SMART GOGGLE PROTOTYPE

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ABSTRACT
Now a days, digital device usage has increased at higher rate among all the age group of people. In this pandemic situation, the world is going more digitally. From school children to elder age people, the work is going online. So, in a day, human eye is exposed to various lights of different wavelengths. People involve in watching movies, playing games, attending classes, doing projects, working on devices, reading notes and so on. This way their eyes will be strained a lot depending on the exposure of different waves with respect to time. These digital eye strains can cause computer vision syndrome with eye irritation, head ache, shoulder pain, depression, bad mental health and so on. IN order to prevent and alert the person from over exposure and eye irritation, I have proposed a prototype called smart goggle. This smart goggle contains LDR sensor that is attached with the spectacles that detects the amount and type of rays falling on the eye, transmits the signal through IOT and records the exposure rate with respect to time in the form of a graph in the respective subject's smart phone. This provides the exposure rate of the subject to backlit devices and gives alarm when it crosses a threshold. This prototype can be potentially used to prevent digital eye strain.

Keywords: Digital eye strain, light intensity, smart goggle, intensity sensor.

I.INTRODUCTION

Clayton Blehm, et all (2005) described about the characteristics and treatment modalities that are available for computer vision syndrome. They describes that ocular and/or extraocular etiologies causes the symptoms of computer vision syndrome. Among all the symptoms dry eye was the major symptom. They have discussed about the various display characteristics and their effects on eye. They define about the asthenopic symptoms, VDTs and Transient Myopia and ocular surface related symptoms. They also provided the visual effects caused by varying in display characteristics like display quality, lightening and glare, refresh rates, differing intensity and type of radiation. Computer glass provides a treatment for computer vision syndrome. They state that the best treatment for computer vision syndrome would be a multi – directional approach that includes lightning and environmental factors, eyeglass correction, properly scheduled work breaks from computer screen and also ergonomics of work station.

Rosenfield.M (2011) reviewed about the principal causes in ocular area for the condition of computer vision syndrome. They are the dry eye and oculomotor anomalies. Dry eye symptoms increase during computer operation. It happens when there is reduced rate of eye blinking and blinking amplitude. Increased corneal exposure is also a cause for dry eye. The treatments for computer vision syndrome that are potential are Dry eye treatment, Vergence anomalies, Refractive and accommodative disorders. But the treatments were unproven that they can reduce the symptoms.

Army L Sheppard and James S Wolffsohn (2018), reviewed about the symptoms, prevalence, measurement and amelioration of digital eye strain. The measuring strategies available to measure digital eye strain are subjective methods that includes Dry Eye questionnaires (DEQ), visual fatigue scale, Likert scale, Rasch-based Computer Vision Syndrome Scale and Computer Vision Syndrome Questionnaires (CVS-Q), objective evaluation methods, Critical Flicker-Fusion Frequency (CFF) and blinking characteristics. Further they have discussed about accommodative effects, Pupillary light reflex and size, refractive error and presbyopia, accommodation and vergence anomalies and blue light.

Chantal Coles-Brennan, et all (2018) reviews about DES symptoms and its management. They states that symptom may be caused by one or more factors, a holistic approach should be adopted. The following management strategies have been suggested: (i) appropriate correction of refractive error, including astigmatism and presbyopia; (ii) management of vergence anomalies, with the aim of inducing or leaving a small amount of heterophoria (~1.5Δ Exo); (iii) blinking exercise/training to maintain normal blinking pattern; (iv) use of lubricating eye drops (artificial tears) to help alleviate dry eye-related symptoms; (v) contact lenses with enhanced comfort, particularly at end-of-day and in challenging environments; (vi) prescription of colour filters in all vision correction options, especially blue lightabsorbing filters; and (vii) management of accommodative anomalies. Prevention is the main strategy for management of digital eye strain.

Camelia Margareta Bogdănici, et all (2017) analyzed the effects of gadgets on eyesight quality. Headache, blurred vision, and ocular congestion are the most frequent manifestations determined by the long time use of gadgets. Among the most frequently used gadgets Mobile phones and laptops play an important role. People using those gadgets for a long time have a sustained effort for accommodation. A small amount of refractive errors (especially myopic shift) also occurred in most cases. Dry eye syndrome could also be identified likewise and use of artificial tears drops for moisturizing eye may be helpful. Computer Vision Syndrome is still under-diagnosed, and people should be made aware of the bad effects the prolonged use of gadgets has on eyesight.

