Human Knee Joint Movement Monitoring using Accelerometer

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Abstract— In the present world the number of health issues are increasing a lot. The most common problem is weakness in knee joint according to sedative counseling. There is no proper product to measure the movements of human knee under observation. If we can measure the movements than it will allow faster recovery of bones near the knee joint with a perfection. Here we are showing a device using two accelerometer to monitor the movement of a human knee joint to measure the accurate value of change form. It will also helpful for athletes.

Key words: Knee Joint Movement Monitoring, Accelerometer

I. Introduction

In this article, going to introduce an angular movement measuring device which is placed on a modest and affordable range. The execute curvature device shaped of MEMS technology through of strong use for accurate curvature measurements with a great acuteness. The basic agreeable precedence of this device are integrity and flexibility. This is wearable, non-invasive and secure. The sensor provides a possibility of monitoring human joints movement using wearable computing, along with an Android software combination.

Day by day we have become more dependent on computer system and basically on internet. Now a days we can maintain our daily needs such as Home automation, utility meters, appliances, security systems, card readers, and building controls just by a software or specific internet browser. Web access is embedded in a device to enable chip cost widely accessible and enhanced user interface functions for the device which can provides access to the user interface functions for the device through a device web page. Even in an appliance can controlled by a web server with internet connection. This device will be beneficial for both pharmaceuticals and game. Normally the sensor for this requisition is dependent upon power tweak, and the most well-known usage are dependent upon force balance because of bowing of optical fiber.

II. Objective

If an athlete gets injure in the knee, maximum care should be taken as soon as possible to recover. In this case the exact value of bending around knee as an athlete have regular activity, essential to notice every moment. It will take a long time to recover the injury if unknowingly the athlete bend his injured knee repeatedly. For this reason we come up with a system that contains two accelerometer sensor placed one above and other one below the knee joint for fastest recovery. So that athlete will be aware about the safety and if anything coming wrong they can correct themselves. This will help them to get well soon. A pie chart will provided on an android based smartphone. The physician also can provide the appropriate medication and advice by using the pie chart.

III. Literature Survey

Yili Fu A light intensity modulation fiber-optic sensor, which can measure curvature directly, has been developed. It is suitable for the measurement of thin, embedded or highly flexible structures. An experimental analysis on the static and dynamic characteristics of sensor has been undertaken. Curvature fiber-optic sensors can be used to build a quasi-distributed fiber-optic sensor system, which can measure curvature and torsion angle simultaneously.

Jovan S. Baji´cIn here, the characteristics of the sensor measured in laboratory conditions as well as measurements of the human knee joint Movements are given. In this paper sensor Sensitivity and resolution, in the measurement range, are 20 mV/° and 1°, respectively. The fabrication process of proposed curvature sensor is also given. Wireless electronics based on ZigBee are also presented. Therefore, the sensor can provide wireless measurement.

Haiting Di A novel fiber-optic sensor that can measure curvature directly has been developed previously. In this paper, the transduction of curvature to light intensity is described analytically by using the geometrical optics analysis. The mathematical model allows a quantitative optimization of the sensor without having to produce many sensors with slightly different combinations of parameters in order to accomplish a similar objective experimentally.

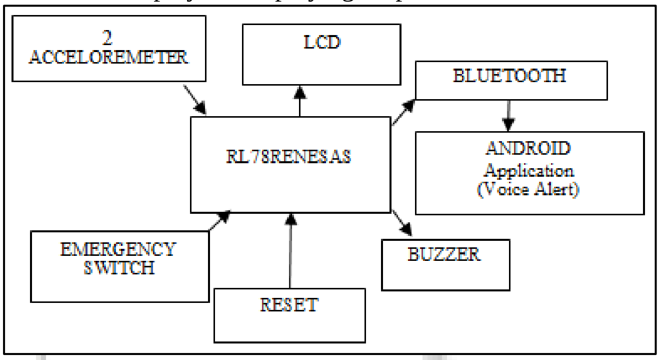
Daniel A. James A sensor data acquisition platform has been developed for in-situ sporting applications encompassing stand-alone high speed sampling and storage of multiple accelerometer data. Ambulatory monitoring of elite athlete in competition or training environments was then undertaken. The platform itself is divided into functional blocks and controlled by a small microcontroller using a custom OS. Hence it is easily customizable for a variety of sporting applications.

Also, the resulting human joint movement monitoring system enables sending measured data over the internet, which provides a possibility of continuous and remote monitoring. This important feature makes the proposed sensor system a better solution in comparison to other sensing systems for human joint movements monitoring.

