Leg Motion Tracker

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Abstract –Tracking human motion attracts significant attention from several areas such as animation production, ergonomics, sport medicine, and biomedical analysis. First, it was intended to detect human motion by using accelerometers. However, after conducting many research and experiments, it was concluded that accelerometers have limitations in detecting motion. In other words, one accelerometer alone cannot detect horizontal movements (on any horizontal ring on a sphere) when there is no dynamic acceleration. One of the proposed and tested solutions was to use compass sensors to compensate for the accelerometers limitations. Therefore, three accelerometers were used to detect the motion of arms, head, neck, and back and the horizontal movement of the back at various angles. The proposed system had lead satisfactory results hence another approach to measure leg movements was implemented.

KEYWORDS: Leg Motion, Accelerometer, Tilt sensors, Microcontroller.

I. INTRODUCTION

The study of human body segment movements attracts significant attention from several areas such as animation production, video game console, ergonomics, sport medicine, rehabilitation and biomedical analysis. This project was inspired by the Occupational Health Department at Ryerson University. “Manual material handling, particularly lifting poses a risk to many workers and is considered a major cause of work-related low-back pain and impairment. The total cost of low-back pain disorders in the United States was estimated to be $90 billion in 1998, and costs have continued to increase. The increased prevalence of low-back pain in the world and its potential future magnitude has motivated many researchers to search for the best methods for estimating the conditions that can potentially increase the incidence of back pain. Biomechanical models such as Link Segment Model (LSM) are used for calculation of forces and moments on all human joints since direct measurements of forces and moments are not practical or feasible in most cases. With the aid of these models, organizations like National Institute of Occupational Safety and Health (NIOSH), have developed equations and guidelines designed to help practitioners and engineers design workplaces that are less problematic for workers. To test the accuracy and precision of devices promising to reduce the forces and moments on human body, such as lumbar spine or lower back, there is the need to monitor body movements and analyzing the obtained data.

II. OBJECTIVES

The main objective of this paper is to identify the leg diseases by determining the muscle contraction in the leg using the tilt sensors. A tilt sensor converts acceleration into a electrical signal. Depending on the tilt value the diseases will be displayed.

III. LITERATURE SURVEY

A). Interactive markerless articulated hand motion tracking using RGB and depth data

In this paper they described a novel markerless hand motion tracking method that captures a broad range of articulation in the form of kinematic skeleton at near-real time frame rates. Hand tracking is inherently hard because of large number of degrees of freedom, fast motions and homogeneous color distribution of skin. Most previous real time markerless approaches captures slow and simple articulated hand motion since reconstruction of a broader range of complex motions requires offline computation.

B). Arm Motion Tracker

This paper presents the AMT device. AMT is an Arm Motion Tracking device that monitors the arm movement. It does that using IMU sensor and tinyduino. AMT will be used on patients suffering from duchenne muscular dystrophy. It will monitor their arm movement and provide necessary data to the FDA.

IV. SYSTEM OVERVIEW

The hardware of a wireless stand-alone human body motion detector for real time tracking of the sensors is in a virtual environment. The design consists of tilt sensors, Arduino and LCD. A tilt sensor is a sensor that converts acceleration into an electrical signal. Both dynamic and static acceleration can be measured using a tilt sensor where dynamic acceleration is the acceleration due to any force except for the gravitational force applied on a rigid body and static acceleration is due to the gravitational force. Depending on the tilt values further action will be taken.

V. BLOCK DIAGRAM

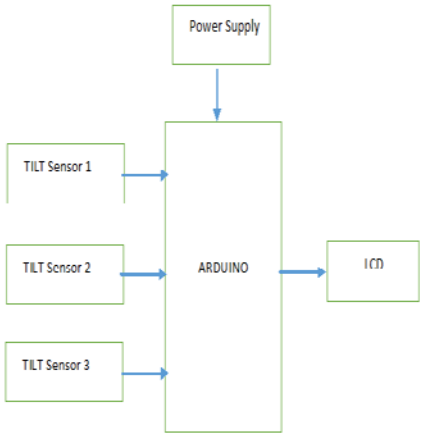

Fig: 5.1 Block Diagram

5V power supply is given to the Arduino. Three tilt sensors are connected to the Arduino. Each sensor measures the angular movement and also sense the environment input such as heat, temperature and moisture, whereas these sensors convert electrical input into an analog output. Each sensor has three terminalsVcc, angular movement and ground is directly connected to the Arduino.

Tilt sensor which directs to the x position, tilt sensor which directs to the y position, tilt sensor which directs to the z position of which these three sensors has three terminals Vcc, angular movement, ground are connected to the Arduino. The output of the system is displayed in the LCD and it also shows the result such as angular movement value, disease name as well as precaution of the disease.

VI. COMPONENTS DESCRIPTION

A) TILT SENSOR

Tilt sensor produces the electrical signals for each angular movement that electrical signal ranges at different motion. Power supply is provided by the VCC terminal and output result as analog signal. Tilt sensor measures the tilting position with reference to the gravity and are used in numerous application.

B) LCD

Liquid crystal device is a electronically modulated optical device, which do not emit light directly instead by using backlight or reflector to produce image in color or monochrome. It can be available to display in both arbitrary images and fixed images with low information content.

C) ARDUINO BOARD

Arduino board are sets of digital and analog input/output pins, It can be designed a variety of microprocessor and controller.The microcontrollers are typically programmed.It can be controlled the whole circuit based on the preprogrammed.

D) POWER SUPPLY

A power supply is a device which supplies electric power to an electrical load.Power supply mainly to convert electric current from a source to the correct voltage,current and frequency to power load.

VII. RESULT

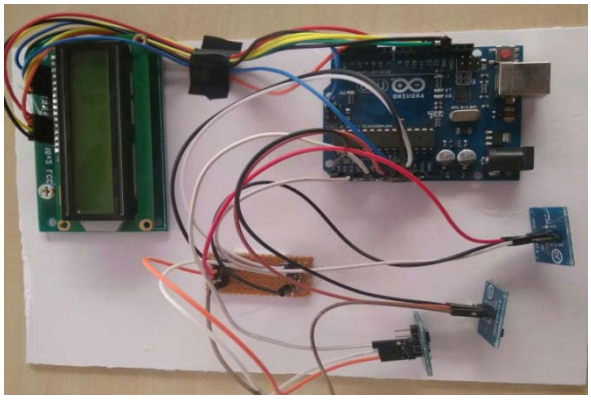

Fig: 7.1 Output

This paper describes the development of Leg Motion Tracker by using a tilt sensor. The tilt sensor senses the areas where muscle contractions don't takes place. The disorders that don't allow the muscles to contract will be displayed on the LCD. The diseases that are displayed are peripheral artery diseases, osteoarthritis (degenerative joint disease),femoral neuropathy, restless leg syndrome and etc.

VIII. CONCLUSION

In this paper, the device has a potential to function as a leg motion tracking system. In this system, tilt sensors are measures the angular movement value. These values are displayed by the LCD display. This technology is enhanced to measure the patient's insensibility without making any disturbance to the patient and it also display the disease name as well as precautions of the leg diseases. This is also cost efficient and reduces the effort made by patient.

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