Posture Detection and Alerting System Using Rtsc Algorithm

A.Kumaresan., M.SureshAnand, K.Deepak Keshav , G.Karthikeyan, B.Vigneshwaran

Abstract: ***In order to detect and correct the posture we developed a wearable garment integrated device to sense the posture of the user and analyze the posture within the device to alert the user remotely. Further the posture data are sends to the server to analyze the data in detail. Device contains the accelero-meter sensor to detect the angle of the user. From the angle the posture is calculated using the microcontroller in the device. The posture is analyzed and if bad posture is detected then the buzzer sensor present in the device alert the user to correct the posture. The bad posture data are sends to server through the wifi module present in the device. The data are stored in the database along with time, date and device id. The month wise statistical graph is developed from the data in the database. Daily analyzes of the posture data is done to provide the average posture of the user and worst posture of the user. The report of the analyzed data can be generated in the website through user authentication.***

Index Terms:: Posture, accelero-meter, buzzer, wifi module, posture correction, report, and wearable device.

I. INTRODUCTION

Changes in the general public workforce in the most recent decades has constrained the grown-up populace to invest extensive stretches of energy in a sitting position in the work environment that combined with an inactive way of life at home is related to medical issues, for example, back and neck wounds. This issue is brought about by terrible posture of a human body. Posture is the situation in which we hold our bodies during the actions like standing, sitting, or resting etc. Without the posture and the muscles that control it we might have chance of basically tumble to the ground. Great posture is the right arrangement of body parts bolstered by the perfect measure of muscle strain against gravity. Great posture encourages us keep joints and bones also maybe in right arrangement so our muscles can be utilized accurately and lessens the weight on the tendons holding the spinal joints together, limiting the probability of damage.

The carelessness of the bad posture leads the human beings to the problem of serious backbone issues. When the individual is aware of his posture and tries to correct the posture,it will be stored as the muscle memory, thus helping that individual adapt to a good posture.But the user needs to be aware of the posture because, when the user is working,the individual's concentration will be on the work he is doing.So many investigation groups have been working in order to solve the problem of an incorrect posture.An accelero-meter is an electromechanical sensor that measures acceleration forces.

The improvement of MEMS advancement has changed the primary accelero-meter applications, making them more diminutive, lower control and progressively precise. We provide a solution for the users who suffer from this bad posture problem by alert the user to correct their posture by using MEMS accelero-meter sensor measurement. The MEMS accelero-meter will be attached to a wearable garment. Using the node mcu esp8266 and the accelero-meter we provide a solution to alert the user to correct the posture and website interface to long term monitoring of the user posture along with the report generation facility for their reference when they consult a doctor. The report comes handy for the doctor's reference to identify how bad the user posture and how much improvement the user showed. With the report generated from the website proper exercise to recover from the damage occurred due to bad posture..

II. RELATED WORK

Intelligent Chair Sensor works on Classification and Correction of Sitting Posture by L. Martins and etal. provide a solution to correct the incorrect posture by intelligent chair sensor. The posture is detected by using the pressure sensor attached to the intelligent chair. The posture classification is done by five institutionalized postures trained through neural networks. The posture correction is done through of the changing angle of the chairs seat and backrest by changing the pressure pneumatic bladders present in chair [7].

A RTSC(Real Time & Self Calibrating) Algorithm Based on Tri-axial Accelero-meter Signals for the Detection of Human Posture and Activity done by Davide Curone and etal. provides a algorithm for detecting the human posture in realtime using tri-axial accelero-meter.The algorithm converts the accelero-meter values into readable values for the processing of data. The microprocessor directly attached to the sensor transimmit a reduced time of the information and the bit map.This algorithm also provides an real-time activity level detection for elderly surveillance using one tri-axial accelero-meter [1].

Bearing defect detection using on-board accelero-meter measurements by Dr. John Donelson and etal. is used to detect the working of the roll bearing in the railroad freight cars. Vibration signature of the roll bearing is detected using the accelero-meter onboard. This reading is analyzed to develop the algorithm to detect the bearing defect. It uses both the ordinary and spectral analyze of the data accelero-meter to detect the known defect of the ball bearing [2].

Wearable & Ambient Sensor-Fusion for the Characterization of Human Motion by Douglas McIlwraith and etal. uses the accelero-meter and gyroscope

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to detect the detailed 3D posture of the user. The device is used to monitor the elderly and chronic disease patient in their homes. The data from the accelero-meter attached to the ear and gyroscope attached to the body so that the full body posture is mapped using the algorithm. The continuous monitoring helps the algorithm to be trained to know the constant pattern of the user so if there is any change in that patterns then the device detect the neurological changes [8].

