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POSTURE DETECTION AND ALERT SYSTEM USING FLEX AND ACCELEROMETER SENSORS

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Abstract – The main objective is to detect thecorrect or incorrect posture by detecting the changes occurring in human spinal cord movement using sensors i.e., flex sensor. Device also contains the accelerometer sensorto detect the angle of the neck movement of the user. The posture is analysed from the data sent from both the sensors and if bad posture is detected then the buzzer sensor in the device alerts the user to correct the posture. The device is made up of a flex sensor, accelerometer module, buzzer, and a microcontroller. The flex sensor is used todetect the bending movement of the spinal cord, and the accelerometer module is used todetect the angle of the neck. Both sensors are connected to the microcontroller, which processes the data and determines if the posture is correct or incorrect. If the posture is incorrect, the buzzer alerts the user to correct their posture. The data is transferred to cloud to store the data and use it as a reportfor doctor. The cloud application allows us toremotely monitor and store our real-time datafrom anywhere in the world.
Keywords - Posture-detection-and-alert- system, flex-sensor, accelerometer-sensor, esp-32.

I. INTRODUCTION

The paper addresses the conditions under which a person maintains their posture. Posture is the way people hold themselves in terms of how they stand, sit, walk, and conducttasks, and it has a substantial impact on their health. By keeping adequate posture, the vertebrae of the spine can be properly aligned. Poor posture has been linked to both poorhealth and poor performance. According toone study, slouching has an influence on the transverses abdominis muscle. The breadth of the transverse abdominis muscle has reduced significantly when an individual maintains aslouched posture. Low back discomfort has been linked to intransitive abdominis dysfunction. Low back pain is one of the most common causes of disability worldwide, affecting an estimated 80% of the population. It is projected that 80 percent of the populationwill experience it at some point.

The posture detection and alert system monitors the users' posture and alerts them torectify their bad posture. The position in whichwe hold our bodies while standing, sitting, or lying down is referred to as posture. A good posture is defined as the proper alignment of body parts supported by the appropriateamount of muscular tension against gravity. The suggested project seeks to provide a wearable monitoring system that continuouslymonitors the user's posture using an accelerometer and delivers the collected data. By remotely monitoring the data on the systemand alerting the user via the buzzer, as well as analysing the data collected in the server and generating a detailed report on the user posture.

a) Existing Work

Correcting poor posture requires a correct understanding of movement. This is not easy due to bad habits and wrong self-concepts people have poor physical condition. Body posture detection devices can help notify userswhen they are in improper posture. We will useit when taking corrective action. Also, careful device design is important and also it is to be economical. With the advancement of wearable technology, attitude control manydevices came into market like Lumo Lift and Upright. But either they were too expensive ornot accurate or uses complex algorithms, which makes them not suitable for generalpeople.

In ‘Development of a posture detector using a flex sensor’ paper the sensor and signalprocessor were embedded on an elastic wrap that was worn in a garment. Here only the movement of the spinal cord curvature is measured which makes it less accurate. It can detect posture based on only one thing i.e., onspinal cord curvature thus In ‘Posture determination by using flex sensor and Image analysis

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technique' paper the flex sensor was used with a complex algorithm which determines the posture by using image analysis techniques which in turn is not portable and very expensive. It uses webcam to analyse the posture but when we are out ofrange of sight it becomes difficult for the system to analyse our posture. As our posture is determined by our body as an involuntary action, it needs to be monitored as a part of daily life activity but not at a predefined area.

b) Proposed Work

The proposed device is designed to detect andalert the user to correct their posture by monitoring the movement of the spinal cord using a flex sensor, and the angle of the neck using an accelerometer sensor. The device willanalyse the posture of the neck and spinalcord, and if bad posture is detected, a buzzer will sound to alert the user to correct their posture.

The flex sensor will detect changes in the bending radius of the spine and change the resistance value accordingly. This movement will be used to detect changes in posture and determine whether the user is maintaining good or bad posture. Similarly, the accelerometer sensor will track the movementof the neck by comparing it to a referenceplane, allowing the device to detect changes inposture and alert the user accordingly.

We also developed a mobile application that can be paired with the device via app (throughInternet). The application will provide real-timemonitoring of the user's posture, displaying thecurrent angle of the neck and spine, and indicating whether the posture is correct or incorrect. It can also help to provide detailed feedback and recommendations on how to correct posture based on the user's specific needs based on the data retained.

Overall, the device will provide real-time monitoring of the user's posture and alert them to bad posture. By monitoring posture over time, users can develop better posture habits and reduce the risk of spinal health problems.

Architecture of the project:

The Architecture of the project consists of:

1. Micro-controller (ESP32)
2. Flex Sensor
3. ADLX (Accelerometer Sensor)
4. Buzzer
5. Cloud
6. Mobile App

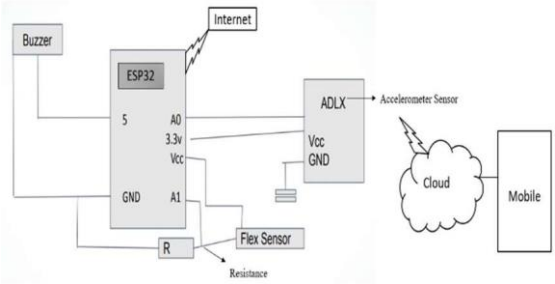

Figure 1: Proposed Architecture of the project

Figure 1 shows the Hardware connections between the components of the project. The connections are to be made as per thearchitecture mentioned above.

