ECG Based Health Monitoring System Using IoT

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Abstract – The paper postulates an ECG Based Health Monitoring System using Internet of Things. The proposed system is portable and continuous cardiac health monitoring system. The proposed quality-aware ECG monitoring system consists of five modules: ECG signal sensing Module; Heart Beat sensing Module, Blood Pressure Module, Temperature sensing Module, SP02 sensing Module; and signal-quality aware ECG analysis and transmission module. The main objectives of this paper are: Design and Development of a portable light-weight ECG based Health Monitoring System for automatically classifying the acquired ECG signal and other health based attributes such as Blood Pressure and Body Temperature into acceptable or unacceptable class and real-time implementation of proposed system.

Index Terms – IOT, Raspberry Pi, ECG, Heart Rate Sensor,MCU, MPPT, SPO2 Sensor,BP Sensor, Wifi.

1. INTRODUCTION

Nowadays healthcare technologies are slowly entering into our daily lives, replacing old devices and techniques with newer intelligent ones. Although they are meant to help people, the reaction and willingness to use such new devices by the people can be unexpected, especially among the elderly. A fall event is one of the main factors that influence the physical and psychological health of an elderly person. Injuries related to falls include physical damages like Heart attacks, bone fractures and general connective tissue lesions.

A fall has also dramatic psychological consequences, since it drastically reduces the self-confidence and independence of affected people. Healthcare technology using wireless sensors hasreached a high level of maturity and reliability and hence these devices are now being deployed in homes/nursing homes for use in managing people's health. In this project, an enhanced fall detection system is proposed for elderly person monitoring that is based on smart sensors worn on the body and operating through consumer home networks. The smart sensors contains temperature sensor, ECG sensor and heartbeat sensor, these sensor values are measured by a microcontroller unit(MCU) and it transmit to the PC through Wi-Fi.

It will receive the sensor values and store into the data base. If any sensor value exceeds the limit it will indicate the corresponding person. . This study further shows that the transmission of acceptable quality of ECG signals can significantly improve the battery lifetime of IoT-enabled devices.

2. RELATED WORK

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. Things have capability with self-configuring based on standard communication protocol. MQTT or MQSeries components are used to tie connected manner other software applications so that they can work connected manner. This type of application is often known as business integration software or middleware. MQTT is one the critical protocol which can be ideal for interconnecting the physical world to the real work.

In double-stage grid-connected photovoltaic (PV) inverters, the dynamic 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.

3. PROPOSED MODELLING

The system consists of several components. These include ECG Unit, Raspberry Pi, Blood Pressure module, Temperature sensor, SpO2 sensor & Computer machine or Android Phone. In proposed methodology, we are going to monitor ECG signals such as Heart Rate, Body Temperature, Blood Pressure and Hemoglobin using appropriate ECG sensor and other sensors respectively.

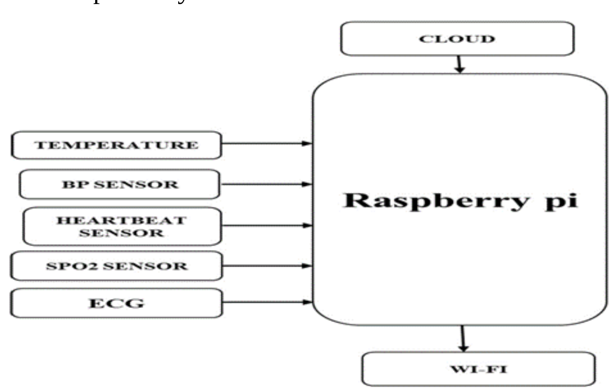


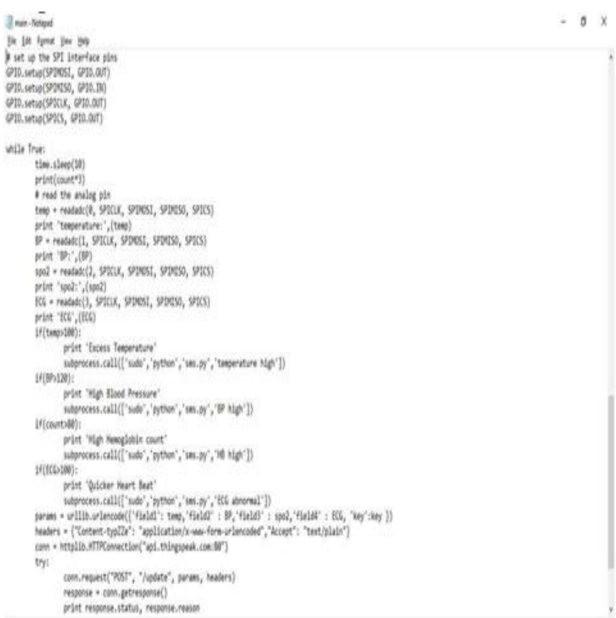
Fig1: Proposed system block diagram

ECG sensor records the electrical activity generated by heart muscle depolarization, which propagate in pulsating electrical waves towards the skin. The blood pressure sensor uses an inflatable air-bladder to measure blood pressure in an artery. This monitoring can be performed efficiently by a blood pressure monitor that contains a pressure sensor for sensing arterial wall vibrations (the oscillometric method).SpO2 sensor gives an estimate of the amount of oxygen in the blood. More specifically, it gives the percentage of oxygenated hemoglobin (hemoglobin containing oxygen) compared to the total amount of hemoglobin in the blood (oxygenated and non-oxygenated hemoglobin).

