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A Prototype Model for Wearable Posture Monitoring System with Vibration Sensor

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ABSTRACT
Posture is the way people carry themselves, and this posture has a substantial effect on their health particularly on our spinal cord which ultimately leads to back pain mainly due to over usage of computers, laptops and smartphones. In survey analysis we have recognized that the existing systems are having some drawbacks such as their sensor selection is not satisfied, in some cases, they lack portability and small profile module. To overcome these problems we have designed a module by using Arduino software which indicates the user by gentle vinration/ LED glow whenever he/she bends. The result will be indicated in four cases sucha s bending towards front, back, right and left. As conclusion this system will help the user to feel comfortable to wear and free to carry the module wherever he/she wish and we hope that the user can correct his/her posture by their own and later they used to maintain a proper posture.

Keywords – Back pain, Bad posture, Potable monitoring system, Sensor.

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I. INTRODUCTION

These days, an enormous level of the dynamic populace is spending numerous hours sitting either for work or recreation (office labourers, staring at the TV, and so on.). Ongoing examinations have indicated that an expanded sitting time may actuate constant infections (in the long run prompting demise) and may likewise sever affect mental wellbeing (prompting tension and depression).To relieve these impacts, as of late numerous arrangements have been proposed for decreasing sitting time. The primary goal of the venture is to structure a wearable framework that screens the sitting stance and forestalling undesirable cell phone practice which adequately screens the sitting stance of an individual while sitting and it additionally quantifies the point of head tilting by the individual. This proposition framework is far superior to the current models from numerous points of view.

Sitting is a fundamental human's resting position. The body weight is upheld essentially by the gluteal muscles in contact with the ground or a flat article, for example, a seat. The middle is pretty much upstanding. Sitting for a great part of the day may present noteworthy wellbeing dangers, and individuals who sit normally for delayed periods have higher death rates than the individuals who don't.

Issues looked by awful sitting stance Current examinations demonstrate there is an altogether higher death rate among individuals who normally sit for delayed periods, and the hazard isn't refuted by ordinary exercise, however it is brought down. The reasons for mortality and dismalness incorporate coronary illness, stoutness, type 2 diabetes and malignancy, explicitly bosom, endometrial, colorectal, lung and epithelial ovarian disease. The connection between coronary illness and diabetes mortality and sitting is entrenched, however the danger of malignant growth mortality is muddled. Stationary time is likewise connected with an expanded danger of gloom in kids and young people. A connection between word related sitting explicitly and higher weight list has been illustrated, yet causality has not yet been set up. There are a few theories clarifying why sitting is a wellbeing hazard. These remember changes for cardiovascular yield, nutrient D, sex hormone action, irritation, lipoprotein lipase action, and GLUT4 action because of significant stretches of strong emptying, among others.

Sitting may possess up to half of a grown-up's workday in created nations. Work environment projects to diminish sitting change in technique.

They incorporate sit-stand decks, guiding, working environment strategy changes, strolling/standing gatherings, treadmill work areas, breaks, treatment balls seat, and venturing gadgets. Aftereffects of these projects are blended, however there is moderate proof to demonstrate that changes to seats (altering the biomechanics of the seat or utilizing various sorts of seats) can adequately lessen musculoskeletal side effects in labourers who sit for a large portion of their day.

The various posture monitoring system for people who are extensively use their computers, Smartphones and other portable devices has been discussed. Past work can be arranged into three classes in term of the embraced technique for acquiring estimations.

First classification of work depends on fibre optic sensors, these sensors utilize the force of light going through as an estimation apparatus which is corresponding to the twist in the sensor. Dunne developed a framework that relates the optical fibre sensor readings to the client's sitting stance. Fibre optic sensors were likewise used to gauge situated spinal stance. Nonetheless, this arrangement is restricted to situate bowing back stances.

Second classification of work goes to utilize non-meddling weight sensors, Dunne utilized material piezo resistive compel sensors to gauge shoulder and neck developments through enrolling the weight among skin and material. Be that as it may, no test was performed to identify the sensors response to developments of fluctuating extents.

