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EYE STRAIN MONITORING SYSTEM FOR ELECTRONIC GADGET USERS

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Abstract

COVID-19 use causes dry eyes, fatigued eyes, increased myopia, shoulder, and back pain. Symptoms include dry eye, vision correction, binocular visual pressure, and precorneal tear film complaints. This project will construct a distance circuit utilising an ultrasonic sensor for a vision care detector, a timer circuit for managing the time duration in using electronic devices to prevent eye strain, and an analysis of the eye strain user's usability in distance and time duration. The Arduino microcontroller monitors the user's sitting distance from the screen and time spent on electronic devices. This project's ultimate result is detecting the user's distance from the computer screen; 40 cm is a reasonable distance. Every two minutes, the user's seating distance is monitored to monitor eye movement, improving sitting posture and preventing eye strain.

Keywords: Eye Strain, Computer, Distance between screen and body.

1. Introduction

The Covid viral pandemic put the world on lockdown towards the end of 2019. Following the forced removal of all teaching process to the online. Using technology in the classroom has gained worldwide appeal throughout this time, attracting both critics and advocates (Branzila, 2020). The overuse of technology may have a stronger impact on children and teenagers who are still developing. Portable tablets, smartphones, and computers can hold a user's attention for hours. Causing eye strain. Social media and mobile gadgets can cause psychological and physical concerns such as eye strain and difficulty concentration. This includes serious disorders like depression. Digital eyestrain creates dry eyes. Neck and shoulder pain from eye strain.

Then, contemporary technological advances have revolutionised worldwide lifestyles. While technology provides many benefits, it also has drawbacks (Stephenson et al., 2017).

Thus, long-term use of electronic devices causes vision problems, such as dry eyes, tired eyes, increased myopia, etc during COVID-19. Digital Eye Strain (DES) can cause eyestrain, headaches, impaired eyesight, dry eyes, and neck and shoulder pain. Sheedy described two causes and symptoms of eye strain, or asthenopia. Internal symptoms of strain, discomfort, and headache behind the eyes are linked to accommodative and/or binocular vision stress. External symptoms of burning, irritation, weeping, and dryness are linked to dry eye.

Correspondingly, Portello distinguished between two types of computer-related symptoms: ones related to accommodation such as blurred vision at close range, blurred distance vision after computer use, and difficulty refocusing from one distance to another. For those related to dry eye that will having irritated/burning eyes, dry eyes, eyestrain, headache, tired eyes, sensitivity to bright lights, and eye discomfort (Sheppard & Wolffsohn, 2018).

Additionally, too far or too near when using electronic devices causing eye discomfort even though electronic gadgets greatly facilitate daily living (Jaschinski-Kruza, 1991). Screen height affects blink rate, ocular symptoms, and accommodation amplitude (Atchison et al., 1994; Burgess-Limerick et al., 1998; Jaschtnski-Kruza, 2007; Saito et al., 1997; Villanueva et al., 2007). Because height affects neck muscle activity and pain, the screen should be 15° to 25° below eye level (James E. Sheedy, 2002; Rempel et al., 2007). According to David Rempel and Kirsten Willms' publication, the average viewing distances from the reference postures for near, middle, and distant distances were 52,4, 73,0, and 85,3 cm, respectively. In each action, participants went closer to the screen. When the display was set to a far distance, participants moved their head and torso forward during the exercise, decreasing viewing distance from 85,3 cm to 77.5 cm. Participants moved farther for the farthest viewing distance compared to near and average. Close distance was related with less blurred vision, dry or irritated eyes, headache, and improved convergence recovery. Displays and computer screens should be 52 cm and 73 cm distant (Rempel et al., 2007).

Finally, continuous or uncontrolled long-term use of electronic gadgets might cause discomfort eye symptoms as well as other symptoms such as pain, weakness and numbness in eyes, neck muscles, arm, and wrist (Sarla, 2020).

The project is to design a distance circuit system by using ultrasonic sensor for vision care detector, proposed a timer circuit for managing the time duration in using electronic gadgets as prevention to sore eyes then analyse the usability of eye strain user in distance and time duration of using electronic gadgets.

2. Methodology

In this section, the progress of a product based on the first and second goals is elaborated. This product is meant to provide a monitoring system and reduce eye strain problems by using a distance-monitoring system. The developed project is then tested through Real-time simulation and data analysis for certain users.

