Pure Spines - An IoT Enabled PersonalAssistant to Predit the Arrival of Back and Leg Pain for Healthier Human Life

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Abstract— **In India 42% of the human beings are affected by back pain due to many reasons. In that most are women's of about 60.9% and men's are about 29.1% are get affected.60.9% of women's are affected by the back ache in the early pregnancy duration. In India 2.1% peoples of overall population are physically challenged humans. In that 2.1%, 31% of peoples are affecting by low back pain due to long duration of sitting. Our aim is to pinpoint and examine continuously to control back pain (spinal strain) in humans during normal work style due to various medical and non-medical issues. Though there are many products like gel, seating cushions are available to cure back ache but there is no effective device to monitor the back pain. So Our "Pure spines"is going to develop a Mobile Application and devices to maintain good health of spines and bones for peoples working for long time. And to develop our project slipper and sitting pads are interfaced with Mobile Application to indicate the arrival of spinal problems. And it is used to communicate the users through the application we are developing for android mobile phones. The App and devices are to be designed based on user centric in such a way to monitor the arrival of back pain based on the physic of the customer. So it is helpful for theIT peoples, working pregnant women, teachers, tailors, drivers and physically challenged people.**

Keywords—Sitting pad, pressure sensor, load sensor,Software Application

I. INTRODUCTION

In India, 42% of the adult populations are affected by LUMBAGO (pain in their lower back) and DORSALGIA (pain in their middle back) to modern lifestyle, work culture, and various medical reasons. In that, 60.9% are women and 39.1% are men. Most of the working pregnant women, physically challenged people and IT Professionals, Bankers, Teachers, Tailors who have a profession for long sitting and standing are affected by back pain related issues. They are the primary customer of our product to maintain health by predicting the arrival of back pain. Secondary customers are Patients, doctors, family members of users who need to monitor the spinal problems to rehabilitate. This health problem affects normal life and career of the individual as well as the organization and the nation's growth, so there isa need for the development of a device as personal assistant to predict the arrival of back and leg pain and monitor the health of the people using an Intelligent Electronic Slippers and

Sitting Pads in Human through Mobile Application to achieve the sustainable development of the nation.

The aim of this project is to develop a prototype which integrates both hardware and software system for the detection of the arrival of spinal problems which can help to maintain the good health of spines and bones naturally without treatment. Development of Mobile Application and devices to Maintain good health of spines and bones for peoples working for a long time. To develop a product which will have a pair of electronic slippers and sitting pads this will be interfaced with Mobile Application to indicate the arrival of spinal problems. These devices should be normally without physical irritation or in a special way. The App and devices are to be designed ergonomically such a way it can predict the arrival based on the physic of the customer. The app to be designed will be IOT enabled which will act as a Personal Assistance for health Monitoring and dates to be stored and viewed by users, users family members and doctors.

The proposed system mainly focuses on the posture of the spinal cord of the human life to maintain good and healthy life. Once the implementation is successful by advancing the proposed system, we can integrate the developed system in the health sector. This will help everyone to lead a healthy and healthy life They need a continues monitoring device while working to indicate the arrival of LUMBAGO (pain in lower back), DORSALGIA (pain in their middle back) and leg pain. A Personalized mobile application to monitor spinal strain to avoid inefficiency in working time and for new joggers and travelers to eradicate early stage cramps. Existing devices like spinal belts, gel causes discomforts and costly to avoid these they need an alternate easy use device. A device to monitor spinal strain during normal life, due to various medical and non-medical issues and send the details to the family members or caretakers. Development of Mobile Application with cloud storage for monitoring the health of spinal strain occurred in their patients for the doctors for better treatment and consulting is needed.

