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KORİNT YAYINCILIK

BAD POSTURE DETECTOR MONITORING SYSTEM

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ABSTRACT

According to the most recent medical information and physiotherapy technology, there are several flaws in monitoring spinal problems among people of various ages. For example, about 16 million adults, or 8% of all adults, suffer from persistent or chronic back pain, limiting their ability to engage in certain daily activities. Back pain is currently the sixth most expensive condition in the world. Many of the condition's indirect costs are related to missed work days and disability benefits. People with back pain is a word used in this profile to denote adults who have persistent or chronic back pain that limits their daily activities. So, by building a system named "Bad Posture Detector Monitoring System," I've decided to aid medical institutions in providing a smart device to identify bad spinal posture, particularly for students and employees who are still working from home. The system works by detecting the human's existence using the PIR sensor and if there's a human detected sitting on the chair, then the ultrasonic sensor will be activated. After the ultrasonic sensor was activated then the distance between the user's back and the chair headrest will be detected, which is then shown as the distance that is appropriate for optimal spinal posture. If the distance indicated by the sensor indicates a faulty posture, an alarming noise or interruption will be triggered to warn the user to improve their posture. The buzzer and LED are the noises mentioned. If the distance between the chair headrest and the user's back is greater than 2 cm, the buzzer will beep and the LED will light up, but if the gap is less than 2 cm, nothing will happen. Additionally, the data will be presented on the Arduino IDE's serial monitor. The proposed system may be readily installed on the chair headrest without interfering with the users' comfort when sitting in the chair. As a result, by using this device, students and employees may experience fewer spinal difficulties, and chronic spinal disorders may be avoided sooner.

Keywords: back pain, spinal, posture, Ergonomic Chair, IOT Chair

INTRODUCTION

Back pain affects practically everyone in all cultures and ethnic groups at some point (about 20% annually), with up to 50% of individuals experiencing it at least once a year. “Sitting is the new smoking”, as you may have heard. Even for persons who exercised regularly, one major study indicated a link between extended sitting and a higher chance of dying from any cause, and people nowadays tend to sit a lot. According to a recent study by the Centres of Disease Control and Prevention, almost 25% of adults sit for more than 8 hours every day. This isn't unexpected, given how many of us spend our days sitting at a desk or working on a computer, especially if we work from home.

Long-term sedentary activity has long been linked to back discomfort, including symptoms in the neck, mid-back, and low-back. People who sit for more than 7 hours a day have reduced spine mobility, which can cause discomfort and weakening in the lower back muscles. Sitting promotes muscular stiffness and puts pressure on the spine's discs, particularly in the lower back. Slouching puts undue strain on the spine's ligaments, creating aberrant forces in the lumbar joints and discs, resulting in pain. The more time you spend sitting, the more likely you are to slouch, which can cause hip stiffness.

There are some ways to avoid this from happening like keeping your back straight rather than curling it into a "C" form when sitting. Furthermore, maintain 90 degrees of hip flexion and keep your back straight. This is tough to maintain for lengthy amounts of time, but an ergonomic chair and appropriate posture can assist. Use a stool or a stack of books if your feet aren't touching the ground. It's also crucial to have a comfy work surface. These are some of the examples that we can do to prevent back pain while working from home but people nowadays are hard to control even though they had been given ways to avoid those problems. Hence, a product with an alarming system absolutely can help to solve this problem. In this project, a placeable bad posture detector with an alarming buzzer and LED to indicate bad posture that could be placed on the chair headrest would be created.

METHOD

There are two parts that involved in this project is software and hardware. This project uses 2 sensor which is the PIR Sensor and the Ultrasonic Sensor, LED, buzzer and Arduino Uno as the microcontroller. The designed controller is using a closed-loop system with Arduino as the main controller. The design of the controller circuit using Arduino realizes using Proteus Software and then convert to a PCB circuit. Maintaining a good posture while sitting necessitates maintaining a 90-degree angle and avoiding slouching, as we all know. As the sensor detects the distance between the person's back and the headrest, data will be transferred to Arduino (IDE) and displayed on the serial monitor. The buzzer will sound and the LED will light up if the distance is larger than 2 cm, indicating that they are in a bad posture position. However, if the distance is less than 2 cm, the buzzer will not sound and the LED will not light up, indicating that they are in a good posture position.

