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SMARTPHONE BASED SYSTEM FOR CLINICAL ASSESSMENT OF A PERSON'S PATTERN OF WALKING BY USING IoT

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Abstract: ***Gait analysis has proven to be a useful technique to evaluate the condition of patients that have gone through lower joints complaints procedures. It is important to have a method to assess the walking capabilities of the patients in order to track their improvement over time. In this paper we proposed a client server based system to perform the Functional Gait Analysis test to assess the balance and fall risk of patients with walking difficulties. It covers few short comings of existing system as self-care, as it does not need of a specialist or physician, mobile, accurate, as it eliminates the ambiguities incurred by specialists.***

Keywords: *Internet of things, flex sensor, Data Sharing*

I INTRODUCTION

The IoT uses low-cost computing devices where there are less energy consumption and limited impact on the environment. Through IoT, billions of devices will be connected to each other including cars, phones, jet planes, appliances, wearable gear etc. Internet of Things (IoT) is an important topic in technology industry, policy, and engineering circles. It has become headline news in both the specialty press and the popular media. This technology is embodied in a wide spectrum of networked products, systems, and sensors, which take advantage of advancements in computing power, electronics miniaturization, and network interconnections to offer new capabilities not previously possible. An abundance of conferences, reports, and news articles discuss and debate the prospective impact of the "IoT revolution"—from new market opportunities and business models to concerns about security, privacy, and technical interoperability. While dealing with IoT, more and more authenticate information is being collected from the devices. Hence, we have to make sure that the security policies are in place to protect the data from the hands of hackers [7]. Now a day the need of people is to monitor and control their business activities or house while moving across the globe. To achieve an economical and safe way of monitoring and the controlling Internet of things can be utilized effectively. The focus of IoT is to allow things to become smarter, more reliable and more autonomous. Sensors have to play a key role in the field of security systems. The use of sensors depends upon the type of application like ultrasonic sensor, flex sensor, temperature sensor.

II PROPOSED WORK

The existing system has many disadvantages. It is difficult to implement and very complex. It requires more human effort and hardware. So, the entire system is expensive. These can be overcome by the use of interactive motion detection security system using flex sensor in IOT. This system consists of three layers- the first layer is for motion detection. In the second layer actions are processed according to Arduino UNO and in third layer recorded data is visible to user as analysis.

III EASE OF USE

This is smartphone based system. So user can record and analyze own data at any place, anywhere, any time. The system records the data from the different sensors, such as the accelerometer, flex sensor, and rotation sector, and sends the data to the server for post-processing and storage to be later reviewed by the specialist or patient.

IV IMPLEMENTATION

Walking cycle is the main concept used in walking pattern Analysis since it is a representation of how a person walks. The gait cycle is commonly divided in two main phases for a given limb: the stance phase, when the foot is in contact with the floor, and the swing phase, when it is not. The stance phase is approximately 60% of the gait cycle, while the swing phase covers the remaining 40%. Figure 1 shows the walking cycle and its phases.

The proposed system evaluates the walking pattern of an individual by automatically detecting and segmenting steps, differentiating between left and right, and performing a signal processing analysis on the data to obtain different regularity and similarity measures. The system uses a client-server architecture to exchange, store, and visualize the information.

Clinical walking Analysis refers to the process of determining what is causing patients to walk the way they do. It is an assessment process which can be used as additional input for clinical decision-making. Hereafter the term clinical is dropped, given that is the main focus of this paper. This section explains the most important concepts, methods, types of assessments, and methods used to quantify walking patters found in the walking analysis literature.

A. Motion Detection

We have used flex sensor with knee pads, and attached them to knee joints. So as the person starts moving the motion is detected and it initiates the sensor.

B. Pattern processing

The data is captured and covered in Arduino UNO. It gives us analog data. This data is sent to system via Bluetooth connectivity. As the secret logic implemented, we can easily separate out the normal walking and unhealthy walking. Similar way, we have covered normal runny motion and unhealthy behavior.