Pure spines will act as a personal assistant for Employees who work for a prolonged time by sitting and standing witha pair of electronic slippers and sitting pad interfaced to a mobile application which will be easy access for the

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customer at any working conditions. Our product aims to detect spinal strain by continuous monitoring to avoid back pain-related issues at the early stages. Pure spine will have a special feature for pregnant women to avoid back pain and leg pain (i.e.) as the baby weight increases the device will adjust the indication time automatically. Since we are developing special electronic slippers and sitting pads with the app it can be used naturally and comfortably. Our Mobile Application with cloud storage for monitoring the health of spinal strain will act a caretaker it will tell what kind of action to be taken to rehabilitate from pain. Elders and the physical challenged person can't take care of themselves or tell their strain to their family our device with IOT technology is designed as a family app and also for the doctor to take care of them.

The slippers and sitting pads which we designed can predict the arrival of back pain according to the increase in weight due to the growth of the baby in an abdomen. Our slippers are made of sponge type material which does not cause any leg pain issues and monitors the arrival of back pain to the customers. In our sitting pads, the user can change their posture and then the device can measure the pressure according to their posture and send a notification. The sitting pads are made in soft type materials which indicate back pain and it is cost-efficiency.

LITERATURE SURVEY
1. MONITORING SEAT BACK USING AN ELECTROTEX TILE SENSOR MATRIX
The University of Manchester -2016

Lower back pain is one of the most common prevalent spinal diseases, where up to 84 percent of adults are reported to experience pain within their lifetime (Ninds.nih.gov., 2016). As reported, bad or incorrect postures are one of the major contributing factors for this condition. This project report describes the design and development of the technology for a textile-based posture monitoring system by using a sensor matrix combined with accelerometers. The proposed system references the pressure distribution resulting from a human back when leaning against a soft backrest, on which a network of pressure sensors and accelerometers are placed. The…This paper shows the language recognizing of 26 hand gestures in Indian signing using MATLAB.

2. SITTING POSTURE MONITORING SYSTEM BASED ON A LOW COST LOAD CELL USING MACHINE LEARNING
Sensors (Basel) 2018 Jan

Sitting posture monitoring systems (SPMSs) help assess the posture of a seated person in real-time and improve sitting posture. To date, SPMS studies reported have required many sensors mounted on the backrest plate and seat plate of a chair. The present study, therefore, developed a system that measures a total of six sitting postures including the posture that applied a load to the backrest plate, with four load cells mounted only on the seat plate. Various machine learning algorithms were applied to the body weight ratio measured by the developed SPMS to identify the method that most

accurately classified the actual sitting posture of the seated person. After classifying the sitting postures using several classifiers, average and maximum classification rates of 97.20% and 97.94%, respectively, were obtained from nine subjects with a support vector machine using the radial basis function kernel; the results obtained by this classifier showed a statistically significant difference from the results of multiple classifications using other classifiers. The proposed SPMS was able to classify six sitting postures including the posture with loading on the backrest and showed the possibility of classifying the sitting posture even though the number of sensors is reduced.

3. WEARABLE POSTURE MONITORING SYSTEM WITH VIBRATIONAL FEEDBACK
International Journal of Engineering Research & Technology

Around 50 billion dollars is spent yearly on therapy for low back pain in the United States alone. Low back pain is one of the most common reasons for doctor visits. Having poor posture has been found to be a main cause of lower back pain as it impacts the transverses abdominis muscle. Maintaining a good posture and changing one's position from time to time is considered to significantly improve and maintain one's health. The world has witnessed a vast amount of smart monitoring devices that are used to enhance the quality of life by providing different types of support. Smart wearable technology has been the main focus of this century, specifically in the medical field, where the advances range from heartbeat monitors to hearing aids. This report highlights the design, development and validation process of a compact wearable device that uses multiple sensors to measure the back posture of a user in real time and notify them once poor posture is detected.

4. Bad Posture Detector using Arduino

International journal of innovation and scientific research Embedded systems have become very popular in recent years, and that field is rapidly advancing especially in health monitoring technology. Therefore, we present in this paper an application for posture correction, utilizing microcontrollers and ultrasonic sensors. When a bad posture is detected, the user is noticed. Our system is designed specifically for computer users to prevent them from leaning too close to their computers' monitors.

