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PROPOSAL ON AN EYE STRAIN MONITORING FOR ELECTRONIC GADGET USERS

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ABSTRACT

The problem statement of this study is long-term use of electronic devices causes vision problems, such as dry eyes, tired eyes, increased myopia, etc during COVID-19. Dry eye is the most obvious symptom, but it also includes symptoms related to vision correction or binocular visual pressure, as well as complaints about the precorneal tear film (Branzila, 2020). The objective of this project is to design a distance circuit system by using the ultrasonic sensor for a vision care detector, to design a timer circuit for managing the time duration in using electronic gadgets as prevention to sore eyes, and analyze the usability of eye strain user in distance and time duration of using electronic gadgets. The Arduino microcontroller is used to monitor the user's sitting distance from the screen and to manage the user's time spent on electronic gadgets. Through the interface of hardware and software, which are the Arduino system and the Blynk app, the user of an electronic gadget will be able to monitor their usage period of the electronic gadgets. Based on the research findings in journals and articles, it proved that the ideals of sitting distance or body between screens will be 0.50m to 0.73m. Consideration of eye-computer screen distance while using computers is also a measuring parameter in this project and then to analyze the suitable range of distance for the computer users, there is some more research needed for this parameter to ensure the expected result. Extensive studies have been carried out in order to identify the blink rate, the average spontaneous blink rate is between 12 and 15 blinks per minute. This system is composed of sensors such as an ultrasonic distance sensor, an Arduino Uno R3, and software programming that can automatically collect data and analyze it to ensure that the parameters of the users are within the expected range. This system will also link to the Blynk smartphone application to assist people suffering from eye strain symptoms.

Keywords: Eye strain, computer, distance between screen.

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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. 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. Additionally, too far or too near when using electronic devices causing eye discomfort even though electronic gadgets greatly facilitate daily living (Jaschinski-Kruza, 1991). 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 proposed study 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.

In addition, eye complaints are caused by changes to the precorneal tear film (PTF). This can be caused by difficult tasks that require a lot of attention, which makes people blink less and exposes more of the eye's surface. These variables and settings can gradually increase water evaporation and hasten the thinning of the PTF, resulting in dryness and the creation of dry spots on the cornea, which may be followed by corneal and conjunctival epithelial alterations and eye complaints (Wolkoff et al., 2005).

According to the American Optometric Association, the most common symptoms of DES include eyestrain, headaches, impaired eyesight, dry eyes, and neck and shoulder pain. Sheedy documented two distinct sets of symptoms and reasons for asthenopia, the medical term for eye strain. Behind the eyes, internal symptoms of strain, discomfort, and headache were related with accommodative and/or binocular vision stress, while exterior symptoms of burning, irritation, and weeping and dryness were associated with dry eye.

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

Based on David Rempel and Kirsten Willm's study, the typical viewing distances from the reference postures for near, middle, and distant distances were 52,4, 73,0, and 85,3 cm, respectively. Across the activity, participants went closer to the screen for each viewing distance. During the activity, the participants opted to shift their head

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and torso forward, resulting in a decrease with seeing distance from 85 cm to 77.5 cm. At the farthest viewing distance, participants moved more than at the near and medium viewing distances. 50-85 cm from a laptop display will alter visual and head pain, convergence recovery, and head posture, depending on the screen character size. Contrast the near proximity to the centre with the great distances. As the monitor was placed further away, the participants' torsos and heads moved closer. Users should position their displays between 52 cm and 73 cm away from them. This article discusses physiological research indicating that viewing distances of approximately 50 cm may cause visual fatigue in individuals with near-convergent problems (Rempel et al., 2007).

Ultimately, reading can induce eye pain and visual tiredness, particularly if electronic devices are used, which can exacerbate these symptoms. Numerous research have examined the connection between eye strain and the use of visual display terminals (VDTs). Users of visual display terminals typically report ocular discomfort and eye fatigue (Fenga et al., 2014). According to a recent survey, the most often reported symptom among office workers was sleepy eyes (40 percent), followed by dry eyes (30 percent) and eye discomfort (30 percent). The connection between dry eyes and VDT use has also been widely documented. Maintaining a regular tear film distribution and protecting the ocular surface requires normal blinking (Abusharha, 2017). It is likely that aberrant blinking will result in inadequate tear dispersion, leading to dry eyes.