Sudip Poudel (2018) also analysed the effect of various gadgets on eyesight. Eye Strain, Dry Eye, and Red Eye are the most frequent manifestations determined by the long time use of gadgets. large hours using Computer as well as mobiles using per day, wearing eyeglass & Using preventive Measures, were significantly associated with present of CVS While CVS symptoms were not associated with Gender, Duration of wearing Eyeglass and duration (years) of using Electronic gadgets. He framed a questionnaire and survey study was conducted on 46 students and their characteristics was observed and analysed.

A. METHODOLOGY

TinkerCAD software is used to design the prototype. Various intensity of lights like Red, Green and Blue are emitted from a neopixel sensor. The intensity of such light is measured by a LDR- photo resistor. The measured intensity is displayed in the LCD screen. The sensor, LDR and LCD are connected to a Arduino UNO board. The program for the prototype was written in Arduino software. The block diagram of the prototype is given in fig.1.

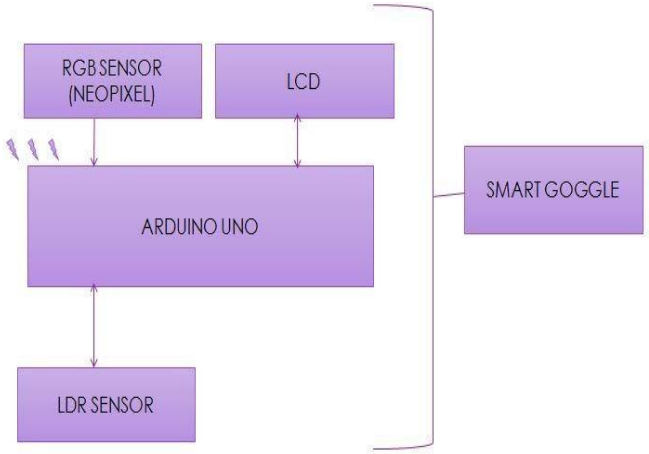

FIGURE 1: BLOCK DIAGRAM

Arduino Uno R3 is one kind of ATmega328P based microcontroller board. The main features of this board mainly include, it is available in DIP (dual-inline-package), detachable and ATmega328 microcontroller.

Specifications:

- The Operating Voltage of the Arduino is 5V
- Digital input and output pins-14
- Digital input and output pins (PMW)-6
- Analog i/p pins are 6
- EEPROM is 1 KB
- The speed of clock is 16MHz
- In Built LED
- Length and width of the Arduino are 68.6 mm X 53.4 mm

LDR

A sensor whose resistance changes based on the amount of light it senses. They can be connected in any direction and can be used to sense light. The model of the LDR used is given in the fig.2.This sensor is placed near the neopixel sensor that emits R,G and B light intensities.

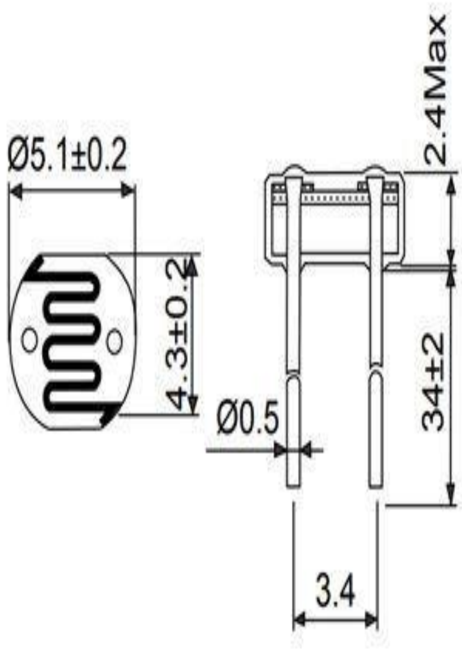

FIGURE 2: LDR

LCD
Liquid Crystal Display is a electronic display module. This LCD is connected to the Arduino Uno for displaying the intensity values that are emitted from the Neopixel and measured by the photoresistor.