This signals from each sensors are given to signal conditioning unit and then to Analog to Digital convertor. This captured ECG and other health sensor signals gives us the Heart Beat rate, Blood Pressure Temperature and Hemoglobin count and by studying the rhythm of heart beats & other health attributes can give valuable information regarding the concerned . This heart beat rate captured from this ECG sensors gets passed to laptop machine and this exact heart beat rate is calculated and displayed on cloud.

4. RESULTS AND DISCUSSIONS

This is the implementation of the project. In the Fig 2 we can see how we are using python getting different variable such as Heart Beat, Blood Pressure, Haemoglobin etc. from different sensors respectively and produce varying output from it.

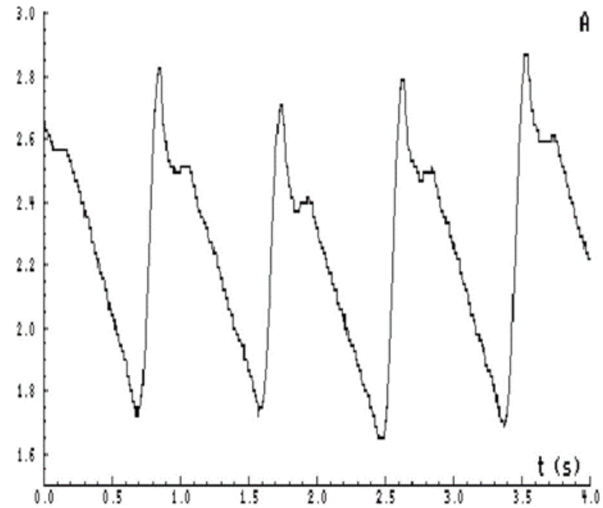


```
# set up the SPI interface pins
GPIO.setup(SPIMOSI, GPIO.OUT)
GPIO.setup(SPIMISO, GPIO.IN)
GPIO.setup(SPICLK, GPIO.OUT)
GPIO.setup(SPICS, GPIO.OUT)

while True:
        time.sleep(10)
        print(count*3)
        # read the analog pin
        temp = readadc(0, SPICLK, SPIMOSI, SPIMISO, SPICS)
        print 'temperature:',(temp)
        BP = readadc(1, SPICLK, SPIMOSI, SPIMISO, SPICS)
        print 'BP:',(BP)
        spo2 = readadc(2, SPICLK, SPIMOSI, SPIMISO, SPICS)
        print 'spo2:',(spo2)
        ECG = readadc(3, SPICLK, SPIMOSI, SPIMISO, SPICS)
        print 'ECG',(ECG)
        if(temp>100):
                print 'Excess Temperature'
                subprocess.call(['sudo','python','sms.py','temperature high'])
        if(BP>120):
                print 'High Blood Pressure'
                subprocess.call(['sudo','python','sms.py','BP high'])
        if(count>80):
                print 'High Hemoglobin count'
                subprocess.call(['sudo','python','sms.py','HB high'])
        if(ECG>100):
                print 'Quicker Heart Beat'
                subprocess.call(['sudo','python','sms.py','ECG abnormal'])
        params = urllib.urlencode({'field1': temp,'field2' : BP,'field3' : spo2,'field4' : ECG, 'key':key })
        headers = {"Content-typZZe": "application/x-www-form-urlencoded","Accept": "text/plain"}
        conn = httplib.HTTPConnection("api.thingspeak.com:80")
        try:
                conn.request("POST", "/update", params, headers)
                response = conn.getresponse()
                print response.status, response.reason
```

Fig2 : Taking different variables from sensors

In the next image (Fig 3) we show the graph which shows deviations from ECG sensor in the proposed model. This is performed in raspberry pi.



5. CONCLUSION

In this paper, we reviewed the current state and projected future directions for integration of remote health monitoring technologies into the clinical practice of medicine. Wearable sensors, particularly those equipped with IoT intelligence, offer attractive options for enabling observation and recording of data in home and work environments, over much longer durations than are currently done at office and laboratory visits. This treasure trove of data, when analyzed and presented to physicians in easy-to- assimilate visualizations has the potential for radically improving healthcare and reducing costs. We highlighted several of the challenges in sensing, analytics, and visualization that need to be addressed before systems can be designed for seamless integration into clinical practice.

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