Third classification of works investigates the utilization of accelerometers, Hanson utilized the utilization of accelerometers to quantify joint edges with great precision results. So also, Van Laerhoven and Martin estimated postural exercises utilizing accelerometers by joining to the jeans. Lin introduced a multi-act checking framework utilizing accelerometers implanted in a wearable vest. In addition, an industrially accessible item, lumo lift, likewise helps screen and mentor chest area developments using a gyrator. The accentuation of this item be that as it may, is on the stylish incorporation of stance criticism to the wearable gadget as opposed to on solid estimations. A portion of the referenced methods above are not appropriate to build up a wearable estimating framework because of the heaviness of the sensor or to the difficulty of setting it on the client's back. We are exceptionally energetic by the current models of stance discovery; a portion of our pioneers are utilizing pressure sensor under the seat legs which quantifies the all-out weight and the dispersion of weight and power practiced to the four legs is checked. For another situation they are utilizing the heap sensors which gives body weight proportion and it isn't versatile. In certain models they are utilizing flex sensors, cell load and inductive sensors which quantifies the spine twisting by changing the voltage esteem due to the variety created by the opposition and inductance yet they are not so much agreeable to utilize. Plastic optical fibre is additionally utilized for estimating twist degree, they likewise not unreasonably much successful in pose recognition.

The serious issue looked by the individuals in the 21st century is the content neck disorder [1]. The content neck has been because of the successive forward head flexion, while utilizing the cell phones for quite a while. The innovation which has been utilized to screen the sitting stance will be separated dependent on the convenience of the framework, used to gauge the stance. The innovation which has been normally used to gauge the stance is pressure sensor. An examination by li jian-rong [2], proposed an observing

Framework utilized with the sensor exhibit comprises of 64 conductive elastic structure, which sense the adjustment in pressure. The microcontroller is utilized to procure the sensor information in the computerized design and that sensor information are send to the preparing module with the assistance of remote transmission module. The sensor-based observing framework created by Jawad Ahmad [3], comprises of sensor design manufactured by the screen printing a piezo resistive ink. The primary objective of this work needs to structure a printed and slight adaptable sensor, which productively sense the weight data from the contact of the body. The information from the seats had been prepared and recognizable proof of sitting stance has been finished.

The stance observing framework utilizes the high range Flexifore A502 to gauge the high and medium weight regions and FSR 406 has been utilized to quantify the lower pressure territories. It's absolutely comprises of eight sensors, two high range and six medium range. This system [4], uses the ATmega32A as the main microcontroller and it’s connected to the ESP8266 Wi-fi module to transfer the data to the server. Yasuhiro Otoda [5] actualized a stance observing framework utilizing accelerometer sensor to perceive the 18 kind of sitting stance as appeared. Each sitting stance has been portrayed by three principle highlights. The principal highlights are portrayed by, how profoundly the individual sitting in the seat. The subsequent component is depicted by, regardless of whether the individual's chest area is inclining left, focus, and right side. The third element is portrayed by the individual is inclining forward, in reverse or

sitting upstanding. It has the ability to detect whether the individual is sitting in the seat or not, by this it can ready to gauge the laborers sitting time. The major limitations of this type of pressure sensor-based posture monitoring systems, they are specific to the environment like office and cannot be used anywhere else.

The framework created by [6], doesn't have any making framework aware of improve the stance of the client in the continuous. What's more, it just measures dependent on the spinal line direction. Another checking framework by [7], has the capacity to quantify the neck edge, however it just centred on the prostrate position. It can't be use in the genuine for all the situations.

II. MATERIALS AND METHODS

This model is developed using the Hardware Components – MPU6050, push button, Arduino Nano and LED and Software Components - Arduino IDE.

The MPU6050 sensor is used to read the current position user as the digital value. It comprises of 3-axis gyroscope and 3-axis accelerometer as shown in Fig. 1.This will enable the sensor to check the orientation of the spinal cord in all the 3-axis. It measures both the axis and the angle of the spinal cord movement.

Fig. 1. MPU6050 Sensor

The interrupt for the system is provided by a Push button. It is used as an interrupt. Whenever the user presses the push button it starts measuring the spinal cord position. If the interrupt pin is high the monitoring system gets 'on' otherwise it remained in 'off' condition. Then the LED is used to indicate the state of the user. This is used for indication purpose, if there is any change in the spinal position the LED will indicate the user by glowing. In future scope we can replace the LED with vibrator for indicating the user with gentle vibration. The microcontroller used for the system is the Arduino Nano as shown in the Fig. 2. It is mainly chosen for its small profile which is helpful for space reduction, weight and it is same as Arduino Uno and it is cost efficient and it is very helpful in prototyping with PCB.