Specifications:
- The operating voltage of this LCD is 4.7V-5.3V
- It includes two rows where each row can produce 16-characters.
- The utilization of current is 1mA with no backlight
- Every character can be built with a 5×8 pixel box
- The alphanumeric LCDs alphabets & numbers
- Is display can work on two modes like 4-bit & 8-bit
- These are obtainable in Blue & Green Backlight
- It displays a few custom generated characters

NEOPIXEL
Neopixel is a single RGB LED that can be controlled using a microcontroller. This is connected to the Arduino uno and push buttons. When the push button is pressed each time, the colour of the LED changes from red to green to blue respectively.

Specifications:
- Individually addressable and programmable RGB LEDs
- Flexible and available in different form factors
- Operating voltage: 3.3V to 5V
- Power consumption: 60mA per LED at full brightness
- Communication: PWM through data pin
- Driver IC: WS2812
- Available in many different packages and form factors

Pin Diagram:

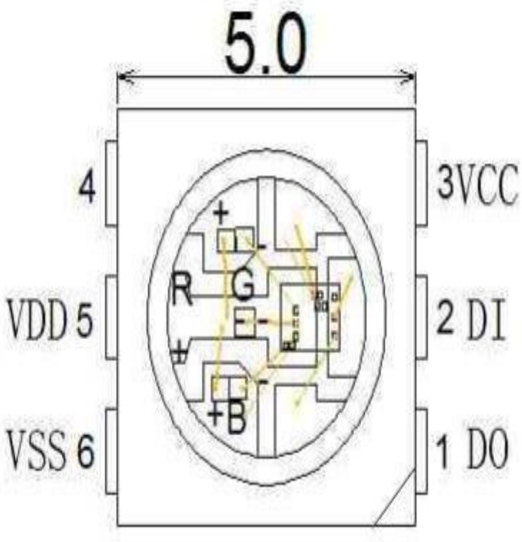

FIGURE 3: PIN DIAGRAM OF NEOPIXEL

3.5 POTENTIOMETER
It is a type of resistor whose resistance changes at the turn of a knob. By turning the shaft of the potentiometer, we change the amount of resistence on either side of the wiper which is connected to the center pin of the potentiometer. The pin diagram of potentiometer is given in fig.6.

Specifications:
- Type: Rotary a.k.a Radio POT
- Available in different resistance values like 500Ω, 1K, 2K, 5K, 10K, 22K, 47K, 50K, 100K, 220K, 470K, 500K, 1 M.
- Power Rating: 0.3W
- Maximum Input Voltage: 200Vdc

- Rotational Life: 2000K cycles

Pin Diagram:

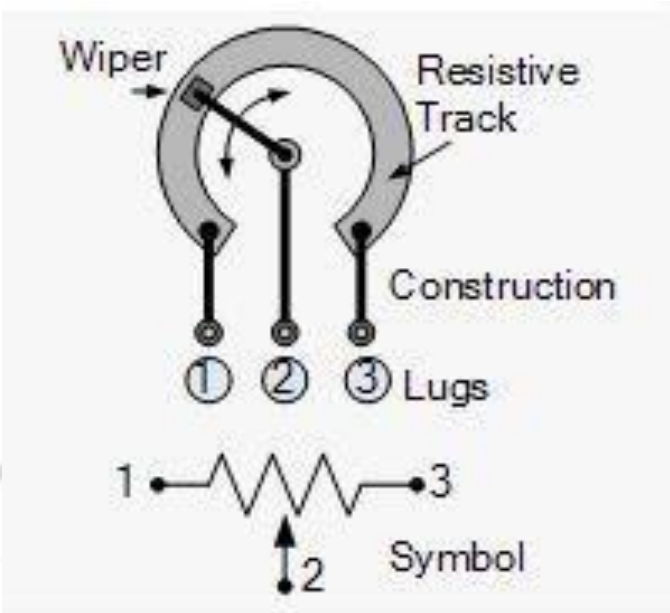

FIGURE 4: PIN DIAGRAM OF POTENTIOMETER

RESISTORS:
It restricts the flow of electricity in a circuit, reducing the voltage and current as a result. 1 K Ω Resistors – 2 Nos. and 250 Ω resistor 1 No. is used.

PUSH BUTTON:
It is a switch that closes a circuit when pressed. Here pushbutton is used to control the colour of light emitted by the Neopixel.

