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SENSITIVE.LY - Environment based Brightness Control

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Abstract **Bad environmental lighting or changing lights while watching television, or continuously working on a laptop or PCs, or while using headsets can bring a significant strain on the eyes. To manage this health issue, this paper proposes a system which detects the intensity of light in the environment, just like the human eye does, and automatically changes the brightness in the electronic gadgets appropriately to bring down the strain on the eye. The main advantage of the proposed model is that it not just brings the optimum viewing comfort to the user, in changing environmental lighting, but also helps to reduce power consumption and extend the battery life of the electronic device. The proposed technique was tested using hardware set up and the results prove that the lighting control reduces the strain on human eyes and increases comfort.**

Keywords— Automated brightness control, PC/Laptops, Brightness.

I. INTRODUCTION

In many devices across the computing device spectrum, the display or the screen is used as the main user interface, including most traditional devices such as desktops and laptops. The size of the display, resolution and brightness are the main parameters to determine the quality of the screen[1]. In this proposed paper our main focus is on the aspect of managing the brightness in order to enhance the viewing experience of the user.

Brightness is supposed to be modified dynamically in order to suit the environment of the user unlike other characteristics of the display. Consider the situation while checking our emails or working for office in a dark environment or at night like in Fig. 1. High brightness can be very harmful and straining for our eyes and low brightness is preferred in such situations. Similarly, while using our device in daylight, on a sunny day, we might need high brightness for us to view comfortably without any strain or harm. A representative image for the case is shown in Fig.1. Therefore, the choice of ideal brightness clearly depends directly on the brightness in the environment [2].

Hence, in this research paper, we have proposed to create an automated system, in which the brightness is set automatically according to the environment lighting to reduce the harmful effect on the user's eyes. This has been carried out using an LDR or a light detecting sensor and a microcontroller[3].

Fig 1. Person seriously working on his pc without knowing the brightness in the surroundings.

II. RELATED WORKS

In this section, we discuss the works related to this field of display brightness and light-detecting sensors.

Matthew Schuchhardt [4] and his team in their research paper titled "CAPED: Context-aware Personalized Display Brightness for Mobile Devices" have suggested the idea which makes the brightness depending on the personalized setting of the user and also the context.

Michael Kishinevsky [5] and his team in their research paper have suggested the idea that the brightness depends on what is actually being done, like if the text is being read etc.

Ying-Wen Bai [6] and his team in their paper titled "Automatic Room Light Intensity Detection and Control Using a Microprocessor and Light Sensors" have devised an idea in which they use microprocessors to automatically change and control the light intensity in the house using light-detecting sensors.

Md Altab Hossin [7] and his team in their paper titled "User Selectable Brightness Control and Adjustment of 3D Digital Oscilloscope", have discussed the brightness control of display on user-based priority.

III. PROPOSED MODEL

In the proposed system, the LDR [8] continuously senses the environment lighting level and transfers it to the PC for further processing. The sensor data is then sent to the device of the user to make the changes in the system. This data is sent via pyserial [9] if data is required to be sent to the system via Arduino, otherwise, Bluetooth modules or any wireless modules [10] can also be used to send data to the system. Once the sensor data reaches the system, we can manipulate the

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system drivers to change the brightness. Fig. 2 shows the step-by-step flow of data.

The magnitude of voltage generated by the LDR is directly proportional to the light intensity falling on it. The relation between light intensity L_{ux} and voltage V_o produced is given by the formula :

$$L_{ux} = \frac{\frac{2500}{V_o} - 500}{0.33}$$

There are 14 digital pins, and six analog pins in Arduino Uno that can be used as input and output. The LDR always gives analog voltages and hence it is connected to the analog input pin on the Arduino. The sensor circuit connected to Arduino can be seen in Fig 3. There is a built-in Analog-To-Digital converter that converts the analog voltages of the LDR to digital values for the Computer to understand, and these digital values are of the range 0-1023. The dim light is in the range 0-500, the medium intensity light is in the range 500-850, and the bright intensity is in the range 850-1023.

The Arduino Uno then sends the digital values to the PC/Laptop where a particular script runs to change the brightness as per the optimum values recommended for screen viewing. Fig. 4 shows the distinct brightness states of the proposed system. Where the brightness of the laptop screen changes as per the distance from the light source around it.