Block Diagram of the Project

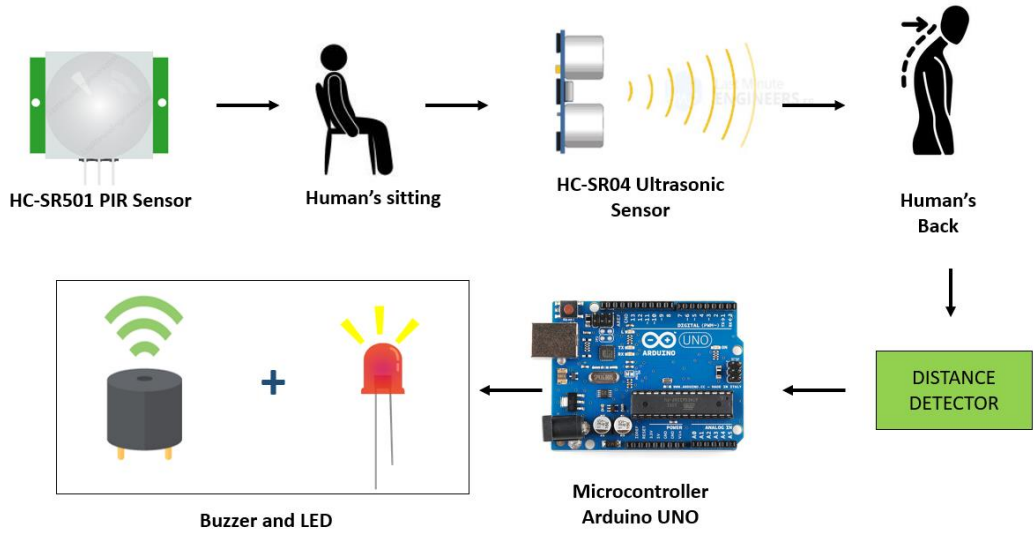

Figure 1. Flowchart for Bad posture Detector Monitoring System

Shows the circuit diagram of the whole system. It comprises of an ultrasonic sensor that detects the distance to the human's back using ultrasonic sound wave signals, calculates the distance using software (Arduino IDE), and the result is determined by the sound of the buzzer and the LED lighting up. It will also display bad or good posture on the serial monitor of the Arduino IDE Software.

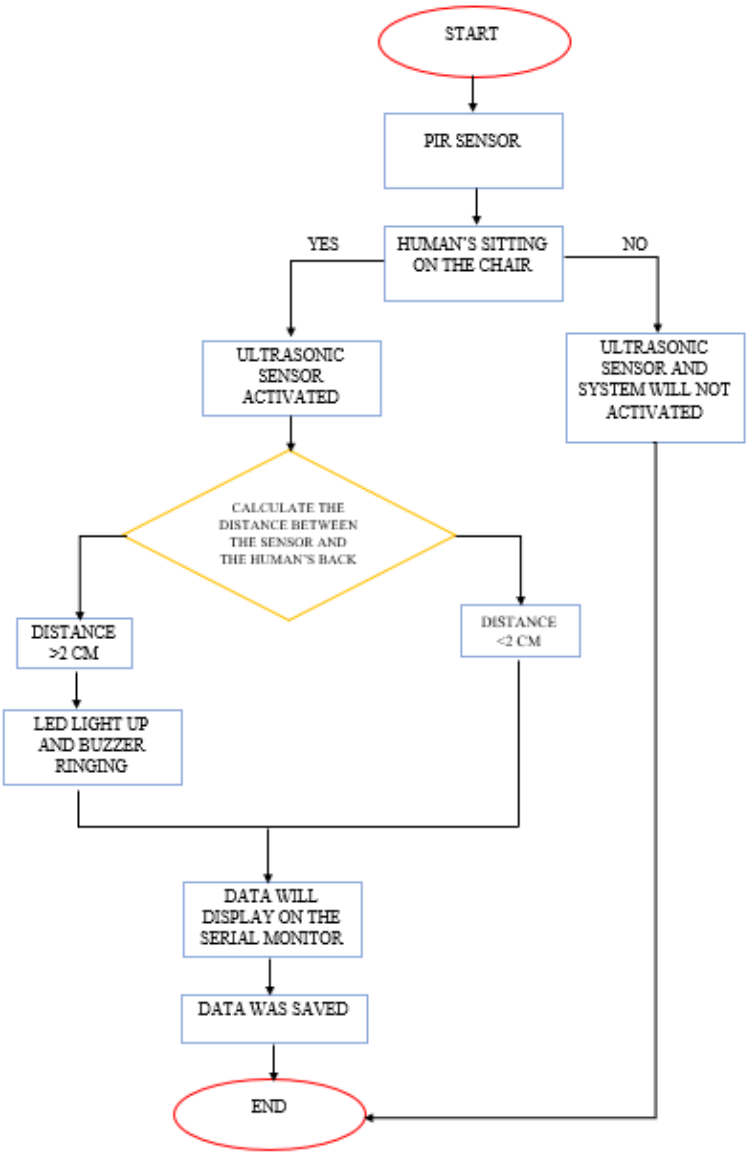

Figure 2. Flowchart for Bad posture Detector Monitoring System

HARDWARE DEVELOPMENT

This project will undergo the process of design development. The process of designing is one of crucial part in developing the bad posture detector system. Hardware that are used in this project is divided into 5 types which is Arduino Board, HC-SR501 PIR Sensor, HC SR-04 Ultrasonic Sensor, LED and buzzer. Arduino Uno will be used to allows to construct the programs in code segments to perform individual task. The coding will be programmed in Arduino Uno to give instruction to the hardware system to work. The next hardware used is the HC-SR501 PIR Sensor that was used to detect the appearances of human sitting on the chair to activate the system. The HC SR-04 Ultrasonic Sensor is used to detect distance between the ultrasonic sensor and the human's back. Next, the hardware used is the buzzer and the LED. This hardware act as the output for the system. If the distance detected

by the ultrasonic sensor is more than 2 cm, then the buzzer and the LED will be light up and beeping but if the distance measured is less than 2cm, then both of the output will not be triggered.