TINKERCAD:
Tinkercad is a free, online, commercial 3D modeling program that runs in a web browser, known for its simplicity and ease of use. This software is used to design the prototype of smart goggle in this project. The model of the browser is shown in fig.7.

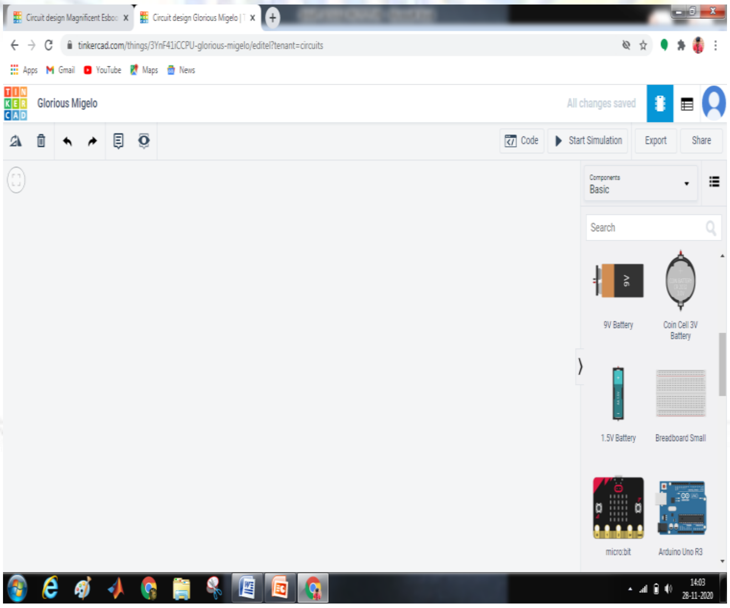

FIGURE 5: TINKERCAD MODEL BROWSER

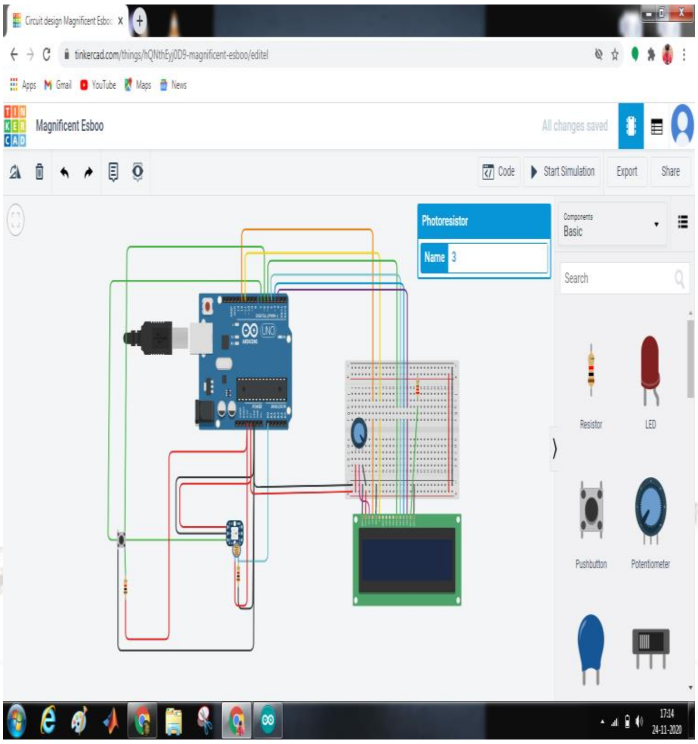

FIGURE 6: SIMULATED CIRCUIT via TINKERCAD

When the simulation is started, the circuit begins and LCD blows. The Neo pixel is initially in 'OFF' condition. When the push button is pressed the Neo pixel starts to emit RGB colours. The photo resistor measures the amount of intensity due to variation in resistance. The potentiometer resistance is varied to increase or decrease the LCD's display intensity. In this simulation, the Neo pixel acts as the different display types that emits different wavelength of light. The LDR acts as the eye that is exposed to different wavelength of lights. The measure of the intensity of light falls on LDR gives the exposure rate of eye.

II.RESULT & DISCUSSION

PROTOTYPE DESIGN: The prototype design of simulated circuit via TINKERCAD is given in fig.7.