METHODOLOGY

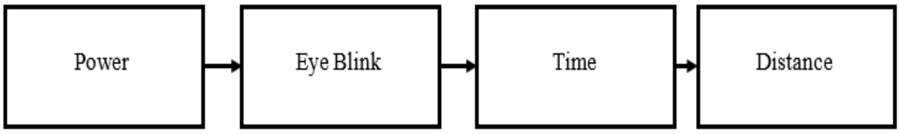

Figure 6 Block Diagram of Development for Eye Strain Monitoring System

Figure 1 illustrates a block diagram of the Development of the Eye Strain monitoring System. The power for this monitoring system is primarily supplied by the USB ports of the laptop, which 5V of electricity supply, or by any USB device that has a 5 V DC voltage. The Infrared (IR) sensor detects a user's eye blinks as an input to this monitoring system. The monitoring system detects the eye blinks of the user, which therefore processes it to determine whether the eye blink rate is within the average spontaneous blink rate of 12 to 15 blinks per minute. Alternatively, a time reading parameter in which two hours for monitoring the users to rest, thus the system will measure the users' distance between the electronic gadget screen and user's eyes. The system has the screen and their eyes set at a distance of 0.50 m to 0.73 m.

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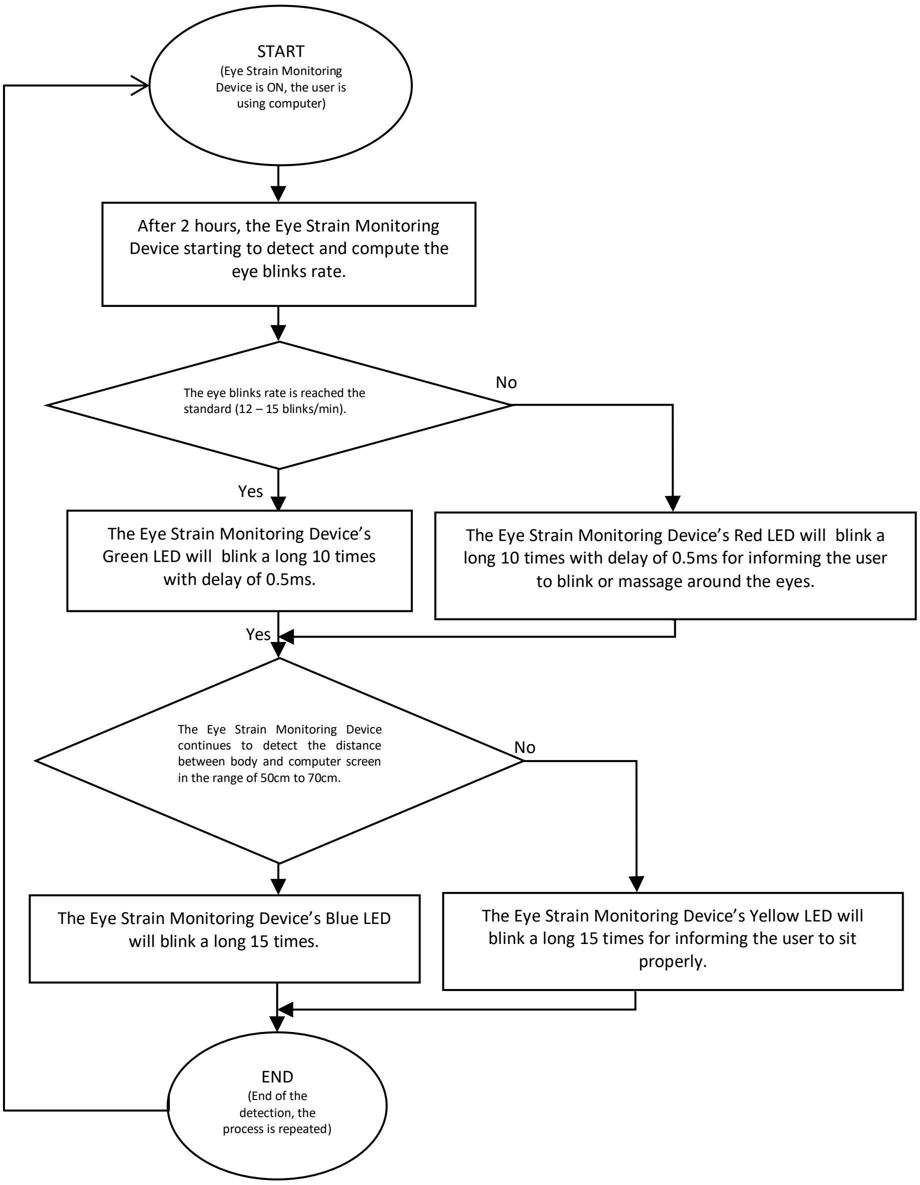