The algorithm of the project is as follows:

1. The device is Powered ON (the code isloaded onto Arduino/Esp32 and it is ready to work).
2. The Sensors gets activated and starts to record the Data in a timely manner.
3. As the Sensor information is analog in nature, it should be converted to Digital data. The micro

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controller collects the data from the sensors.

4. The data is then processed and checked for the constraints matching as per our situations.
5. If the conditions are exceeded thenBuzzer is switched ON and until the values gets under our conditions, thenthe Buzzer will be switched OFF.
6. And this cycle continues again fromstep 2.

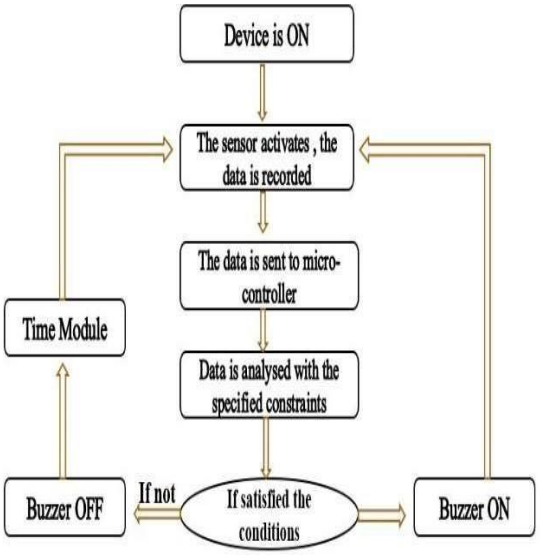

Figure 2: A Flow Chart illustrating themethodology.

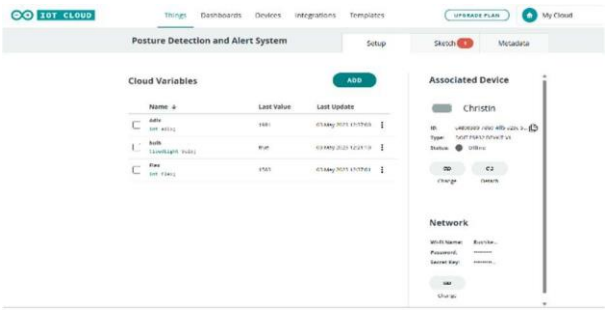

Figure 3: Interface of Arduino IoT Cloud

Software Implementation:

To connect ESP32 board to the Arduino IoTCloud, the steps are as follows:

1) Start the Arduino IDE, then select File > Examples > Arduino IoT Cloud > Getting- Started. With this, the Getting-Started sketch will launch.
2) Locate the line "const char THING_ID[] = "Your Thing ID>";" in the sketch and change "Your Thing ID>" to the ID of your thing in the Arduino IoT Cloud. On the IoT Cloud dashboard, navigate to the Devices section to identify the ID..
3) The name of your Wi-Fi network should be entered in place of "Your SSID>" in the line that reads "const char SSID[] = "Your SSID>";" further down.
4) The line "const char PASS[] = "Your Wi-Fi password>";" should also be changed to read "Your Wi-Fi password>."
5) Use a USB cord to link your ESP32 board to your PC.
6) Select "ESP32 Dev Module" under Tools -> Board.
7) Select the port that your ESP32 is attached to under Tools -> Port.

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8) To upload the sketch to your ESP32 board, click the "Upload" button.
9) After the sketch has been uploaded, select Tools -> Serial Monitor to launch the Serial Monitor.
10) The ESP32 should be connected to the Wi-Fi network and the Arduino IoT Cloud when you look at the Serial Monitor.
11) You can now view the data being delivered by your ESP32 by visiting the Dashboard part of the IoT Cloud.

II. RESULTS

Figure: 4 Output shown on the Arduino IoTCloud application by the Flex Sensor

Figure: 5 Output shown on the Arduino IoTCloud application by the Accelerometer Sensor

As shown in the above figures, we havecreated a system where the Arduino IoT Cloudapplication depict the range of values collectedby the Accelerometer Sensor and the Flex Sensors as a result of the bad posture and the good posture. The Figure:4 graph depicts the range of Flex Sensor data over time. The Flex Sensor's value changes as the resistance in thecircuit changes. When a person's back is straight, the Flex Sensor permits the graph lineto range from 1000 to 1800. When a person bends his or her back, the Flex Sensor changesthe graph, with the graph line increasing its value to a higher value ranging from 1800 to 3000. As the value on the graph rises from 3000, the bending of the back becomes more severe. The Figure:5 graph displays the range of Accelerometer Sensor values with regard totime. The Accelerometer Sensor allows the graph line to range from 1000 to1700 when a person's neck is straight. When a person bendshis or her neck, the Accelerometer Sensor produces a corresponding change in the graph,where the graph line increases its value to a higher value ranging from 1700 to 2000. The bending of the neck becomes more severe as the value on the graph rises from 2000 and beyond.

The graph can be seen in four differentways: live analysis, day analysis, week analysis,and 15-day analysis. The “No of Bad Postures”tab displays the overall number of problematicpostures over the course of a day or a week. The daily analysis of one’s bad posture data canbe downloaded as a file if needed by the doctor.

CONCLUSION

In the modern world, posture-related problems are a serious issue. Poor posture contributes to a number of health issues. As a result, our project offers a tool to identify the user's posture. With this project, you can measure your seated spinal posture withaccuracy and dependability. In this work, the sensor was assessed in a wearable setup intended to reduce the circuit's complexity.However,

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doing so frequently necessitates sacrificing user comfort and the socialacceptability of clothing.

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