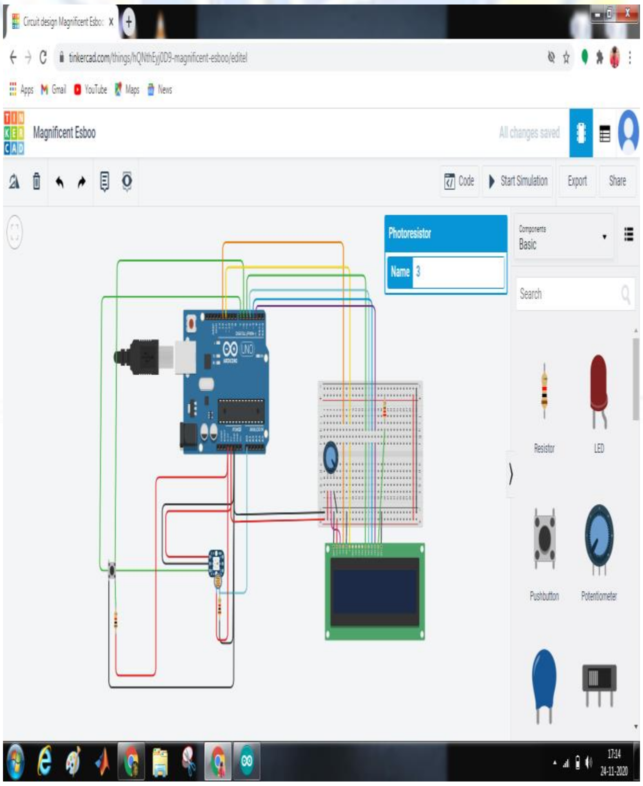

FIGURE 7: SIMULATED CIRCUIT via TINKERCAD

When the simulation is started, the circuit begins and LCD blows. The Neopixel is initially in 'OFF' condition. When the push button is pressed the Neopixel starts to emit RGB colours. The photo resistor measures the amount of intensity due to variation in resistance. The potentiometer resistance is varied to increase or decrease the LCD's display intensity. In this simulation, the Neopixel acts as the different display types that emits different wavelength of light. The LDR acts as the eye that is exposed to different wavelength of lights. The measure of the intensity of light falls on LDR gives the exposure rate of eye.

Step 1: Running the program

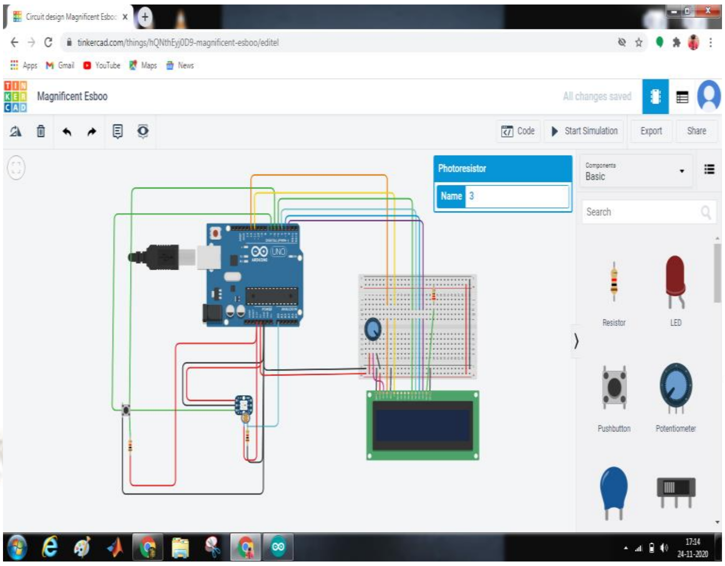

FIGURE 8: CIRCUIT 'ON'

Step 2: Pressing the push button. Red light starts to blow. Varying the intensity by changing the resistance can be shown in LCD.