Figure 3 below shows the circuit diagram of the Bad Posture Detector system. We used TINKERCAD to design the circuit of the Bad Posture Detector system.

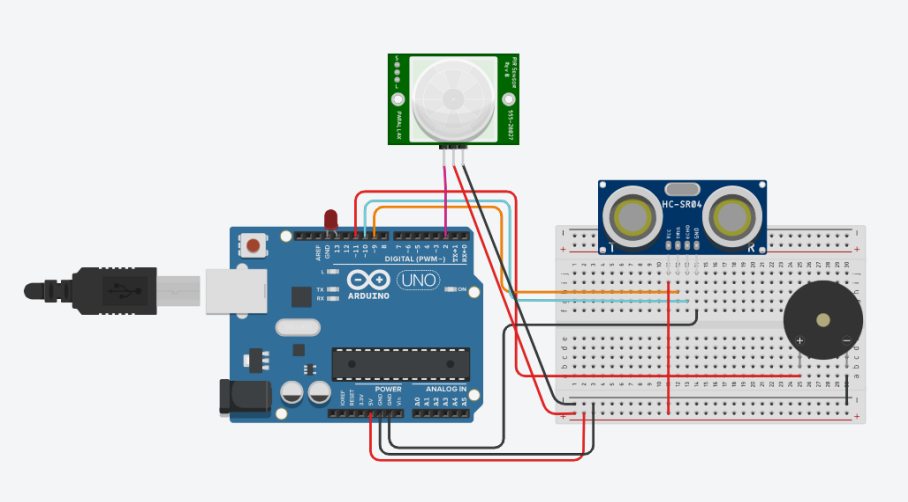

Figure 3. Circuit Diagram of The Bad Posture Detector

PROJECT DESIGN

Figure 4 shows the design of the Bad Posture System. The project consists the adjustable casing to match the chair's height.

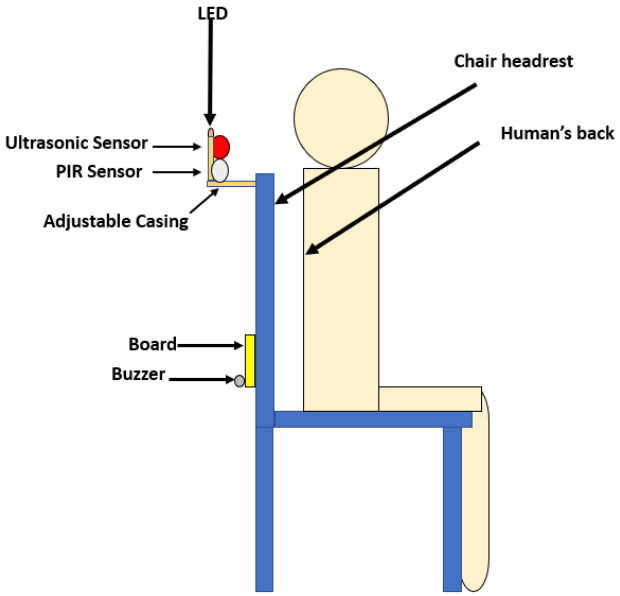

Figure 4. Project Design of the Bad Posture Detector

RESULT & DISCUSSION

Table below shows the expected results for the project.

DISTANCE / CONDITION	RESULTS
Above 2CM (Indicate slouching to the front)	• LED lights up and buzzer beeping • "BAD POSTURE!" displayed on the Serial Monitor
Below 2CM (indicate sit straight or completely leaning their back to the chair)	• Nothing happened • "GOOD POSTURE" displayed on the serial monitor
Bent over to the front (indicate only neck slouching to the front)	• LED lights up and buzzer beeping • "BAD POSTURE!" displayed on the serial monitor

CONCLUSION

Finally, this initiative suggests that a person's posture be monitored in order to determine whether they have good or bad posture by using an HS-SR04 Ultrasonic Sensor to determine the distance between the back and the chair headrest that would indicate their current posture. The project may be able to help students and employees who work from home avoid back pain. This monitoring system's architecture allows it to measure the distance between a person's back and the chair headrest, allowing them to remain aware while working. Furthermore, establishing a bad posture detector monitoring system can serve as an early warning system for diseases caused by poor postures, such as Lower Back Pain and Spinal Osteoarthritis. People will be more focused on keeping their back straight at 90 degrees as a result of the introduction of this monitoring device to the market. There are several posture monitoring devices on the market presently as some of us are aware. However, my idea concentrates more on the prevention of poor sitting posture. That's why the monitoring system was attached to the chair headrest. I wanted the user to feel at ease while sitting without being bothered by the device's existence. As a result, I'd design this system to be as compact as possible so that the user isn't aware of its presence while yet being aware of its posture. The alarming LED, on the other hand, will be placed in a visible location so that the user can remain awake while seated.

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