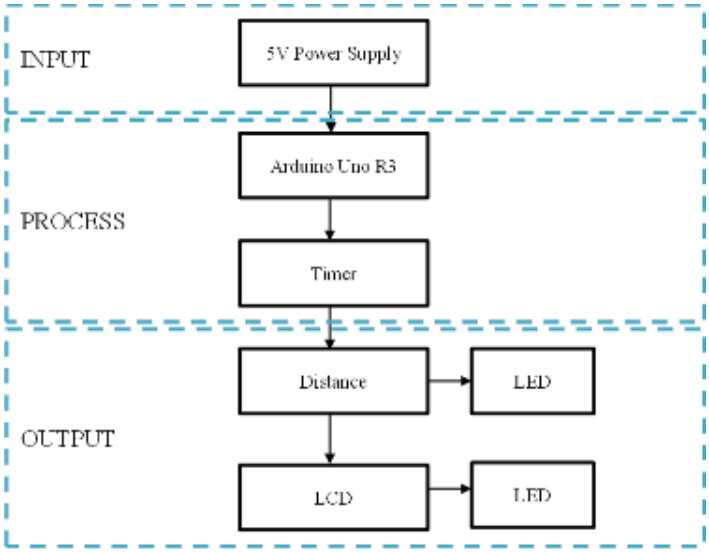

Figure 3: Block Diagram of Eye Strain Monitoring System for Electronic Gadget Users

Figure 1 shown a block diagram of the Eye Strain Monitoring System for Electronic Gadget Users for those who suffer from eye strain, neck and back pain as a result of long-term use of electronic devices. In order for an electronic project to work, it needs a power source. In this case, the power source is a 5V power supply from their devices' USB ports or a smartphone adapter. Arduino Uno R3 is a low-cost and open-source board, and its IDE software is compatible with all operating systems. This system contains an Arduino Uno R3 microprocessor, which serves as the system's central processing unit. The Arduino Uno R3's built-in timer keeps the operation on schedule by synchronising with either the system clock or an external clock, and it can also serve as a reminder to the user to keep track of the time.

A user's distance from their screen is detected after two minutes of the system being activated. The LCD of the device would display messages to remind the user to alter their sitting position in order to maintain proper posture. The LCD would also display additional messages every minute based on the existing distances established in the Arduino to advise the user to rest their eyes and stretch their muscles. Finally, these operations will continue to repeat until the system is shut down.

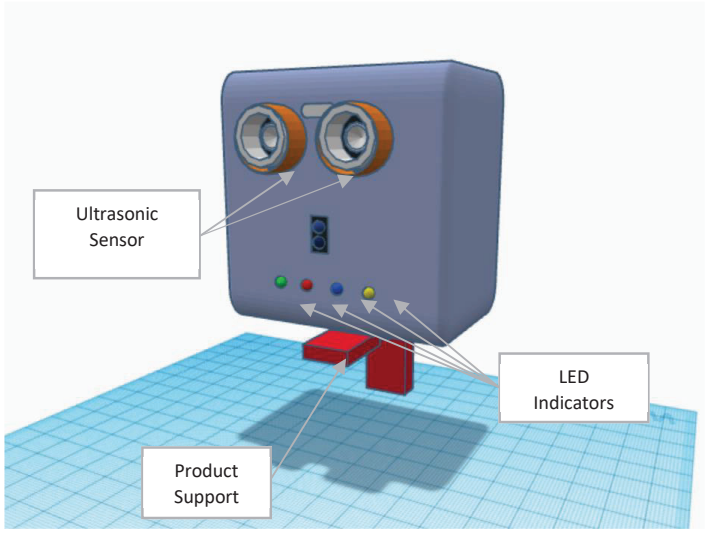

Figure 4: Front View of the Project

Figure 5: Overview of The Project With Electronic Gadget

Both Figure 2 and Figure 3 shown the 3D design that was created for the project using Tinkercad. This design includes all of the necessary components for the project, with their respective layout sizes taken into consideration. After being designed in Tinkercad, the product is expected to have dimensions of 9 cm x 15 cm x 8 cm. As a result, the product is compact and lightweight.

3. Result And Discussions

In this section, the findings of the produced Eye Strain Monitoring System For Electronic Gadget Users are discussed briefly relying on the hardware implementation, data analysis, and standard operating procedure for the product.