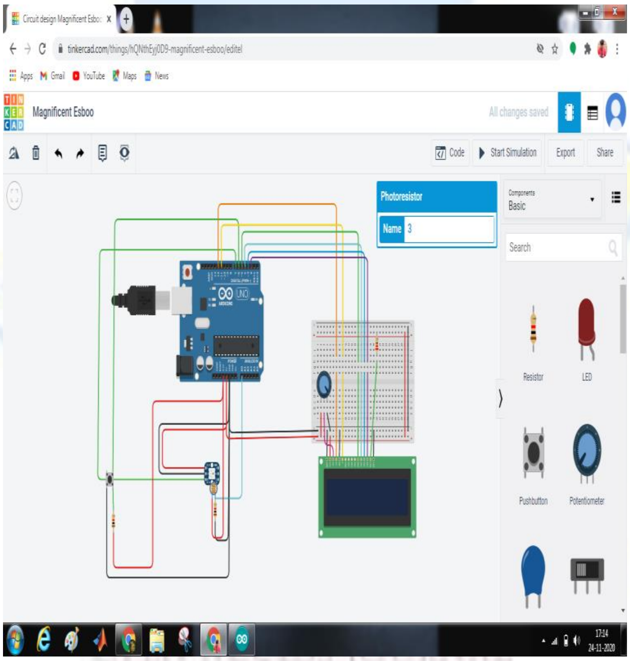

FIGURE 9: RED LIGHT EMITTED AT LOW INTENSITY

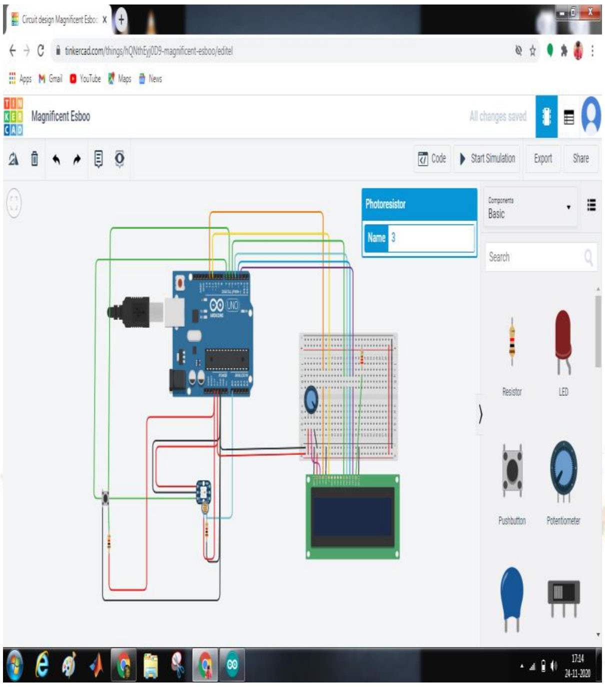

FIGURE 10: RED LIGHT EMITTED AT HIGH INTENSITY

Step 3: Pressing the push button. Green button starts blowing. Varying the intensity by changing the resistance can be shown in LCD.

