

An IOT Based Monitoring System for Human Gait Detection

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Abstract

Nowadays, through Internet of Things (IoT) we can predict any kind of abnormalities. The Gait detection can be observed through Internet of Things(IoT). Previous existing methods are not accurate and they cannot detect the gait by many parameters. The objective of this paper is that the by the walking patterns of a person we can detect a cautious gait. To study this we need a Heartbeat sensor that detects the pulse values so that the pulse rate can be determined. IoT shoe with Wi-Fi to detect the pressure and accelerometer values. Temperature sensor is used to check the condition of the patient whether there is an high temperature or normal temperature. A smartphone with an Bluetooth is required such that through Bluetooth the sensor results can be seen in an smartphone.

Keywords: Raspberry Pi, Heartbeat sensor, Pressure sensor, IoT shoe, Bluetooth.

1. INTRODUCTION

In recent times, one of the major problems is heart attack. Without any age considerations the heart attack stroke is observed in all kind of ages. There are many reasons to occur the heart attack. The research describe that the detection is observed after a stroke[1]. Heart attack is one of the main cause for mortality in adults in recent times. In the Hemiplegic gait the leg is stiff and without flexion at knee and ankle, when a step is rotated away from body.

Detection of Cautious gait we can reduce the mortality rate by being direct contact to caregiver. In previous studies there are three stages to detect gait performance in

adults [2]. In the first stage it is determined by the stance time, cadence and swing time. In the second stage it is determined by speed of gait and length of stride. The third stage it is determined by length of stride and its variability

The previous studies state that these systems were developed using Smartphone to detect gait for patient when he is affected with heart stroke. But these could not help from the falling. These smart phone monitoring systems can be monitored from anywhere. All the mobile phones have inbuilt sensors.

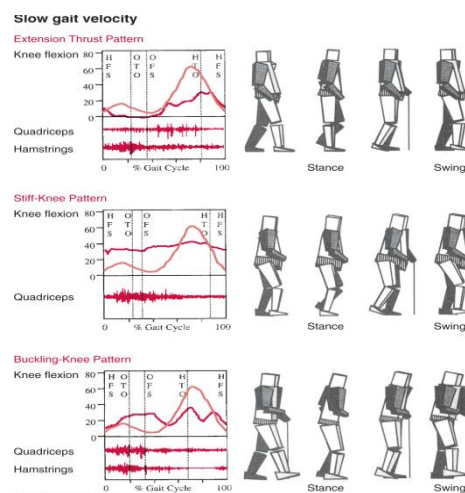


Figure 1 Gait Observation in Patients

This paper deals with the detection of gait using Raspberry pi, Heartbeat sensor, Accelerometer, Temperature sensor, IoT shoe and Bluetooth. It is implemented to apply for the real time monitoring of the gait detection.

2. ARCHITECTURE OVERVIEW

Raspberry pi is a microcontroller unit which of around the size of a credit card. It is configured with An SD card slot which can be used as a hardware drive and itis USBpowered. The video output can be viewed in a monitor or a TV using HDMI port. Raspberry Pi 3 is a 64-bit Quad core processor running at 1.2GHz. It consists of a 1GB SDRAM with built in WIFI and Bluetooth with 2.5 amps of power and 5V of voltage. We use Raspberry Pi 3 module B in this paper which is of third generation Raspberry pi. Raspberry Pi 3 module b is more powerful processor which is 10 times faster than the first generation Raspberry Pi. It is a high efficiency CPU used for wide range of applications in mobile, TV and networking[4].

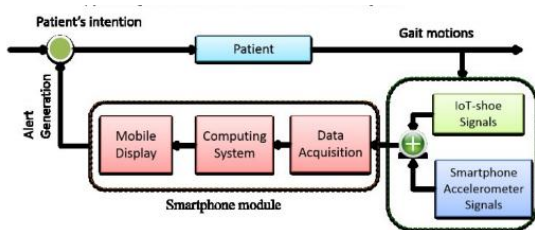


Figure 2 General Gait Detection System Model

The contracting and expanding of human heart while the blood travels from one human organ to another organ then sound generated by valves is known as the heartbeat. The heart beat rate is calculated as number of times the heart beats per minute. Photo phlethysmography is the principle used for heart beat sensor. The change in volume of blood through any human organ results in a change in the light intensity through that human organ. As light is absorbed by blood, signal pulses are same as heart beat pulses and the

rate of heart pulses decides the blood volume [5-8].

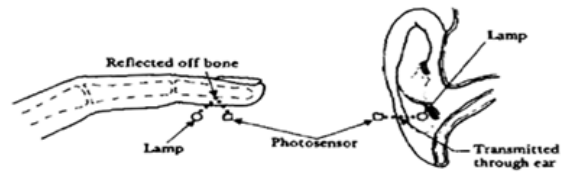


Figure 3 Working of heartbeat sensor

There are two types of photo phlethysmography. Light emitting device emits light and this light is transmitted through body's vascular region is received by arranged reflector.

