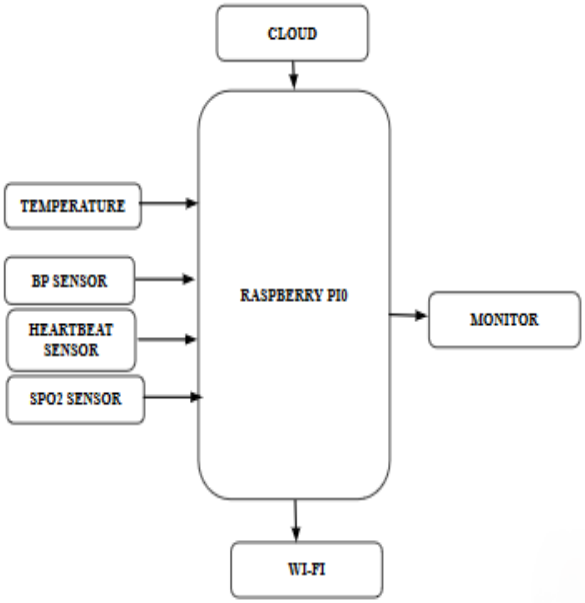
In double-stage grid-connected photovoltaic (PV) inverters, the charismatic interactions among the dc/dc and dc/ac stages and the maximum power point tracking (MPPT) controller may reduce the system performances. In this paper, the detrimental effects, particularly in terms of system efficiency and MPPT performances, of the oscillations of the PV array voltage, taking place at the second harmonic of the grid frequency are evidenced. The use of a proper compensation network acting on the error signal between a reference signal provided by the MPPT controller and a signal that is proportional to the PV array voltage is proposed.

Drawback:

- low-frequency oscillations of the voltage across the bulk capacitor

III. PROPOSED SYSTEM

Wireless devices have invaded the medical area with a wide range of capability. To monitor the patient details in a cyclic interim is not possible using existing technologies. To overcome this, we have changed recent wireless sensor technologies. This project uses MQTT (Message Queuing Telemetry Transport), which has a lot of advantages over HTTP (Hyper Text Transfer Protocol). MQTT comprises of ISO standard which is publish-subscribed-based messaging protocol. It is employed on top of the TCP/IP protocol. In general, six different sensors are used to gather patient medical information without being injecting inside the body by this we are achieving remote monitoring and data gathering of patients.



In this project IOT is used for monitoring various health aspects of patients. All the different sensors like temperature sensor, BP sensor, SPO2 sensor are measuring various health parameters of the patients. All the data obtained is converted from Analog to digital using ADC in the raspberry pi.

The Converted data is then sent to the cloud which can also be accessed by doctors from anywhere. This helps doctors to monitor the patients in real time even when they are not around. If any abnormalities in the readings are found, an alert message is sent to the doctor as well as to the registered number. All the data is also shown on a webpage. each patient has his own portal and the doctor can access everyone's portal using his access.

This project has an edge over others as we can monitor the patient from anywhere. It is more secure as we used MQTT protocol which has many advantages over HTTP protocol such as MQTT is one to many transmission protocol whereas HTTP is one to one transmission protocol. MQTT also uses lesser bandwidth as a result data transfer is faster also at 1G and 2G.

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Raspberry pi uses Raspbian OS which is a free Linux based distribution. And so is programmed in python. The program present in the raspberry pi contains the code for the operation of the ADC and also the code for message transfer. The analog signal coming to the raspberry pi are converted into digital form of ten binary digits. A webpage has also been made using PHP which employs the REST Architecture for GET, PATCH, PUT, POST requests. The Styling has been done in CSS. The raspberry pi zero has been used. It is a 16 bit IO expander and uses I2C communication.