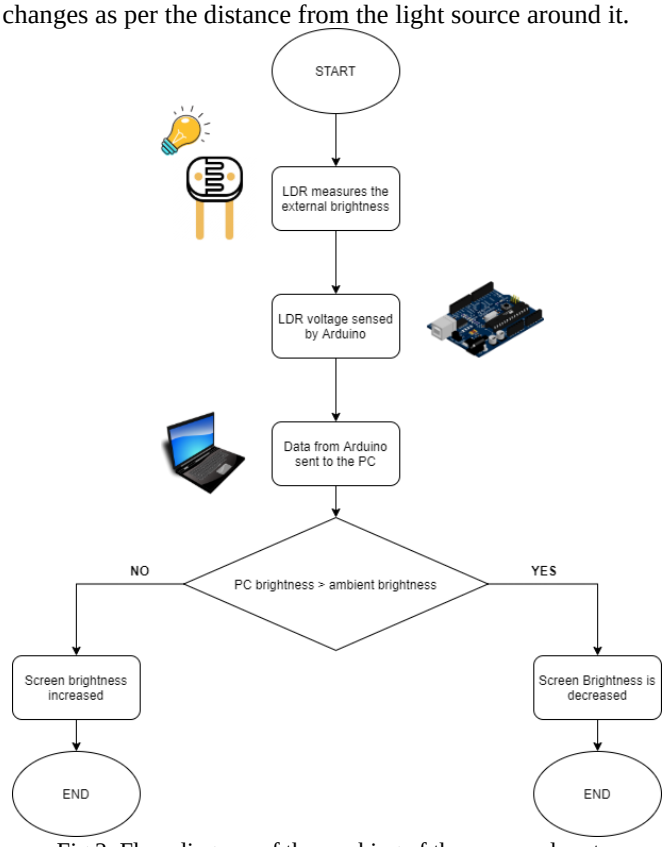

Fig 2: Flow diagram of the working of the proposed system.

IV. DESIGN

The circuit diagram is given in Fig. 3, it shows the proposed Arduino Uno along with the LDR module that leads to the changes into the user's system.

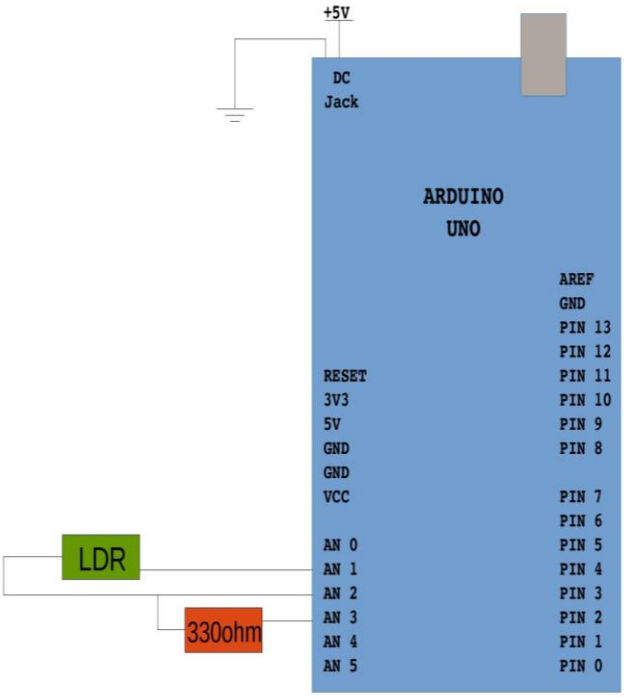

Fig 3: Schematic circuit diagram showing the pin connections.

As far as the design is concerned, it is pretty much simplified, robust and minimal.
The Arduino can be replaced by a much cheaper and specially designed microprocessor or microcontroller when manufacturing the product on an industrial scale.

