

REVIEW ON: A WIRELESS IoT SYSTEM FOR GAIT DETECTION IN STROKE PATIENT

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Abstract - Gait monitoring using IOT is an important medical diagnostic process for stroke patient. We will design and implement an IOT system with Wi-Fi communication model and smart phone to discreetly monitor insole pressure of the patient's motion. this system is helpful for fall detection, the best way to reduce number of falls and to predict and prevent them from happening in first place. in this system an Internet based body sensors are used which is a wireless portable network used for gait detection and prevention of fall in stroke patient.

For this study, a smartphone built-in sensor with a Wi-Fi communication module is used to discreetly monitor insole pressure and accelerations of the patient's motion. To the best of our knowledge, we are the first to use the gait spatiotemporal parameters implemented in smartphones to predict a cautious gait in a stroke patient. The proposed system can warn the user about their abnormal gait and possibly save them from forthcoming injuries from fear of falling.

Keywords - Gaits, IoT, Health, Wireless, Internet, Sensor, Network, Device, Detection.

I. Introduction-

IoT is for internet of things. It refers to ever growing network of physical object that feature an IP address for internet connectivity and communication that occurs between these objects and other internet enabled devices and systems.

IoT is a system of interrelated computing devices, mechanical and digital machines, objects that provided with unique identifiers and ability to transfer data over network without requiring human-to-human or human-to-computer interaction.

I. It is a modern wireless communication technology having its application areas in various diversified domain areas. The basic idea of this concept is the pervasive presence around us of a variety of things or objects – such as Radio-Frequency Identification (RFID) tags, sensors, actuators, mobile phones.

II. Injuries due to a heart attack are a major health problem all over the world. More than 85% of heart attack patients regain the capacity to walk but their gait differs from that of healthy subjects. In older adults, the fear of falling after a stroke, named “cautious gait” leads to a specific gait pattern with reduced stride length and gait velocity. This diagnosis will also help to predict and prevent users from an injury. Stroke is one of the leading causes of morbidity and mortality in adults, accounting for 17.3 million deaths per year. Strokes significantly contribute to reduced gait performance. The majority of stroke patients do not reach a walking level that enables them to perform all their daily activities

IoT has created an explosion of sensor data due to the increased number of devices with embedded sensors. the aim of this study is to determine if the gait of stroke patients changes significantly over successive gait trials using smart phones. Data from a pressure-sensor embedded shoe and smart phone sensor were used to validate the proposed approach and to identify fear of falling with cautious gaits.

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For this project, we want to create smart sensor device that give the user feedback on any recognized walking abnormalities as fast as possible. Even though we think this will be more for older people, the product will be helpful for people of all ages. Using concept of IoT, to detect and translate physical data from real world. The device will track the user

walking pattern and over course of few minute be able to give the user different type of feedback, from type of support that user need for improving walking pattern every day. This device is mainly used to prevent fall of stroke patient with help of gait detection using sensors.

II. LITRETURE -

LITRATURE REVIEW:

1) Daiwat A. Vyas, Dvijesh Bhatt, Dhaval Jha, Assistant Professor, Dept. of Computer Science and Engg. Nirma University, Ahmedabad, India ^[2] presented a IOT which is network of physical devices accessed through the internet. It is a embedded technology to interact with internal states or external environment, it is a wireless technology that has its application in various domains IOT focus on aspects such as global real time integration, mobility, distributed intelligence, continuous connectivity etc.

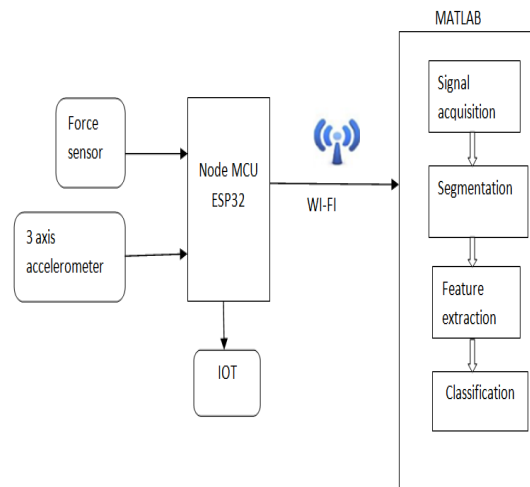
2) K. Snehasri, N V Raghava Swamy ^[3] presented a wireless system to analyse gait using pressure sensors along with the IoT system for the real time detection of abnormality in users' gait pattern. Quantitative analysis of gait is provided by a device in conditions outside of the motion lab. While this work is continuing to be developed, it shows great promise as a future contributor to clinical gait analysis. Also, we are planning to compare healthy and stroke patients' data where the pairs are closely comparable based on gender.