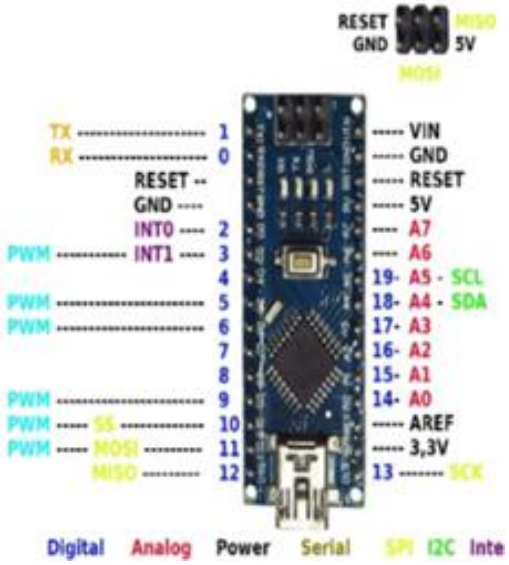

Fig. 2. Arduino Nano

III. METHODOLOGY

In this category we are going to see about the working method of the project. This project will alert the people those who are maintaining bad sitting posture for a prolonged period. The system comprises Arduino Nano, MPU 6050, push button and LED and the connection are done as shown in the Fig. 3. The Arduino Nano integrates the functioning of the sensor, interrupt and indicator, it helps to get and process the data that is sensed by the MPU 6050 and it helps the LED to glow once the interrupt is given by the push button.

MPU6050 sensor comprises of 3-axis gyroscope and 3-axis accelerometer this will enable the sensor to check the orientation of the spinal cord in all the 3-axis it will initializes one starting value for comparison, the value will be initialized once the interrupt is given by the user via push button. If once the Arduino finds the deflection from the calibrated value it will indicates the user.

Initially the user should maintain in a steady idle position after wearing this module, then he or she press the interrupt button(push button) that value is initialized for comparing the incorrect values which obtained during bad sitting posture as shown in the Fig. 4. Once the change his posture he will be recognized by the sensor and indicated by the LED.

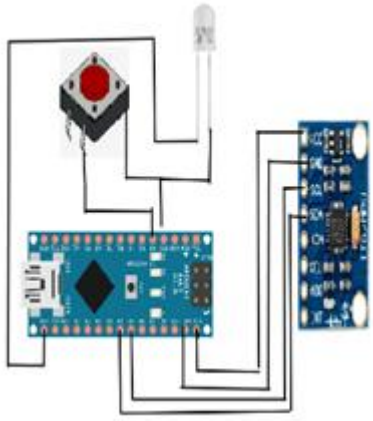

Fig. 3. Connection Diagram of Components

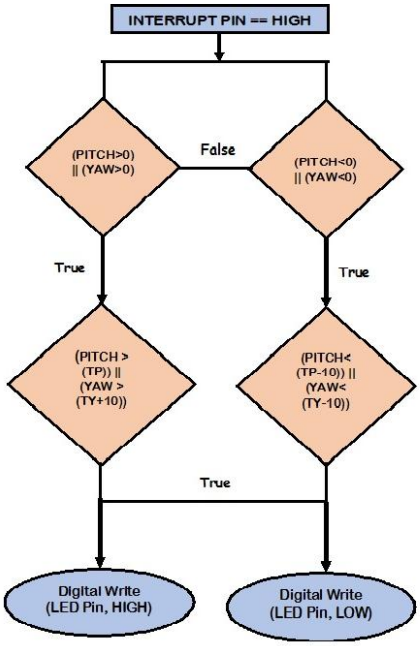

Fig. 4. Flowchart of Sitting Posture Detection

The client needs to wear the sensors as per the characterized position. From that point forward, he/she needs to align gadget dependent on his/her present stance. This will be finished by tapping the adjust button, which will send the order to the processor to dole out the present sensor incentive to be a reference an incentive for gadget observing. By this procedure, the sensor will get the qualities to contrast the estimating sensor esteems with discover the deviation in the stance. At the point when the gadget found any deviation from the typical stance, it will give a delicate sign to the client to remind them to address their stance.

This undertaking will alarm the individuals the individuals who are keeping up terrible sitting stance for a drawn-out period. The framework contains Arduino Nano, MPU 6050, press catch and LED. The Arduino Nano coordinates the working of the sensor, hinder and marker, it assists with getting and procedure the information that is detected by the MPU 6050 and it encourages the LED to shine once the hinder is given by the press button.