Forward flexed Posture Detection for the Early-Parkinson's Disease Symptom by Wen Shao Wu and etal. proposes a device that detects the chronic disease such as Parkinson's and also Alzheimer's diseases using a single axial accelero-meter to form a linear transformation of forward flex of the user. Algorithm based on CORDIC is used to convert raw accelero-meter reading into tilting angle of the user. The accelero-meter is embedded with the microcontroller and power supply.CORDIC based algorithm can reach the accuracy 0.1 degree. Further reducing the complexity time less algorithm is proposed to detect the body lean forward tilting angle while moving [5] .

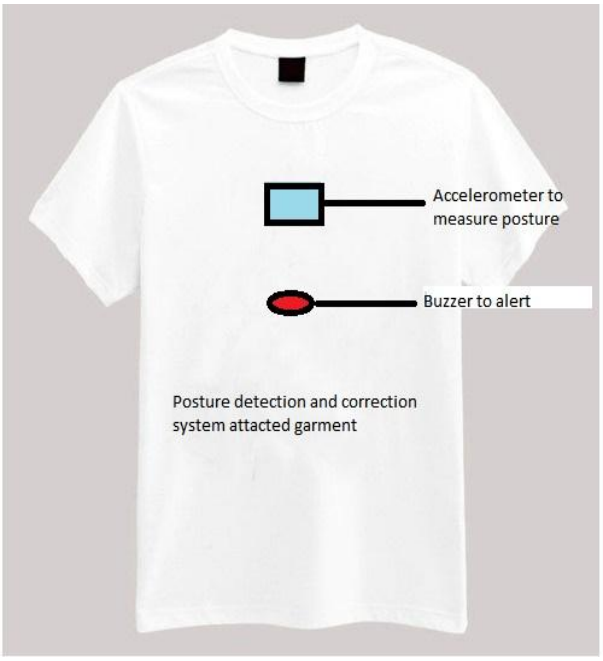
Light Weight Online Un-supervised Posture-Detection through Smartphone Accelero-meter ÖzgürYürür and etal. proposed to detect the posture of the smart phone using the accelero-meter present in the Smartphone. It provides the user state information like sitting, standing, walking and also running. Lightweight process is used analyze and classify without any priori information. Online processing is used to reduce the computational burden and the Smartphone accelero-meter can also be used in reduced frequencies [6].

Clinical apps of sensors for human-posture & movement analysis: A review by WAI YIN WONG and etal.proposed to measurement of human posture and movement is an important area using accelero-meter, gyroscope, flexible angular sensor, electromagnetic tracking system and sensing fabrics. The data collected from this sensor are used for clinical analyze of the data to provide a human posture measurement for clinical application [3].

The Design of InLine Accelero-meter Based Inclination-Sensing System by Xu Yao and etal. used to measure the tilting angle of the user by tri-axial accelero-meter. Using the low power microcontroller and digital accelero-meter accurate measurements are obtained. Implement a novel algorithm on the microcontroller the raw data from the accelero-meter is converted in inline angular form [4]..

III. PROPOSED SYSTEM

The wearable garment is designed which as an accelero-meter, node mcu ESP8266 with build in wifi module and buzzer with a power supply. The web interface support is also given with an authentication for individual user. Device the user to correct their posture. Accelero-meter calculate axis of user upper body A RTSC (Real Time & Self Calibrating) Algorithm Based on Tri-axial Accelero-meter Signals is used for calculating human posture and activity Device compares the posture value with the threshold value The threshold value normal human posture from Intelligent Chair Sensor paper Classification and Correction of Sitting Posture is collected from 5 neural network data which is normalized and used.



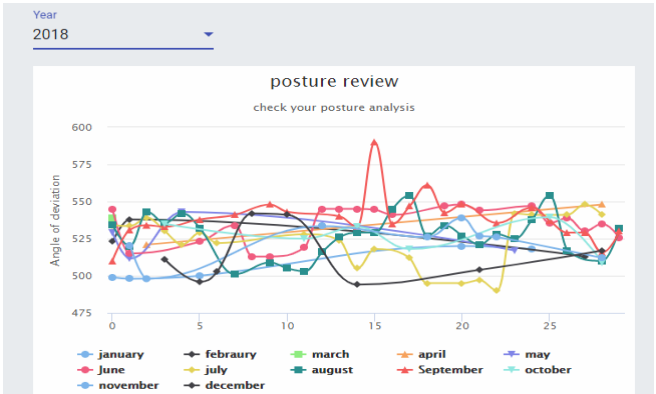
Accelero-meter reading measured in the voltages are converted into accelerations (xG, yG, and zG), measured as multiples of g by