IV. Working Procedure

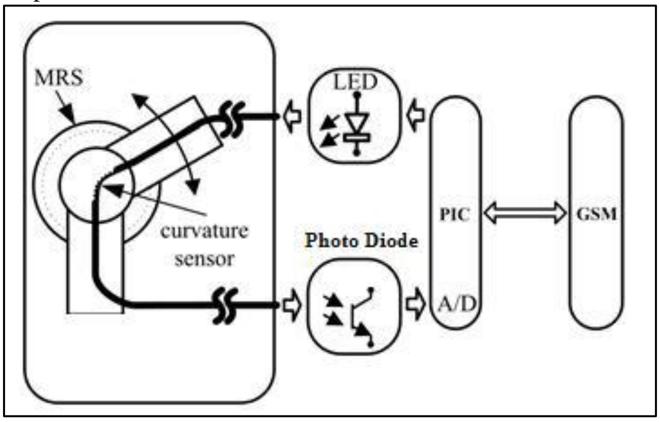
As the major electronic device run in the DC, the construction of a power supply is necessary. The uses step-down transformer for steeping down the 220V AC to 12V AC. A bridge rectifier is used to rectify the 12V AC into 12V DC. The IC regulator is used to convert 12V DC to 5V DC. The power supply is getting constant 5V DC as output.

The curvature sensor is optimized for small curvature measurements, and has a high sensitivity in a wide measuring range. The power supply and curvature sensor is connected to PIC controller. The 5V DC is given input to PIC micro-controller. It has 40pin IC. The only 35 single-word instructions to learn. The Operating speed is DC – 20 MHz clock input and DC – 200 ns instruction cycle. Up to 8K x 14 words of Flash Program Memory, Up to 368 x 8 bytes of Data Memory (RAM), Up to 256 x 8 bytes of EEPROM Data Memory. Pinout compatible to other 28-pin or 40/44-pin PIC16F877A microcontrollers. The LCD and Bluetooth is connected to PIC microcontroller. Wireless communication electronics based on Bluetooth standard, by which the sensing part of the system communicates with a Mobile Station, is developed for this sensor. Here using 16×2 LCD display for displaying output.



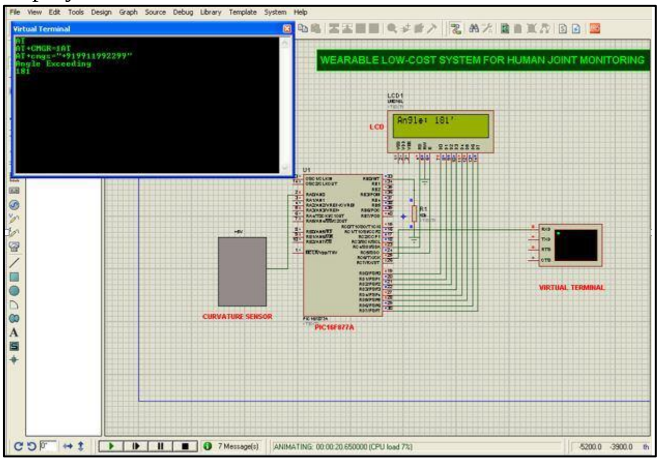
Shows a block diagram of the experimental setup for angular movement measurement. For laboratory tests sensor is mounted on an improvised joint, which is attached to a precise manual rotation stage (MRS) produced by Thorlabs,

Inc. As a light source and detector, LED and transistor are used. High power LED, BC 547 with the peak wavelength of 660 nm, and NPN transistor produced by Industrial Fiber Optic, Inc. are used. The transistor provides a very high optical gain, eliminating the need for the post amplification.



The software package splits into three parts very conveniently namely, ISIS (Intelligent Schematic Input System) for drawing circuit diagram etc., ARES (Advanced Routing and Editing Software) for producing PCB layout drawings, LISA(Lab center Integrated Simulation Architecture) for simulation of circuit diagram.

The curvature sensor is connect to PIC microcontroller. The manually we want change the angle in the curvature sensor. We set angle 80 degree in the curvature sensor. If angle is excited above 80 degree the message will sent. The message is will display in the LCD display.



V. MERITS

- In a very low cost this device will provide lots of advantage.
- Sensors are modest, light weight and portable.
- Sensor is wearable, non-invasive, nonintrusive, and completely harmless.
- Sensors are also electrically safe and immune to any radiations.

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