5. The effects of an office ergonomics training and chair intervention on working knowledge, behavior and musculoskeletal risk
Liberty Mutual Research Institute for Safety, Hopkinton, MA 01748, USA.

A large-scale field intervention study was undertaken to examine the effects of office ergonomics training coupled with a highly adjustable chair on office workers' knowledge and musculoskeletal risks. Office workers were assigned to one of three study groups: a group receiving the training and adjustable chair (n=96), a training-only group (n=63), and a control group (n=57). The office

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ergonomics training program was created using an instructional systems design model. A pre/post-training knowledge test was administered to all those who attended the training. Body postures and workstation set-ups were observed before and after the intervention. Perceived control over the physical work environment was higher for both intervention groups as compared to workers in the control group. A significant increase in overall ergonomic knowledge was observed for the intervention groups. Both intervention groups exhibited higher level behavioral translation and had lower musculoskeletal risk than the control group.

3. EXISTING SYSTEM

Sitting posture monitoring systems (SPMSs) help assess the posture of a seated person in real-time and improve sitting posture. To date, SPMS studies reported have required many sensors mounted on the backrest plate and seat plate of a chair. The present study, therefore, developed a system that measures a total of six sitting postures including the posture that applied a load to the backrest plate, with four load cells mounted only on the seat plate.

4. PROPOSED SYSTEM

The pressure created in human while standing is needed to monitor for predicting the arrival of back pain the best way is to measure the weight applied using an electronic pair of slippers. This left leg slipper observes the pressure and evaluates using a load and pressure sensor and sent the data using Bluetooth Enabled Arudino. This electronic slipper also designed to measure the pressure applied using a load and pressure sensor and using the Arudino receives the data from the left leg controller synchronize both the data and transmits to Mobile App to predict the arrival back pain and leg pain. This Ergonomic sitting Pad is used to calculate the time duration of the user sitting and indicate it to Mobile Application. It has two to four Pressure sensor, two load cell and Arduino. This sitting pad can be synchronized to slippers if needed for monitoring both sitting and sending time-based on the need of the user. A mobile application will be developed as a Personal Assistant with IOT Enabled data sending and storing. This application software is designed to run on a mobile device, such as a smartphone or tablet computer. Our Pure spine app is mainly used for Acting as a personal assistant for human Receiving of data from the controller ,Predicting and notification the back pain arrival to the users, Storage of body stress level on regular basis, Adjustable prediction of pain arrival for pregnant women as Labour grows, Sending of data to multi users- care takers for elders or physically challenged person, doctors for studying the patient for better treatment, interact with the user to take Limit bed rest, Keep exercising, Maintain good posture .

Block Diagram and Explanation:
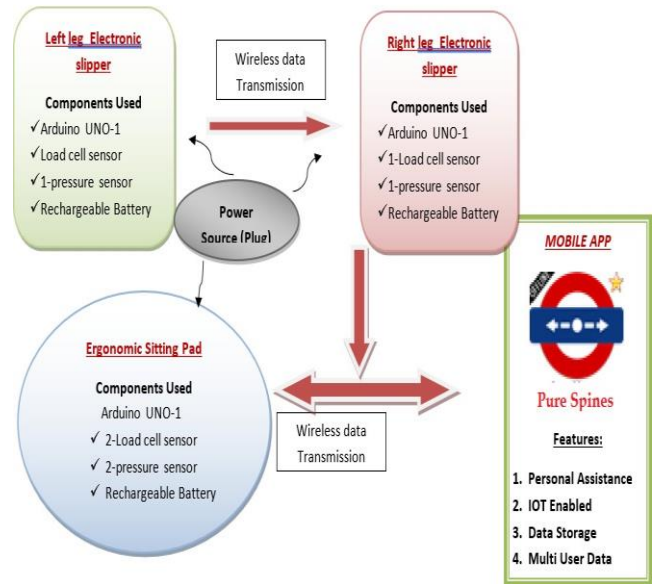
A. DESCRIPTION