- xG =(x − V0)/Sx
- yG =(y − V0)/Sy
- zG =(z − V0)/Sz

If the value exceeds the threshold limit for the duration of a minute the device remains the user to correct the posture through the buzzer. When buzzer is activated then device sends posture value to the server using the wi-fi on the device

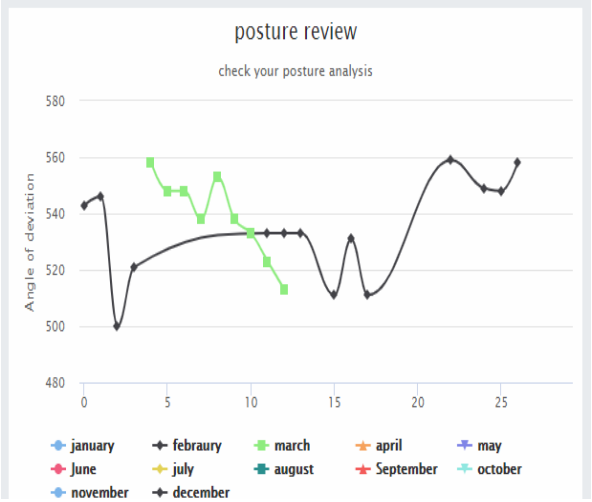
The accelero-meter reading data that are collected are stored in database along with the date, time and user id. This information are analyzed to form real-time monthly statistically varying graph. The report can be generated in PDF form which contains graph and analyzed table. The analyzed table has the highest value and the average value for every day.

IV. DATA ANALYSIS



Graph 1

For the user1 the data from the year 2018 are analyzed. The data are obtained from the manual model, no actual user are used to measure the value. From the graph most of the posture readings are similar for every month.

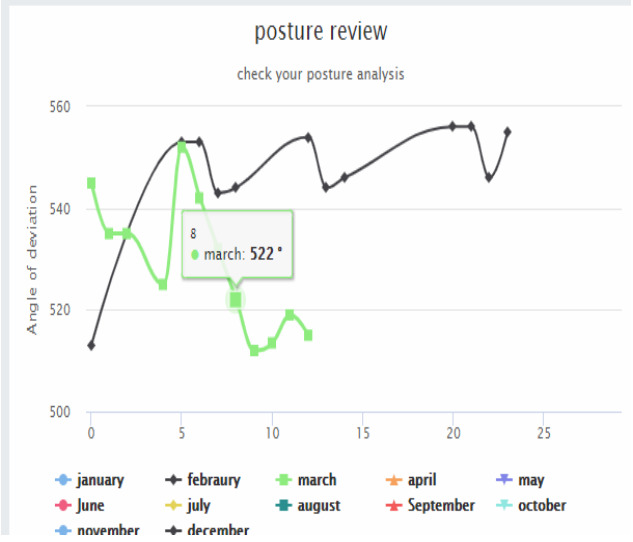


Graph 2

Ttable1

date	maximum deviation	average
26/02/2019	548	548.00
25/02/2019	549	549.00
23/02/2019	559	559.00
18/02/2019	511	511.00
17/02/2019	531	531.00
16/02/2019	511	511.00
14/02/2019	533	533.00

The prototype of the device is been tested on two user. The graph 2 contains analyzes of every bad posture data of the user on daily basis in month wise. The table 1 the average deviation of the posture and the maximum value of the bad posture are determined.



Graph 3

Table 2

date	maximum deviation	average
13/03/2019	515	515.00
12/03/2019	519	519.00
11/03/2019	516	513.50
10/03/2019	512	512.00
09/03/2019	522	522.00
08/03/2019	532	532.00
07/03/2019	542	542.00

The graph 3 and table 2 are the data of another user. The both the user graph improves in the next month. But the maximum value of the posture of the day does not change much but the average value considerably decreases for both the user. This decrease in the average is due to the muscle memory. By continuously alerting the user the user remembers to maintain good posture.

V. CONCLUSION

Posture related problem is major problem in the modern world. The bad posture causes many health related problem. Thus our project provides a device to detect and correct the posture of the user. Article of clothing incorporated gadget gives a precise and solid proportion of situated stance through estimation of accelero-meter. The measurement is analyzed in onboard micro controller to alert the user in a less time. In addition the web interface is provides platform to analyze measured reading from the better experience of the user. From data analyses we come to a conclusion that by using the device posture average decrease up to 25% from the previous month. The sensor is cheap and appropriate to wearable applications with respect to its little size, adaptability, and effectively modified length

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