Figure **7 Project Flow Chart**

Figure 2 shown the project flow chart of "Eye Strain Monitoring System for Electronic Gadget Users". The user will using their electronic gadgets and the monitoring system is turn on. After 2 hours, the Eye Strain Monitoring System starting to detect and compute the eye blinks rate. if the eye blinks rate is reached the standard, then the Eye Strain Monitoring System's green LED will blink a long 10 times with delay of 0.5ms. In opposite, The Eye Strain Monitoring System's red LED will blink a long 10 times with delay of 0.5ms for informing the user to blink or massage around the eyes. After that, the Eye Strain Monitoring System continues to detect the distance between body and computer screen in the range of 50cm to 73cm. If the user sitting in the range of 50cm to 73 cm to the screen, The Eye Strain Monitoring System's blue LED will blink a long 15 times. Differently, the Eye Strain Monitoring System's yellow LED will blink a long 15 times for informing the user to sit properly. After end of the detection, the process is repeated until the user is stop using their gadget, then turn off the Monitoring System.

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EXPECTED RESULT

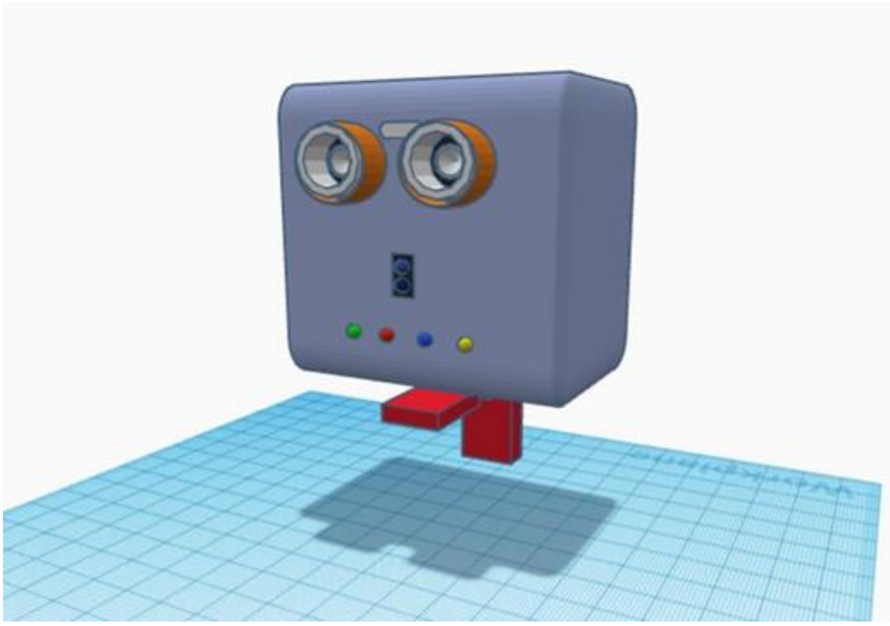

Figure 8 Project 3D Design (Left Side View)