a . Load Sensor

A load cell is an electronic sensor for measuring weight and force. When a force is applied to it, a weak electrical signal at the millivoltage level appears on its output wires. In fact, the load cell is a transducer which converts force into measurable electrical output. A load cell consists of a metal core and a set of electrical resistances that transform when a force is applied to it. But after the force is removed, it returns to its original state. The reversibility of this material determines the quality and accuracy of the load cell. The equivalent electrical circuit of a load cell follows:


Fig. Load Cell

b. Arduino

Arduino are inexpensive compared to Microcontroller platform. it was to published as open source tool. AVRC programming code directly into Arduino program. The process extract and install all the requires to execute properly the Arduino software.

b. pressure sensor

A pressure sensor is a device for pressure measurement of gases or liquids. Pressure is an expression of the force required to stop a fluid from expanding, and is usually stated in terms of force per unit area. A pressure sensor usually acts as a transducer; it generates a signal as a function of the pressure imposed. For the purposes of this article, such a signal is electrical. Pressure sensors are used for control and monitoring in thousands of everyday applications. Pressure sensors can also be used to indirectly measure other variables such as fluid/gas flow, speed, water level, and altitude.
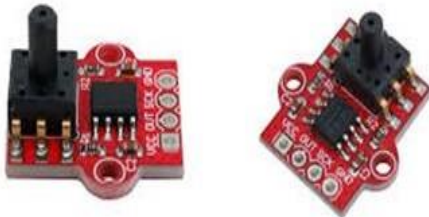
c. Sitting Pad

In our sitting pads, the user can change their posture and then the device can measure the pressure according to their posture and send a notification The sitting pads are made in soft type materials indicate back pain and it is cost efficiency

e. Slippers

In our slippers the user can change their leg position and then the device can measure the pressure according to their and send a notification The slippers are made in medical materials indicate back pain and it is cost efficiency

f. HX711 driver

HX711 is an IC that allows you to easily integrate load cell into your project. No need of any amplifiers or dual power supply just use this board and you can easily interface it to any micro-controller to measure weight. The HX711 uses a two wire interface(Clock and Data) for communication.

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Our Mobile Application with cloud storage for monitoring the health of spinal strain will act a caretaker it will tell whatkind of action to be taken to rehabilitate from pain

5. FUTURE SCOPE

The proposed system mainly focuses on the posture of the spinal cord of the human life to maintain good and healthy life. Once the implementation is successful by advancing the proposed system, we can integrate the developed system in the health sector. This will help everyone to lead a healthy and healthy life.

6. CONCLUSIONS

Pure spines will have the following impact in the user/ customer life in maintaining good health and also it will have a sizable market in the healthcare sector due to the following reasons

1) In India, 42% of the people are affected by back pain due to various reasons. Our product will be useful for those people

2) In India out of 100 pregnant women 20 women are working they need a product like pure spines to monitor the arrival of back pain and leg pain.

3) Modern jobs professionals to work with sitting before computer for a prolonged time (E.g: IT, BPO, Bank, etc.) needs a product like pure spines to take care of health naturally.

4) Our product will be a unique device in the market as it will act as a personal assistant for the well-being of humans. It can be used normally by users, there is no need of special knowledge except app usage.

5) Pure spines will be customized as user-centric design with satisfying all ergonomic constrained design. Slippers and Sitting Pad is designed for comfortable usage for all age groups with back pain issues.

6) Our product as we mentioned as a personal assistant will have a slipper and sitting pad which will be easy access for the customer at any working conditions.

7) Multiple user facility of the Mobile App will make the family members of elders and physically challenged to feel safer and secure on body pressure of the user.

8) Spine, pregnant women Doctors may suggest pure spines product to their patient for continues health monitoring.

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