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Rehabilitation Of Sprained Ankle Using Internet Of Things Technology

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ABSTRACT

Ankle sprains are frequent injuries that occur among all cohort peoples. Ankle sprains constitute nearly 15% of all sports injuries, and are the foremost common traumatic emergencies. Without proper treatment and rehabilitation, a more severe sprain can weaken the ankle, making it more likely for fresh injures, and leading to long-term problems. During this work, we present an inertial measurement units (IMU)-based on physical interface for measuring the foot attitude, and a graphical computer program that acts as a visual guide for rehabilitation of patient. Development of foot mounted physical interface for ankle rehabilitation was developed. The physical interface is additionally connected with therapy system, and provides feedback to the patient while reading the sensor parametric values. The system is additionally integrated with force sensor and temperature sensor to look at changes and allows for in-home rehabilitation at a reasonable price while engaging the patient through active therapy. As per the results, more consistent rehabilitation is additionally achieved by providing feedback on foot position during therapy procedures.

Keywords: Accelerometer sensor, Internet of things, Force sensor, Therapy.

INTRODUCTION

Ankle Injuries are one among the foremost common kinds of athletic injuries and might have adverse effects on existence similarly as athletic performance. Proper rehabilitation of an ankle injury is vital so as to forestall long run persistence of those affects. Balance, proprioception and range of motion are often negatively affected due to ankle injuries and in severe cases chronic ankle instability can occur. It is important to grasp the physiology and biomechanics involving the ankle so as to assess and treat an injury. The range of motion, ankle torque and plantar forces are a number of the pieces of data that contribute to this understanding. The acquisition of plantar force has been a very important a part of gait and stance analysis within the past, and as such various experiments to record this data are performed. Gait and stance analysis play an outsized role within the rehabilitation of ankle injury and management of symptoms in diseases such as cerebral palsy or the consequences of aging. It follows that gait analysis techniques are numerous and a number of other devices do exist to extract this data employing a form of methods. Many methods are guaranteed to a laboratory and require a user to walk in a specified pattern or along a particular contour while other methods have become less restrictive and cumbersome. However, none of those methods take under consideration, the position of the lower leg relative to the foot and the plantar force alone doesn't accurately portray joint position, though experiments that consider shear forces are trying to fulfil this need by combining the plantar force analysis with ankle range of motion analysis during gait and other activities perhaps more insight into the onset and pathology of problems with the gliding joint and gait may be provided.

Devices like these are often utilized in a clinical environment by physiotherapists and other medical or staff. Specifically, within the practice of physiotherapy, gait and range of motion information

are important diagnostic tools accustomed find appropriate treatments and assessments. However, a number of the practices during this field have qualitative aspects that rely heavily on the aptitude of the practitioner and as such interpretations and

results of the many tests can differ between individual physiotherapists within the case of musculoskeletal injury, assessments often involve viewing movement of the affected region, examining the muscles by hand to pity abnormalities and determining the amount of pain related to the injury This approach is sufficient for several injuries, but quantitative assessments could help improve the consistency of diagnoses among physiotherapists. Existing in-shoe plantar force sensors use a variety of force transducers, sensors and modalities. Hottest systems are attached to a shoe and either use a range of force transducer matrix or affix sensors to specific anatomical landmarks, though attaching sensors to a sole is additionally utilized in some commercial systems like the F-Scan system. Many of those implementations are used to track the effect of footwear on the walking cycle instead of to analyse normal gait, and no commercially available system incorporates ankle torque or range of motion information within the same device. Additionally, the systems that are available are quite expensive because of the price and complexity of transducer arrays and in and of itself don't seem to be widely used.