IV. SYSTEM ARCHITECTURE

A. INTERNET OF THINGS

IOT stimulates the communication between devices, also prominently known as Machine-to-Machine communication. This results in the physical devices to stay connected and hence the total lucidity is available will high efficiency and greater quality. As a result, the devices interact with each other which results in automation. Ideally, IoT is expected to offer exceptional connectivity of devices, systems, and services that goes above the limit of machine-to-machine (M2M) communications and camouflage a variety of protocols, domains, and applications.

B. HEARTBEAT SENSOR

This heart beat sensor is created to produce digital output of heart beat of the subject when their finger is placed on it. This digital output of the heartbeat sensor is connected to the raspberry pi directly to gauge the Beats per Minute rate. It works on the principle of light modulation by blood flow through finger at each pulse, which detects the change in volume of the blood flowing through vessels and causes an alteration in the light intensity passing through the organ (a vascular region).

Fig. 1. Heartbeat Sensor

C. SPO2 Sensor

SpO2 is a device which gives an estimate amount of oxygen saturated in the blood or which refers to the amount of hemoglobin contained in the blood. Hemoglobin is a protein that is responsible for carrying oxygen in the blood to different parts of the body. It is found inside red blood cells and gives them their red color.

Fig. 2. SPO2 Sensor

D. BP Sensor

The MPX2050 series devices are silicon piezo resistive pressure sensors providing a highly accurate and linear voltage output, directly proportional to the applied pressure.

Specifications:

- Temperature Compensated Over 0°C to +85°C.
- Unique Silicon Shear Stress Strain Gauge
- Easy to Use Chip Carrier Package Options.
- Radiometric to Supply Voltage
- Differential and Gauge Options

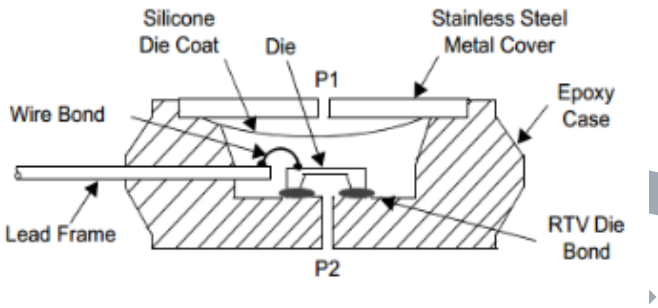

Fig. 3. BP Sensor

E. TEMPERATURE SENSOR

Basically, Thermistors are devices which consist of resistors which are sensitive to heat and whose major responsibility is to detect and show a large, predictable and precise change in electrical resistance when subjected to a corresponding change in body temperature

F. RASPBERRY PI ZERO

The Raspberry Pi zero is a cheap alternative to the computer and can be used by plugging into a computer monitor. The raspberry pi is the cheapest ARM11 powered Linux operating system single board computer board. It is a small and cheap computer which helps and enables people of all ages to learn about computers and programing like python, Minecraft, and other languages like scratch. We have used pin 2 for 5V power, pin 6 for ground, 19th pin for MOSI and 23rd pin for SCLK. Pin 8 and 10 are used for TxD and RxD respectively.

Fig. 4. RPi Zero

V. FINDINGS AND RESULTS

1. Temperature Sensor

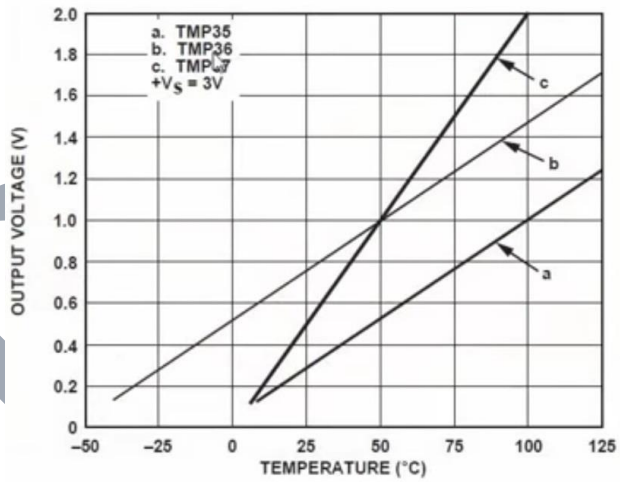

Fig. 5. Graph between voltage and temperature

Above is a datasheet diagram of TMP35 temperature sensor. The graph represents that the temperature is directly proportional to the output voltage.The equations used for the simulation of the graphs are