The pressure measurement of gasses and liquids is measured by pressure sensor. Force required to stop a fluid from expansion is an expression of pressure. Pressure sensor generates a electrical signal used for controlling and monitoring in many applications. These sensors are manufactured from piezoelectric materials like quartz.



Figure 4 Pressure sensor

3. RESULTS& DISCUSSIONS

This system develops gait assistance data based on gait spatiotemporal parameters when they are moving around. To analyze this parameters the pressure sensor is placed at the bottom of the shoe. The accelerometer is used to measure the acceleration of the body. The Heartbeat sensor is used for the pulse rate of the body. Hencea sensor named LM35 is used to serve this purpose.

This sensor converts the temperature sensor values into electrical pulses. LM35 series sensors are precision integrated-circuit temperature sensors whose output voltage is linearly proportional to the Celsius temperature[9].

To run the Raspberry Pi3 we need an external SD card where the OS is been written. Control section includes a PC or any display and a Smartphone. The use of Smartphone is to provide hotspot for the PC and the Raspberry Pi board. Once the proper connections are provided then we need to insert the SD card loaded with Raspbian OS. The values are displayed on the LCD and these can also be seen in the server. The values of temperature sensor, pressure sensor and heartbeat are determined [1-4].

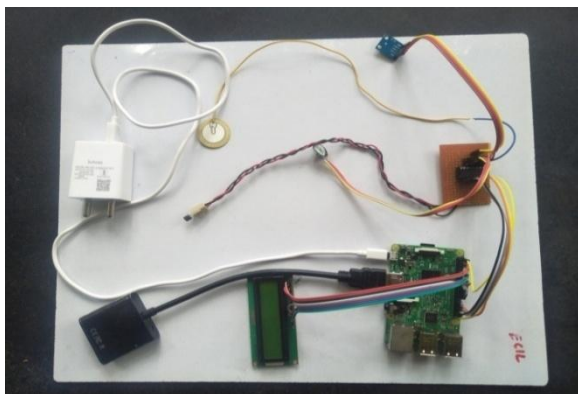


Figure 5 Developed Hardware Module

The Bluetooth is connected to hardware module. When the values of temperature, pressure, heartbeat values increases automatically the values are uploaded to Bluetooth. These values are displayed in a Bluetooth app which is in the smartphone.

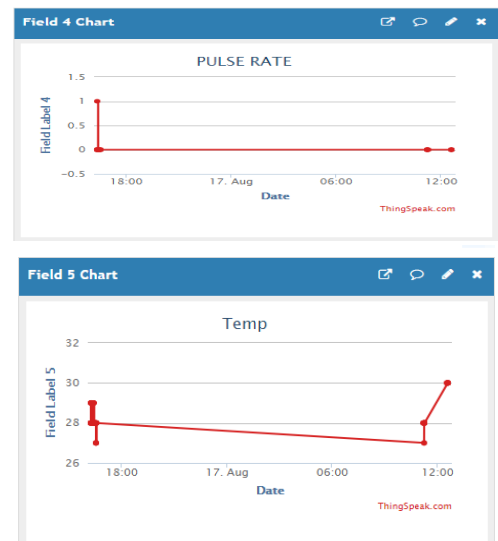
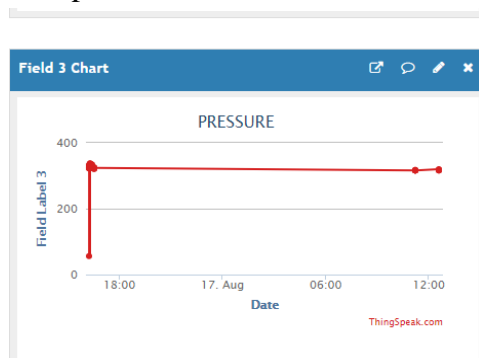


Figure 6 Graphs of Pressure sensor, Heartbeat sensor and Temperature values

4. CONCLUSIONS

This work is a wireless system for Gait analyzation with the help of IoT-shoe based network and a smart phone (mobile) sensors with a real -time abnormality detection observed in the gait schema of the consumers. This IOT system can detect and predict cautious gait which can lead to abnormalities like falling on to the ground. These preliminary results from patients from the embedded IoT system are observed and it can be observed that the data is used for analyzing the cautious gait. This developed system finds several applications in gait detection for a person with several disabilities, who may at a higher risk of falling on the ground with location information.

For testing permanence of chronology and long term feasibility of the proposed approach for more advanced applications we propose a real time testing of this proposed system with the received data from the elderly people who are suffering from chronological heart diseases. In addition this system can be extended and implemented for a smart home monitoring system for gait monitoring and connecting the system in to the digital world using any wireless technology like Wi-Fi or Zigbee.

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