3.1 Developed Eye Strain Monitoring System for Electronic Gadget Users

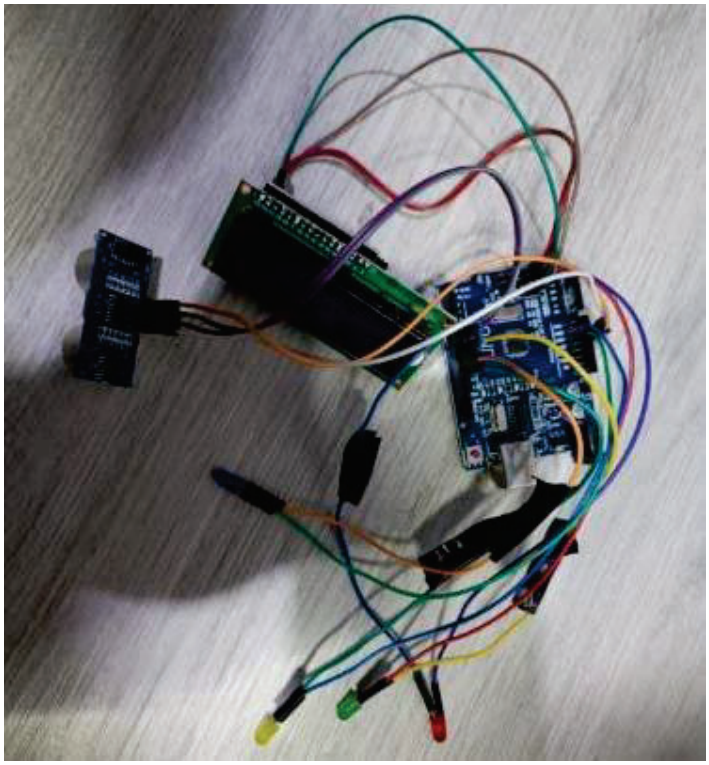

Figure 6: Electronic Circuit connection of the Product

Figure 4 shown that a circuit connection for the electronic component. The electronic components consist in the block diagram are Arduino Uno R3, 16x2 Liquid Crystal Display (LCD) Module, Male-to-Male connection jumpers, 4 LEDs (blue, green, red and yellow) and an ultrasonic sensors. This project was succed to launch as a product and a LCD is added to display messages sush as “Please sit properly.” and “You should rest your eyes or massage the area around your eye“.

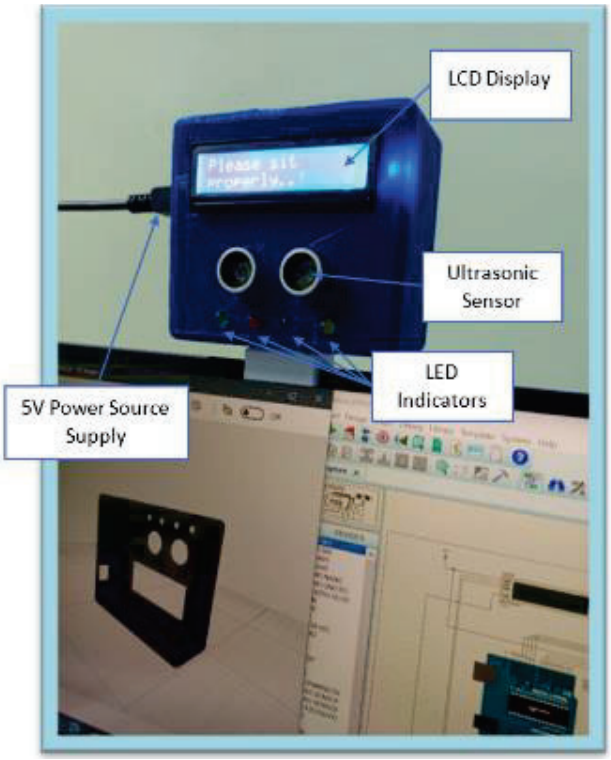

Figure 7: Prototype of the Product To The Electronic Gadget

Figure 5 shown that the application of the product to the electronic gadget for example laptop.