Figure 3 shows the output simulation of Tinkercad, which is used to create an optimal design for the project. An Arduino Uno R3 is used as the system microcontroller on which programmes may be loaded from the user-friendly Arduino computer application. In addition, an ultrasonic sensor is used to measure the distance between the user's body and the screen of the electronic gadget. The blink rate of a user's eyes while using electronic gadgets can also be measured using an IR (infrared) sensor. Indicators of the system use green, red, blue, and yellow LEDs to tell the user to take a break and maintain a distance from the screen.

Figure 9 Project 3D design with gadget

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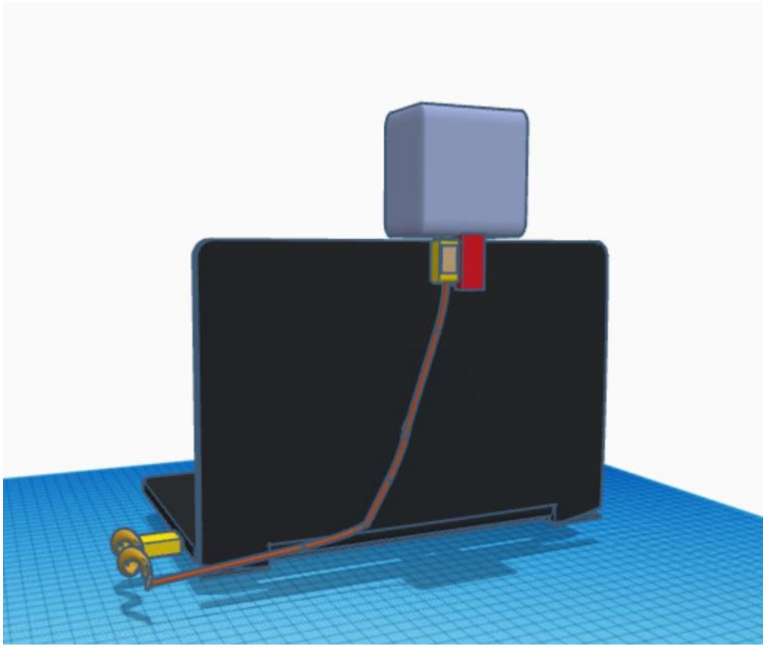

Figure 10 Project 3D design with electronic gadget

CONCLUSION

This study proposed project that beneficial to electronics users during pandemics or when there is a high demand for use when working, studying, or teaching. The goals of this project are to assist users in maintaining a healthy lifestyle, as well as their mental and physical health with the intention that this management will aid users in later adjusting their seating gap within 40cm to 75cm of the eye-screen distance using an ultrasonic sensor. The monitoring device's objective is to collect and analyse the ideal eye-screen distance range for each individual. Therefore, the user can focus on their task while sitting without being distracted by discomfort or pain, especially in terms of vision and body position by the aids in the management of sitting distance when using computers.

RECOMMENDATIONS

The results of the Eye Strain Monitoring System project, based on the functions of managing time duration using a computer, are that this device's LEDs will blink every two hours, thereby alerting users to blink their eyes, so reducing eye discomfort. The 20-20-20 rule recommends that every 20 minutes, users of electronic devices should look away from their screens and focus on an object approximately 20 feet (6.09 metres) away for 20 seconds. This provides an opportunity to relax eye muscles (Chu et al., 2010; iHasco, n.d.). As a result, it facilitates the management of sitting distance when using computers, with the intention that this management will eventually aid users in rectifying their sitting gap. As a result, the user may focus on their task while seated without experiencing discomfort or pain, especially in terms of vision and body position.

ETHICAL TEXT

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In this article, the journal writing rules, publication principles, research and publication ethics, and journal ethical rules were followed. The responsibility belongs to the author (s) for any violations that may arise regarding the article.

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