METHODOLOGY

Concept we are using Multi Connect sensors to analyse various factors, we aren't only detecting the matter but also are providing rehabilitation therapy using Vibration Motors together with storing the info to watch Recovery rate through IoT Based Cloud Platform. In our Project two Microcontrollers are used (i) Arduino Where all the Input sensors like Force Sensor, Accelerometer sensor, Temperature Sensors are connected because the Input of the Microcontrollers together with that MOSFET and Vibration Motors are connected as output of the Microcontroller to visualise the info two techniques are used the output can be monitored through LCD Display (ii) Node MCU Microcontroller is employed as second a part of the Project which has inbuilt Wifi Systems which is able to keep uploading the info to the cloud platform and therefore the data can be visualized both through Graph and Excel Sheet which can be helpful to watch or compare the newest and former data which is able to help us to indicate the improving trend of the topic supported which the subsequent course of action can be decided.

PROPOSED SYSTEM

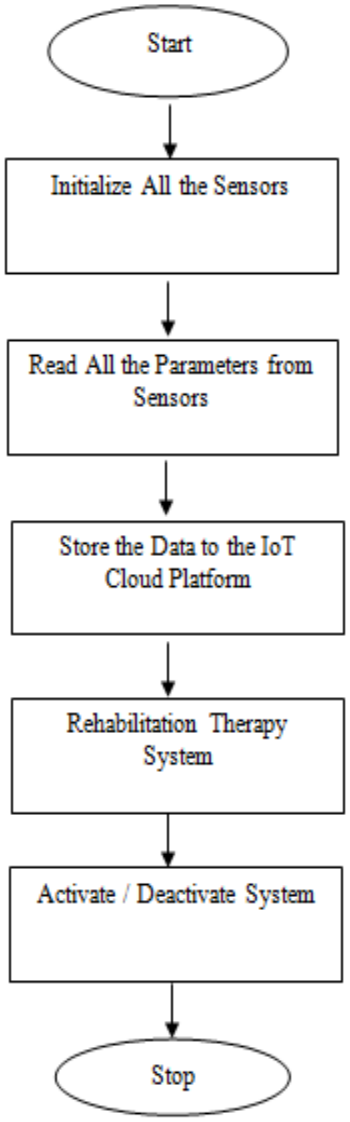
In our Proposed System, we present an inertial measurement units (IMU)-based physical interface for measuring the foot attitude, and a graphical user interface that acts as a visual guide for patient rehabilitation. The physical interface also is connected with therapy system, and provides feedback to the patient while reading the sensor parametric values. The system is also integrated with force sensor and temperature sensor to monitor changes and allows for in-home rehabilitation at an affordable price while engaging the patient through active therapy. According to the results, more consistent rehabilitation could be achieved by providing feedback on foot angular position during therapy procedures.

EXISTING SYSTEM

The diabetic foot is one in all the foremost devastating complications associated with diabetic. Its significance is expounded to a better incidence and amputation percentage likewise as deaths. Given the very fact that laboratory diagnoses trials are both limited and expensive, the foremost typical alternative continues to be supported disease's signs and symptoms. Therefore, the attending physician fills out a questionnaire supported its support instrumental measurements and its own observation. The aforementioned questionnaire will provide the considerable ideas for the diagnosis that also depends on the standards and therefore the consultant's experience. However, for a few variables like the laceration (injury or wound) and –or-location the previous dependency isn't acceptable. This paper aims to become the first link to optimize the diabetic's foot evaluation through the introduction of digital image processing techniques. The employment of advanced object segmentation techniques and a parameter that adjusts the system's sensibility until obtaining the specified results it had been possible to use an

algorithm to a series of trial images provided positive results for wound and site detection.

WORK FLOW DIAGRAM



Mechanism of Ankle Sprain

Lateral ankle sprains commonly occur during a frequent shift of body center of mass over the landing or weight-bearing foot. The ankle rolls outward, whilst the foot turns inward bringing the lateral ligament to stretch and tear. When a ligament tears or is overstretched its previous elasticity and resilience hardly returns. Some research scholars have explained situations where return to play is allowed too early, convincing sufficient ligamentous repair. Reports have proposed that the greater the extent of plantar flexion the upper the likelihood of sprain Yeung et al, 1994, in an epidemiological study of unilateral ankle sprains, reported that the dominant leg is 2.4 times more susceptible to sprain than the non-dominant one. A smaller common mechanism of injury involves eversion movement forcefully at the ankle injuring the healthy deltoid ligament.