Table 9: Table of Messages Displaying of The Products

Stages	LCD Messages Display	LEDs
The product is turned on.	"Initialize…"	Blue & Green & Red & Yellow
	" Please wait.."	
	" WELCOME"	
When the distance is exceed 40 to 60 cm.	" Please sit properly!"	Blue & Yellow
When the timer counted every interval 1 minutes and the distance exceed in 40 to 60cm for eye blinks.	" You should rest your eye or massage around your eyes."	Red & Blue

3.2 Standard Operating Procedure of Product

This section will outline the application of the project, as well as the flowchart used in the developed of Eye Strain Monitoring System For Users Of Gadgets.

Figure 6 and 7 shown the used of “Eye Strain Monitoring System for Electronic Gadget Users”. The user will use electronic gadgets while the monitoring system is active. After two minutes, the Eye Strain Monitoring System begins to detect and compute the distance between the user and the device's screen. If the distance detected is not between 40cm and 60cm, the yellow and blue LED will blink and the LCD will display the message "Please sit properly." Following that, the Arduino Uno R3's timer will count up to 1 minute’s intervals. After 1 minute, the ultrasonic sensor will detect the distance between the user and the screen once again. Alternately, if the detected distance is out of range, the LCD will display a message such as "You should rest your eyes or massage the area around your eye." The red and blue LEDs will blink simultaneously. The process is repeated until the user stops using their gadget, at which point the Monitoring System is turned off.

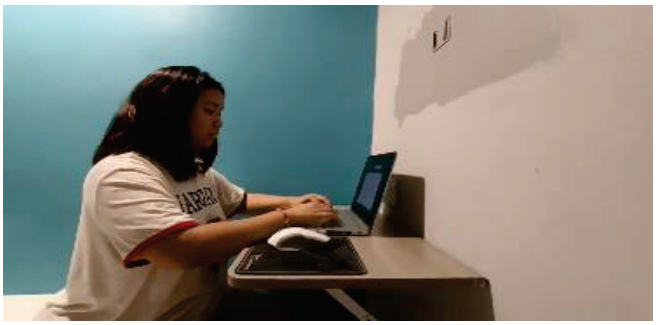

Figure 8: User (A) before using Eye Strain Monitoring System

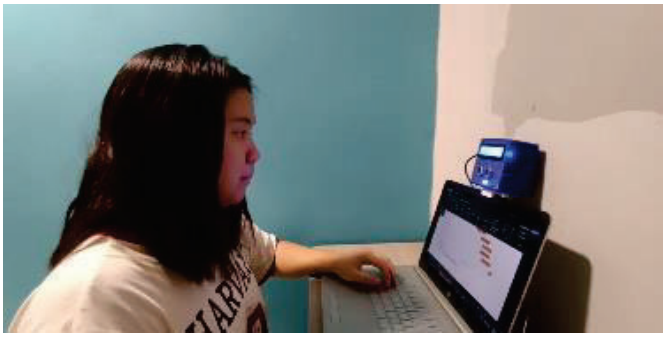

Figure 9: User (A) after using Eye Strain Monitoring System

Figure 6 shown that the user was no awareness without the monitoring system. Due to the analysis stage, the symptoms such as dry eye, headache, shoulder and back pain obviously discovered before she was used the product. Figure 7 shown that the user was using her laptop within the product. During the testing stage, the products control the ultilize timing for the user while using laptop. The eye strain symptoms and also the sitting distance also improved due to the messages displays that notify the user.The message “Please sit properly” is to notify the user the maintain a good sitting distance with the screen while the message “You should rest your eyes or massage the area around your eye.” is to monitor the user to follow up their vision condition and also stretch their shoulder, arm and back.

4. Conclusions

These studies served three unique aims, all of which were accomplished. First, the development of an eye strain monitoring system for electronic gadget users is performed by embedding a system that maintains the user's distance from the device's screen. The rate of eye blinks increased due to the use of this product by those who experience eye strain and bodily pain while using electronic devices. It has been demonstrated that reminder messages can relieve symptoms of eye strain and body pain. Aside from the fact that the product was successfully developed, several suggestions were made to enhance its usefulness. Modernize the detection of body-screen distance using an AI camera in order to detect and identify the sitting angle and several sitting positions. Configure the distance and height studies and product updates based on different user categories, such as children, adults, and the elderly. Develop an IoT interface system so that consumers may utilise the product by selecting and controlling modes based on their group status.

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