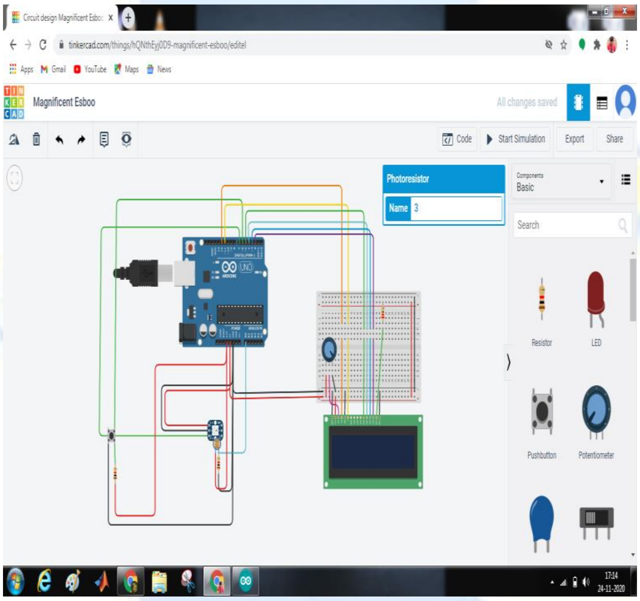

FIGURE 11: GREEN LIGHT EMITTED

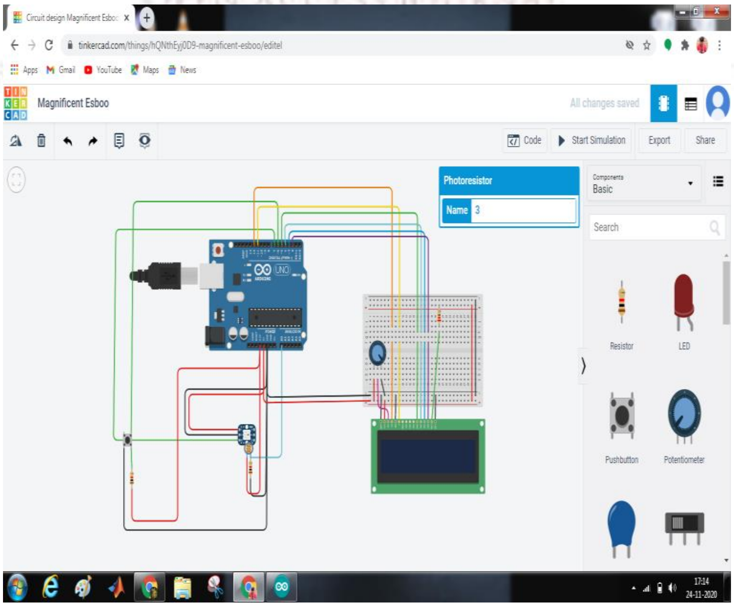

FIGURE 12: GREEN LIGHT EMITTED AT LOW INTENSITY

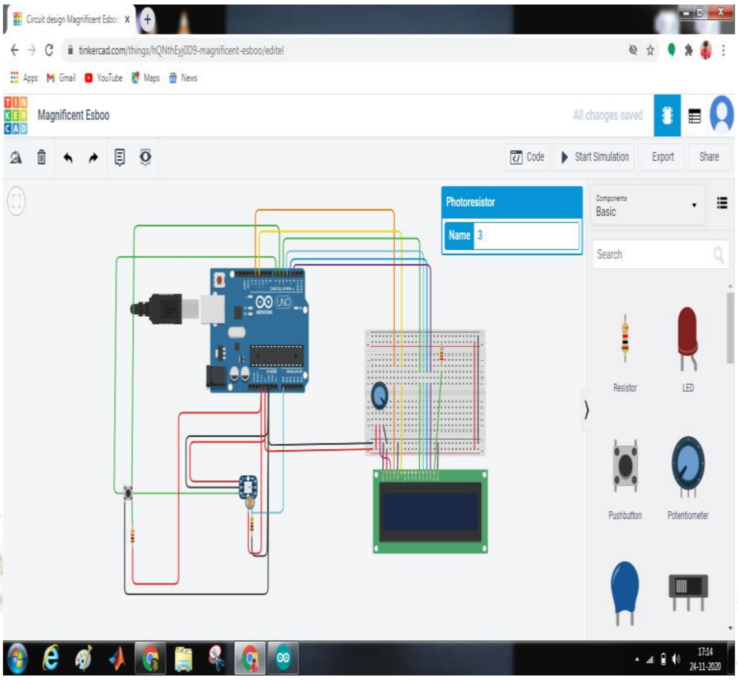

FIGURE 13: GREEN LIGHT EMITTED AT HIGH INTENSITY

Step 4: Pressing the push button. Blue button starts blowing. Varying the intensity by changing the resistance can be shown in LCD.