MPU6050 involves 3-axis gyrator and 3-axis accelerometer this will empower the sensor to check the direction of the spinal rope in all the 3-hub it will introduces one beginning an incentive for correlation, the worth will be instated once the hinder is given by the client by means of press button. On the off chance that once the Arduino finds the avoidance from the adjusted worth it will demonstrates the client. At first the client ought to keep up in a consistent inactive situation in the wake of wearing this module, at that point the person in question press the hinder button (push button) that worth is introduced for looking at the off-base qualities which acquired during terrible sitting stance. When the change his stance he will be perceived by the sensor and demonstrated by the LED.

IV. RESULT AND DISCUSSION

The result of the system will be in four cases. They are bending towards front direction, bending towards back direction, bending towards the right side of the user, bending towards the left side of the user.Whenever the user bend towards in the front direction and back direction he will be indicated by the LED blink. Similarly, when the user bend towards in the right direction and left direction he will be indicated by the LED blink as shown in Fig. 5.

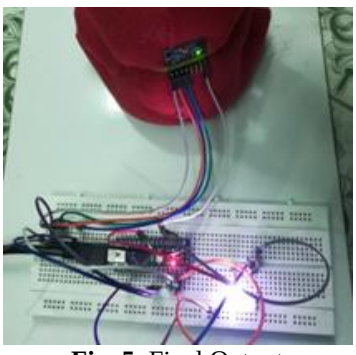

Fig. 5. Final Output

As mentioned in the above point it is portable, the user can carry with him/her. Reason for selecting Arduino Nano are First and foremost reason for choosing Arduino Nano is its small profile (compact) which will be highly helpful for

reducing space and weight of our prototype. It is cost efficient while compared to others. As same as Arduino Uno it also powered by Atmega328 processor. Unlike the Uno, it doesn't connect to the Arduino shields which is very helpful for breadboard prototyping or in the PCB with the use of the sockets.

The MPU sensor comprises both the accelerometer and gyroscope in a single profile it will be helpful for detecting the both axis and orientation.In some models they have used load cells which are detects based on the pressure that may vary with people's weight so it fails to correct their posture.One more point is these load cells are placed only in the chair so it fails in portability and compatibility.In some models they were using fibre optics sensor which may have possibility to break easily.Flex sensors also used in some cases these are very costly, fragile and because of its flexible nature it provides 'n' number of errors for long period usage.As considering all these drawbacks we have chosen the MPU6050 sensor for this model.

V. FUTURE SCOPE

It will be more effective when the blinking feedback is replaced with the vibrator and also the sensing value is transferred via Bluetooth to the mobile application for real time monitoring by which the user will be highly comfortable for correcting his/ her posture. They also visually updated by their daily improvement via the application. Sorts of modes for future extension are Tracking, Mode Normal mode and Active mode. In the Tracking mode, gadget just screens the stance and monitor it. On the off chance that the client sits in the unusual stance or stance shift from typical one, it will simply track of it. It won't vibrate to remind them to change the stance. This mode will be valuable in the condition, where the client just need to monitor the stance and don't need the vibration to upset them. In the Normal mode, gadget will monitor the stance of both neck and spine. It will vibrate, when the client not in the correct stance dependent on the qualities which it has been appointed to the microcontroller. During the adjustment stage. Be that as it may, it won't remind them to take a break, when they sit for a significant stretch of time. In the Active mode, gadget will continue checking the stance and furthermore the timeframe of the sitting and it will effectively remind them to change the stance. When it is anomalous and remind them to take a break after sit for a more drawn out period. In light of the mode chose by the client, the gadget will give its input progressively.

VI. CONCLUSION

Most of the methods which has been used in the existing systems are not that much portable, wearable and they seem to be bulky. By the above proposed device, sitting posture along with neck posture is also monitored and we have improved the system into small profile, wearable and ease to carry every place. This will improve their health and prevent them from various spine related diseases. We have used Arduino software for the development of model and we have used single sensor for tracking the spinal cord position and the user will be indicated by LED glow later it can be replaced with vibrator and in future development we can connect the device to mobile by means of Bluetooth for tracking our posture daily. We hope that our proposed system will help to correct and maintain the user's spinal cord posture and especially we believe that IT employees will be benefited a lot.

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