3) Mark Sullivan, Casey Knox, Juan Ding ^[4] presented a system for Gait analysis through the Internet of Things (IoT) is able to provide an overall assessment of daily living. They design a next generation sensor embedded smart IOT shoe can detect abnormal walking patter by foot pressure variation. In this when voltage is small the small variation in voltage then there is large change in pressure it creates a problem for sensors.

4) Wenlong Zhang, Student Member, IEEE, Xiuming Zhu, et.al.^[5] presented a network-based mobile gait rehabilitation system is proposed for improved mobility and tele-rehabilitation. A compact rotary elastic actuator (cRSEA) has been introduced as the rehabilitation device. A new wireless protocol called MB Star Plus has been proposed to achieve a high sampling rate and guarantee real-time communication. A modified linear quadratic Gaussian (LQG) controller has been combined with a disturbance observer (DOB) to deal with the packet loss in this system. System integration method has been introduced and experimental results have been shown to validate the performance of this system. The plan for future clinical testing has been developed.

5) Parameters Felix Kluge, Heiko Gaßner, Julius Hannink, et.al. Presented a system for the sensor-based system ^[6] presented in this has great potential for the assessment of spatiotemporal gait parameters of healthy subjects and mildly affected gait of patients with PD. The possibility to quickly analyse a large number of steps that contribute to clinical decision making or treatment evaluation is an advantage compared to traditional motion capture laboratories. 6) Ruth E. Taylor-Piliae, M. Jane Mohler¹, Bijan Najafi, Bruce M. Coull^[7] presented a system in this Falls and fall risk are major concerns for stroke survivors. Since the majority of fall-related events occur at home or in community settings, the use of wearable mobile technology in stroke survivors may be useful to monitor fall risk and gait in these settings, which could further enhance recovery and/or prevent injuries. We have demonstrated the utility of the PAM Sys system for incorporation into cross-sectional monitoring of fall risk and gait assessment, with the potential for rehabilitation outcome assessment. As sensor algorithms become increasingly more predictive with less obtrusive applications, the potential for continuous monitoring of those at high risk for falling will develop into practical solutions for home and community settings.

PROPOSED WORK:



Block description:

1) Microcontroller Node MCU ESP32:

ESP32 is a progression of ease, low power framework on a chip microcontroller with incorporated wi-fi and double mode Bluetooth. The ESP32 arrangement utilizes a Tensilica Xtensa LX6 microchip in both double center and single center varieties and incorporates into constructed reception apparatus switches, RF balun, control enhancer, channels and power the executive's modules. ESP32 is made and created by espressif frameworks.

It is single 2.4 G HZ WI-FI and blue-tooth chip designed with low power 40nm technology. It is programmed using Aurdino software.

2) ADC:

It is an analog to digital converter. This device is used for converting analog signal to digital and gives a digital output.

In gadgets, a simple to-computerized converter (ADC, A/D, or A-to-D) is a framework that changes over a simple flag, for example, a sound got by an amplifier or light entering an advanced camera, into a computerized flag. An ADC may likewise give a separated estimation, for example, an electronic gadget that changes over an information simple voltage or current to an advanced number speaking to the size of the voltage or current. Regularly, the computerized yield is a two's supplement paired number that is corresponding to the information, yet there are different potential outcomes.

There are a few ADC models. Because of the multifaceted nature and the requirement for unequivocally coordinated segments, everything except the most specific ADCs are executed as incorporated circuits (ICs).

An advanced to-simple converter (DAC) plays out the turnaround capacity; it changes over a computerized flag into a simple flag.