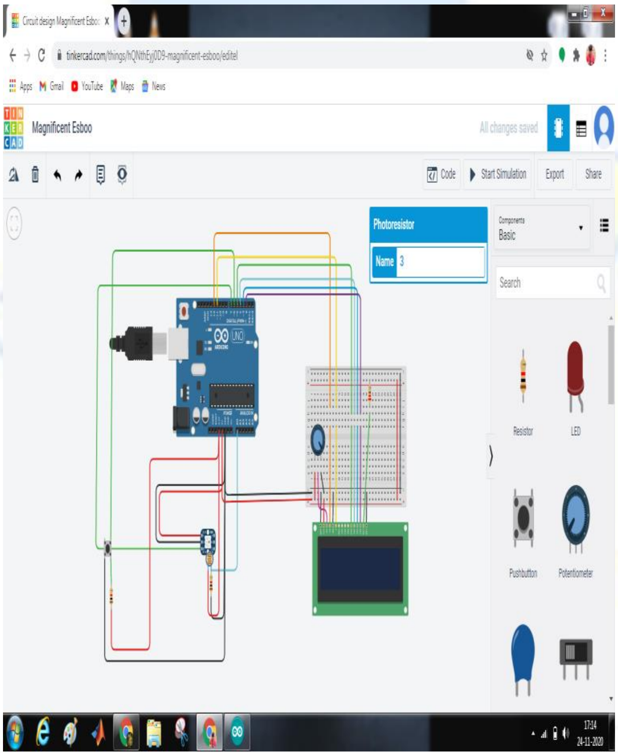

FIGURE 14: BLUE LIGHT EMITTED

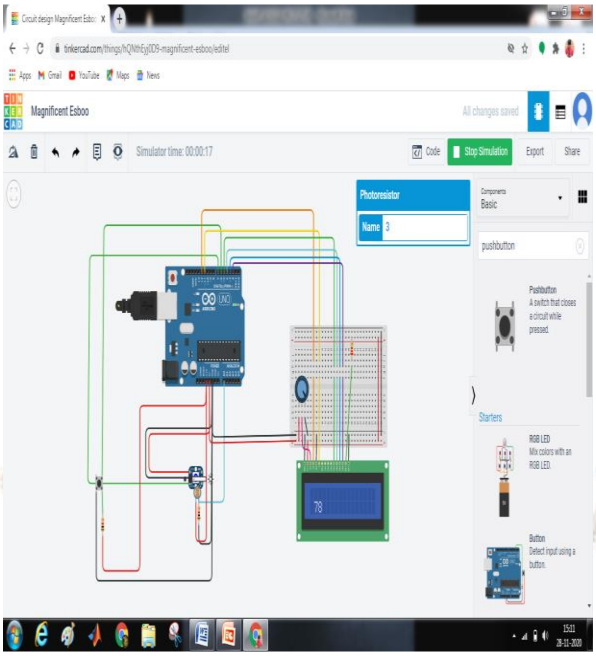

FIGURE 15: BLUE LIGHT EMITTED AT LOW INTENSITY

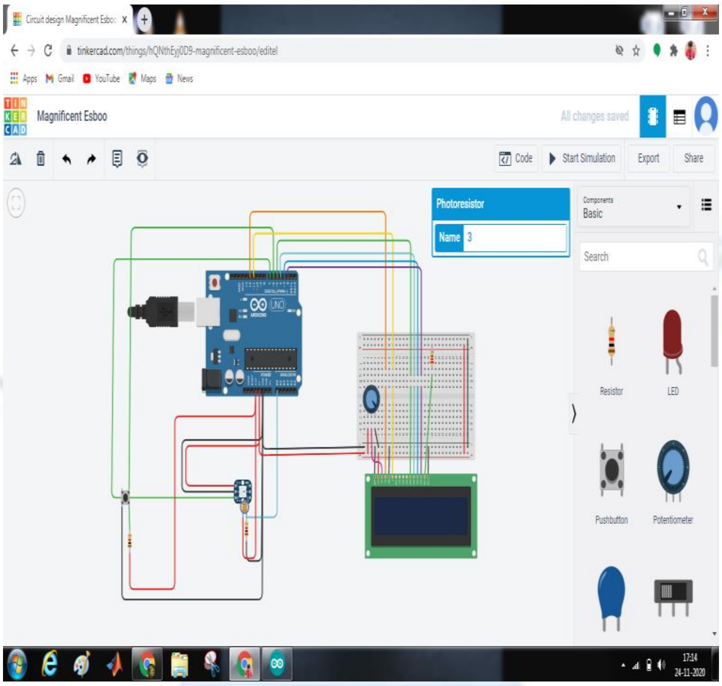

FIGURE 16: BLUE LIGHT EMITTED AT HIGH INTENSITY

III.CONCLUSION

Digital eye strain serves as a major problem for people in their day-to-day life due to use of large number of electronic gadgets for a longer period of time in various fields. Protecting or preventing them from over exposure and CVS is very much necessary. There are computer glasses available that blocks partial amount of blue light from backlit devices that reaches the eye. However, they may not act as a complete saver. This prototype called smart goggle can be embedded, enhanced and installed in the computer glasses or any kind of power glass frames. This will measure the exposure rate on our eye by different intensity radiations emitted by various electronic gadgets. In future work, this exposure rate can be sent to individual devices to keep track on the exposure rate of light on our eye daily. And this prototype can be used for future studies and research also.

CONFLICT OF INTEREST

The Authors of the paper find no conflict of interest

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