C. comparative data visibility

The captured data is made visible to user as left leg and right leg. For simplicity and better understandability, we have shown it as graphical form.

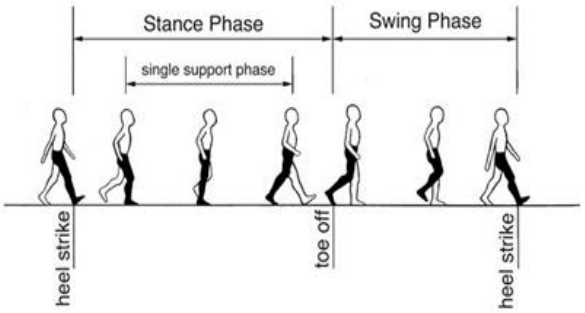


Figure 1. Walk cycle and main phases

Figure 2. Bluetooth connectivity

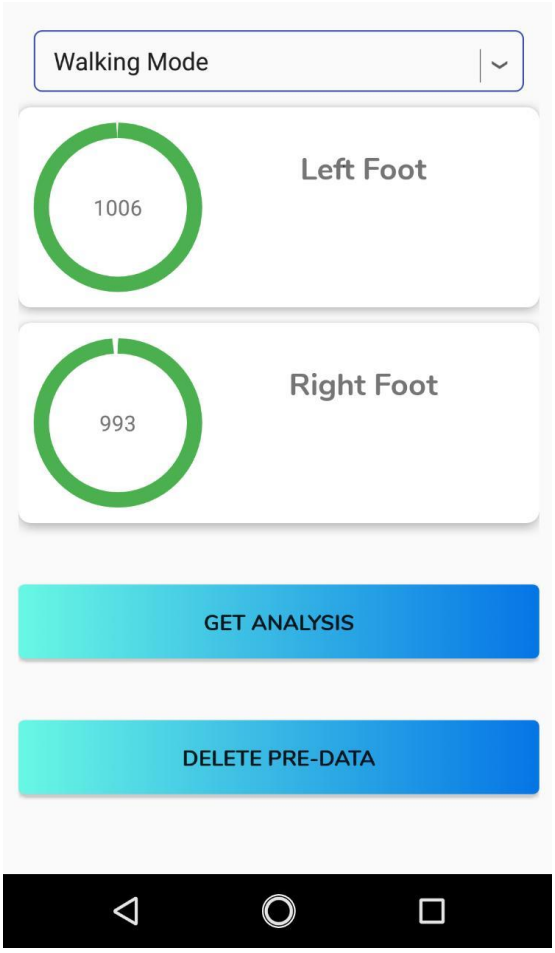


Figure 4. Result values recorded

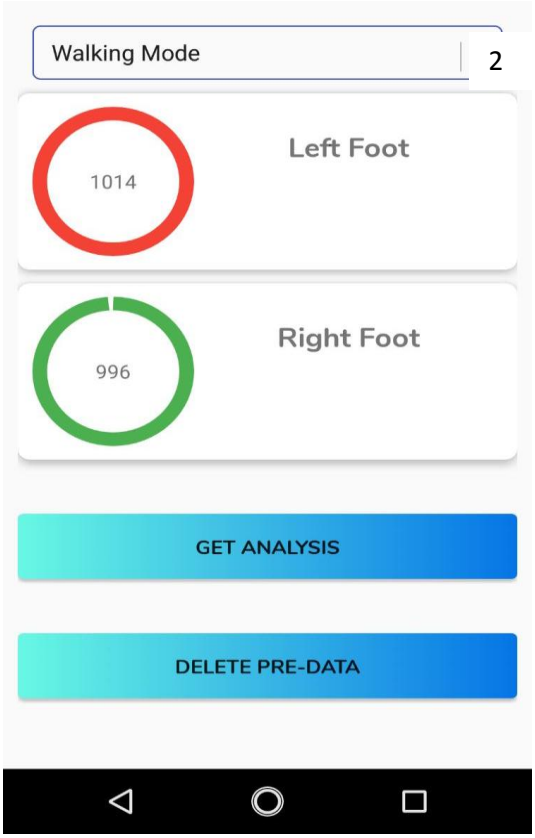


Figure 5. Result values recorded with unhealthy leg

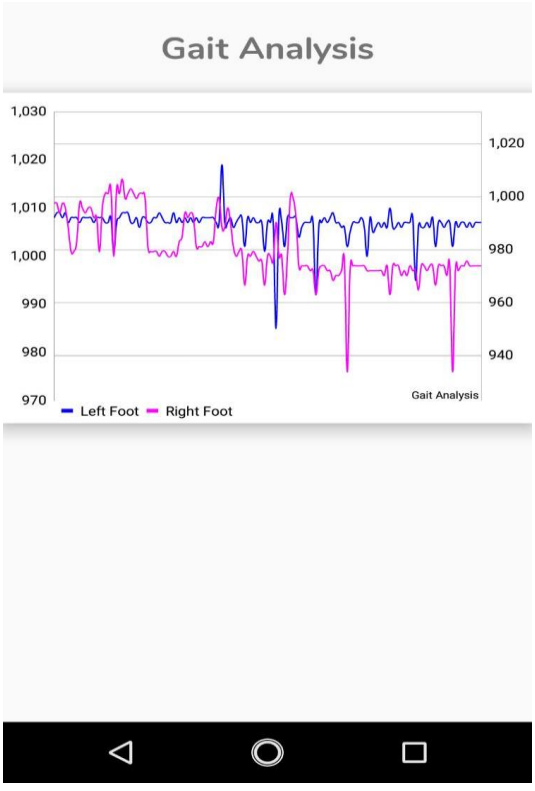
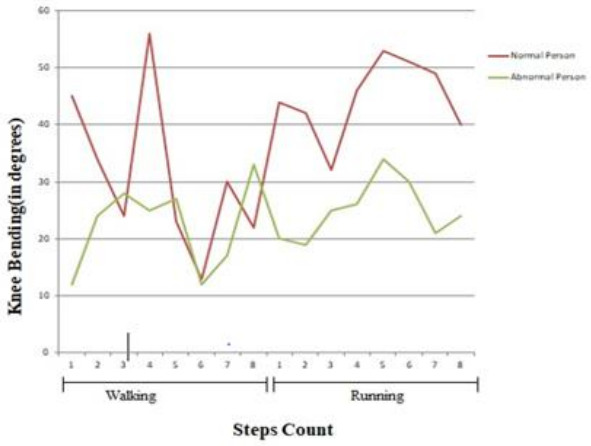


Figure 6. Analysis recorded

Lower joints complaints, including more than one million surgeries involving total or partial hip, knee, and ankle replacement are major health problems. These procedures require some level of post-op physical therapy (PT), to recover most of the walking capabilities. Gait analysis has proven to be a useful technique to evaluate the condition of patients that have gone through post-op physical therapy procedures. The system promotes self-care, as it does not require the presence of a physician to do the assessment. Each of the modules was tested with three different sets of tests: bare foot, left leg impediment, and right leg impediment [5].

This graph represents the analysis of knee bending between normal and disabled person. We can clearly see that a normal person has high knee bending angle than the person with leg disability. This comparative analysis can help us in



taking decision based on the condition of a person problem.

Figure 7. Knee bending analysis

V CONCLUSION

This system is used to help physicians and patients perform clinical gait assessments with the sensors. Futuristically, we can embed sensors in current off-the-shelf smart phones. When one can use this application to measure and study his/her own readings. As this application is making use of real-time step detection algorithm, user can easily monitor own readings and compare with past performance. Also the approach is to make use of a current application to send data to a server back-end application that stores the data and extracts the different gait metrics from such data.

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