Tissue Injury to Foot and Ankle

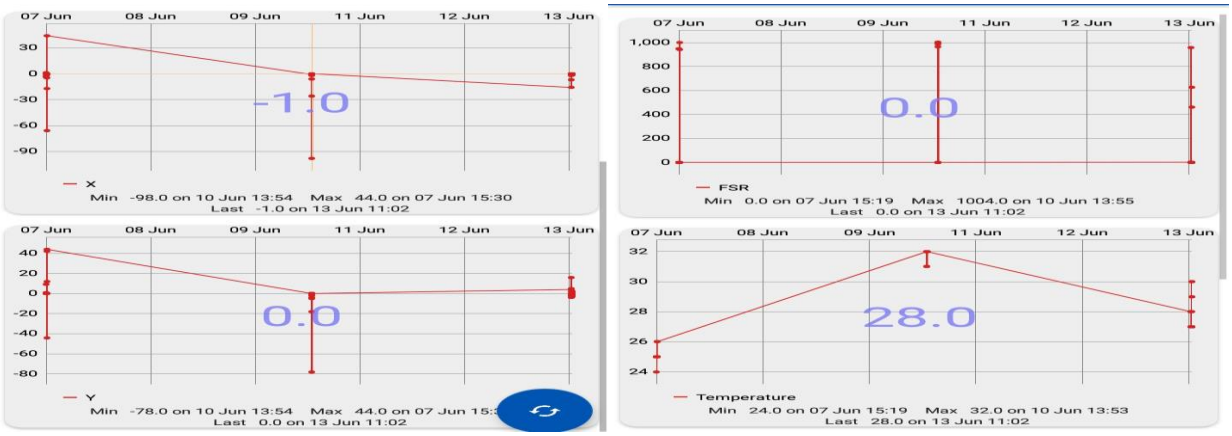
Complex trauma of the foot and ankle is characterized by fractures with severe soft tissue damage related to neurovascular injury and joint involvement. These injuries are frequently present within the polytraumatized patient and are a predictor of unfavorable clinical outcome. Within the initial approach to a patient with complex foot and ankle trauma, the choice between amputation and reconstruction is crucial. The assorted existing classification systems are of limited effectiveness and will function tools to help and support a clinical decision instead of as determinants of conduct.. The previous consists of definitive fixation and immediate skin coverage, using either primary closure (suturing) or flaps, and is sometimes reserved for fewer complex cases. Staged treatment is split into initial and definitive. The objectives within the first phase are: prevention of the progression of ischemia, necrosis and infection. The principles of definitive treatments are: proximal-to-distal bone reconstruction, anatomic foot alignment, stable internal fixation and adequate skin coverage.

RESULTS AND DISCUSSIONS

This displays serial sent from the Arduino board over USB or serial connector. To send data to the board, enter text and click on the "send" button or press enter. Choose the baud rate from the dropdown menu that matches the rate passed to Serial - begin in the sketch. Note that on Windows, Mac or Linux the board will reset (it will rerun the sketch) when serial monitor is connected. Note that the Serial Monitor does not process control characters; if the sketch needs a complete management of the serial communication with control characters, an external terminal program and connect it to the COM port assigned to the Arduino board.

Thingspeak Output for Clinicians

Thingview Output for User Reference



DISCUSSION

All the sensors said in the Block Diagram was connected and the data were observed and the output received from the device was satisfactory and reliable as there is not only detection but also solution based on non-invasive therapy which helps the subject by providing them relief and all the data's were also monitored through IoT Cloud platform and data were visualized through Graphical Format and Excel Sheet Format as future enhancement we would implement a shoe module using machine learning which will help the subject more effectively by understanding the stored values.

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