V. WORKING

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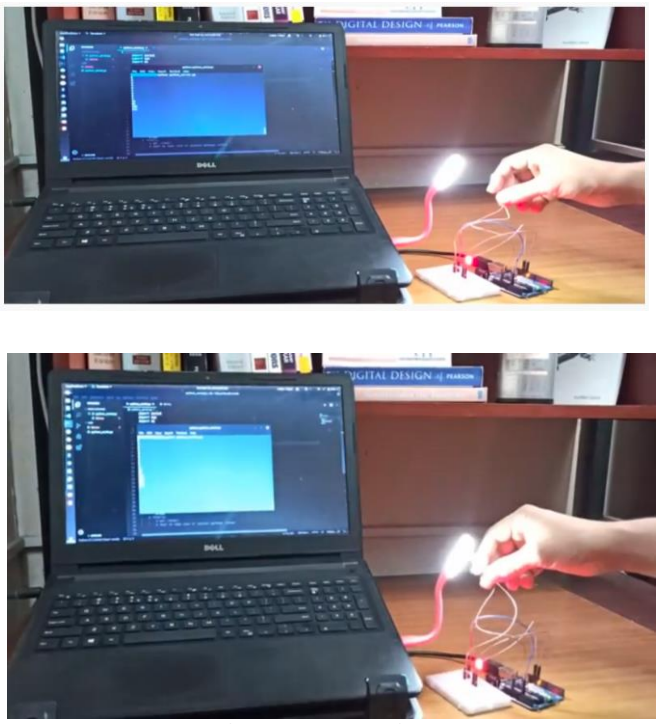

Fig 4: Working of the LDR portion of the proposed system.
(a). When light is very far from LDR
(b). When light is at an optimum distance from LDR
(c). When light is very close to LDR.

VI. RESULTS

The automatic brightness controller was implemented successfully. The system was tested extensively by adjusting the surrounding environment brightness and the output was found as expected. Utility and scope of implementation were analyzed and the product was found to be of immense utility for people who need to work extensively on laptop/PCs. The system was found to be both technically and economically feasible.

The tests were performed by varying the screen brightness in various external lightening systems, and the optimum brightness levels were chosen. The digitally converted LDR values versus the brightness values in NITS (candela per square metre) can be seen in Fig. 5. This graph clearly shows that there is a positive correlation between the brightness of the environment and laptop screen brightness.

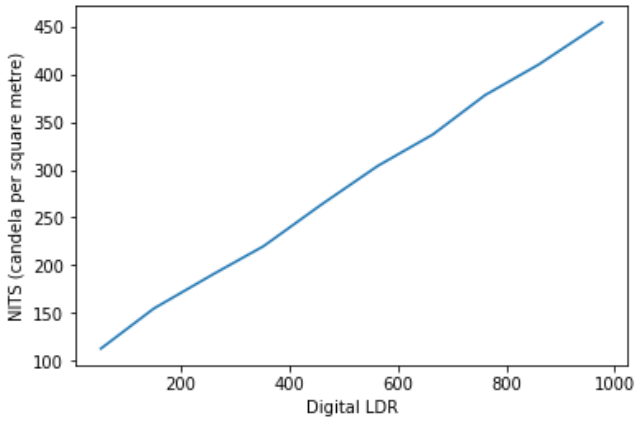

Fig 5: Correlation of LDR and Screen Brightness.

VII. FUTURE SCOPE

The brightness controller module that is being proposed here can be further extended into a “universal brightness controller”. This will not only control the brightness of the Laptop/PC but it will control the brightness of almost all light-emitting objects in the home/workspace. These include lights, Television, etc. This can be achieved using IoT. The brightness controller module can be further designed to control the light coming from doors/windows by adjusting the curtains/blinds. This will help the user to harvest the natural sunlight to its maximum potential and help him conserve electricity. The brightness controller module of our proposed system can be designed in a way to control the amount of lighting in an area as per the number of people present or the activity taking place. More people or activity implies more amount of lighting and fewer people and activity means less amount of light requirement. This can be especially useful for industrial applications where there are large spaces available but few people working around at some particular time. Brightness controller module can be used in automobile vehicles to adjust both internal and external lighting as per the conditions of the environment. This will lead to a reduction in the number of road accidents caused due to improper lighting. This auto system controller is very useful for people with physical disabilities. This will help them control things with almost zero physical movements or at least allow them to do things that their disability will not allow.

VIII. CONCLUSION

This proposed Automatic Brightness Controller has been designed and implemented successfully. As nowadays most of the things are getting automated, this proposed system is also an attempt to implement something similar to the Auto-Brightness module that is available in mobile phones. Utility and scope of the proposed model have been analyzed and the proposed work was found to be extremely helpful in real-world scenarios. The proposed method has a huge economic application upon performing an analysis on technical, operational and economic feasibility, this proposed model was found to be feasible as well as extremely helpful in all the mentioned aspects.

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