TempC = (v – 0.5) * 100;

TempF = (9/5) * TempC + 32;

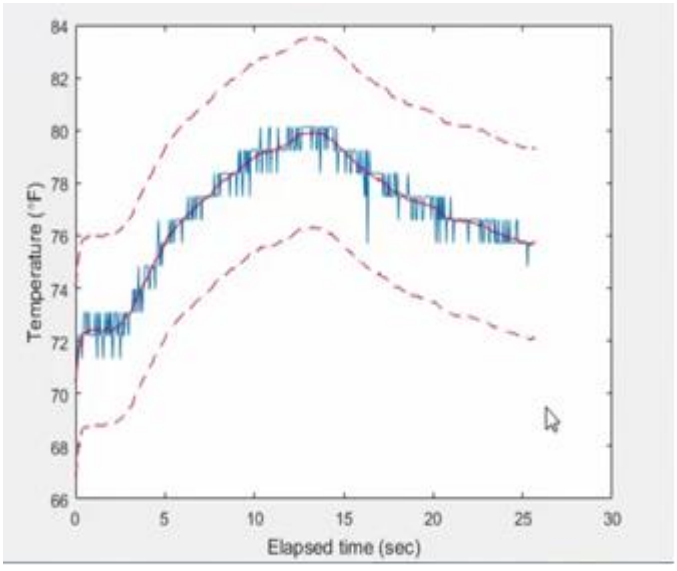

Fig. 6. Graph between temp. and time

The temperature sensor has a tolerance of about 2 degrees Celsius at room temperature.

Using this information, we have plotted the largest and smallest possible values the sensor can measure.

2. Thingsview app simulation

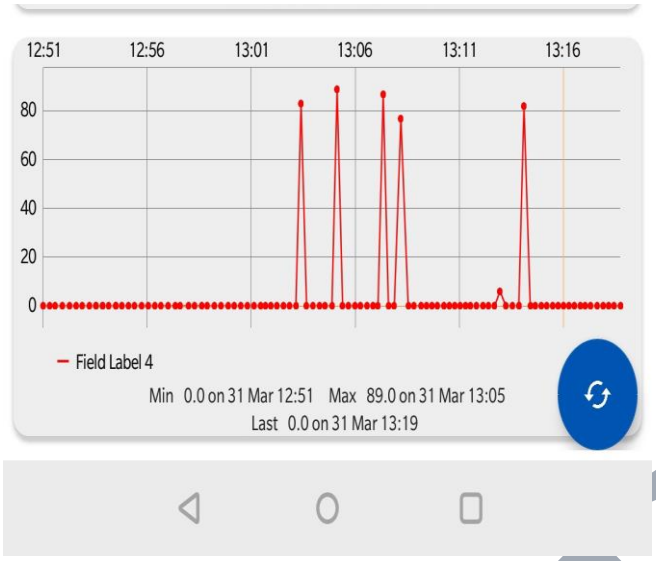

Fig. 7. Heartbeat sensor outut

This is the simulation output of the heartbeat sensor which has been viewed in thingsview app by matlab.

VI. CONCLUSION

Compared to the previous systems, the project has higher efficiency, low power consumption, high data transmission rate, one to many communication techniques and gives higher security end. This paper designs a wireless sensor network system using Raspberry Pi as a base station, MQTT as networking protocol and a combination of various sensors. Simulations were done on MATLAB and the graphs were recorded.

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