3) Input Data:

It is a data taken with the help of body sensors. The sensors used are accelerometer sensor and pressure sensors.

a) Accelerometer sensor:

MEM Solver is an incredible yet basic structure and investigation apparatus for analysts, architects and understudies working in the field of Micro Electro Mechanical Systems or MEMS. MEMS is a very specific between disciplinary field of building which participates in the advancement of micromechanical sensors, actuators and other miniaturized scale gadgets. The ADXL335 sensor has inbuilt tri-axial accelerometer and gyroscope which enables three-dimensional gesture

monitoring. A solitary tri-hub accelerometer can give item's increasing velocities in three ways which incorporate the impact of gravity. An arrange will be assembled when the accelerometer is fixed on human's body. Gyroscope can offer angular velocity as added information which enables an efficient fall detection system with less resource and power consumption. ADXL335 is accelerometer sensor which takes a shot at the rule of piezoelectric impact. At whatever point we will tilt the sensor the ball should move toward that path as a result of Gravitational power. The dividers are made of piezoelectric components. Along these lines, each time ball is contacting the divider an electric flow will be delivered which will be translated as qualities in any 3D space. ADXL335 is a triple hub accelerometer for example it will give 3 esteems in yield. BW is adjustable as it has single capacitor per axis. Analog interfacing is done for communicating with other devices.

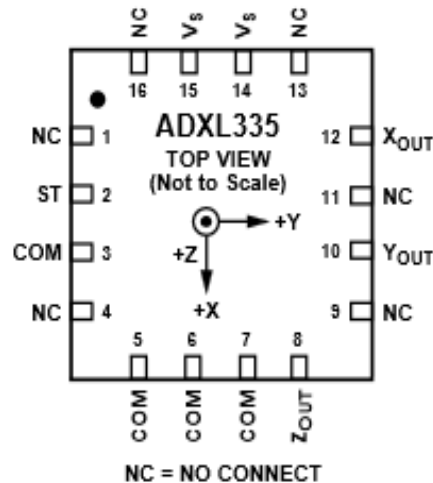


Fig: Accelerometer ADXL 335

b) Pressure sensor:

It is a device for measure the pressure typically of gases or liquids. Pressure is an expression of force to stop gas or liquid to analyze the spatiotemporal parameters and kinematic motion of the gait, four piezo-resistive pressure sensors were placed at the bottom of the shoe to assess the pressure distribution. It is observed that more than 70% body pressure is measured from the front foot and back foot regions while walking.



Fig: - Pressure Sensor

4) Signal Analysis:

a) Segmentation:

The data taken through the wi-fi is get separated i.e. the unwanted data is removed and expected data is taken.

b) Spatiotemporal parameters:

The parameters measured from the insole pressure variation from an IoT-shoe and from the accelerometer of the smartphone was calculated to investigate common information between the parameters. Parameters with a higher coefficient were interpreted as being significant contributors to normal or abnormal walking detection. We investigated

the relative error of spatiotemporal gait parameters of free gait with respect to parameters from the simulated motion gait. We observed that cadence and stride time for motion gait is higher than free gait for each trial.

C] Signal Classification:

Signal classification is to build a predictive model of signal trajectory densities in an RPS and differentiate between signals. First, we applied our technique to the two data sets generated from free gait and simulated cautious gait events. It was observed that the pressure variation with one or two sensors during cautious gait was much higher than free gait with respect to subject's gender, age, height and weight. We can also see the variations of different walking patterns for different subjects.

Random forest technique is used for the classification of data. Two types of data, i.e. motion gait and free gait, are provided and checked according to input data and gives the output data. In classification, there are two methods: training and testing.

1) Training:

In training, firstly, the signal is given to signal acquisition where it converts the signal in digital form and then the signal is segmented and from that we get the required data. Then it can be stored in feature database and then the classifier gets trained and then it is given to validation block where signal is checked and gives the accurate data and then it goes to the trained classifier and we get the required signal and then it can be tested.

2) Testing:

In testing, the signal is again converted into digital form and then it can be segmented, and we get the required data and then the classifier is loaded and it gives the classified result and then we get the output signal which is required.

III. Conclusion -

Gait monitoring using IOT is an important medical diagnostic process for stroke patients. We will design and implement an IOT system with Wi-Fi communication model and smart phone to discreetly monitor insole pressure of the patient's motion. In this system, internet-based body sensors are used which is a wireless portable network used for gait detection and prevention of fall in stroke patients and this is most helpful as number of falls mostly in older people is increased due to the abnormality in gait of stroke patients. In this paper, we presented a wireless system to analyze gait using sensors through a real-time detection of abnormality in user's gait patterns. The proposed IOT system can detect and predict cautious gait that can lead to a fall. Here, preliminary results from a patient using the embedded IoT system are shown and the data can be used to analyze the cautious gait. The system may also find multiple applications in gait behavior detection for people with various disabilities who are at a high risk of falls related injuries with location information.

IV. Reference -

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