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Light Intensity Control Using Polaroids

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Abstract: ***In today's era of illuminating devices, there are a wide variety of devices available in aesthetics but the none with variable intensity of light. Using the basic principle of polarization of light using a Polaroid filter or polarizer, the designing of a light intensity control was done.***
The polarizing angle of the filter decides the intensity of the light that would pass through the filters. According to the principle of propagation of light, the electric and magnetic vibrations of a light wave occur perpendicularly to each other. A light wave that is vibrating in more than one plane is known as unpolarized light. The light emitted by the sun, by a lamp or a tube light are all unpolarized light sources.
The other kind of wave is a polarized wave. A Plane polarized light vibrates on only one plane. The process of transforming unpolarized light into the polarized light is known as polarization. Using the same principle and with the use of a LDR (light dependent resister) as a sensor to sense the intensity of the surrounding light and then rotate the polaroid filter sheets accordingly using a stepper motor for the required change in intensity.
The sensing and sending of feedback and subsequent rotation of the Polaroid filter sheets would be automated by ATMEGA32 microcontroller and L293D.
Keywords: Polaroids, LDR, Light Variation, ATMEGA32, L293D

I. INTRODUCTION

Due to inability to vary the incoming light intensity some obstructions have to be used and that makes it inefficient. Whereas if there is a possibility to vary the intensity for the same light source the efficiency and ease of use is more. The theory of polarization of light is used here where the two constituents of the light beam have vibrations perpendicularly and thus the same have different results upon polarization.

A LDR senses the surrounding light intensity, then using the feedback loop kind of concept sends the relevant information to the microcontroller that then rotates the Polaroid sheets with the help of stepper motor and gears to achieve the required result. We have thus tried to create a system that can also function as an intelligent window that automatically reacts to changes of the light intensity over the day and over the year.

II. OBJECTIVES

A. To design a Light Intensity variation project using Polaroids.
B. To understand Polarization and implement it in the project.
C. To be able write a program in Embedded C on microcontroller (ATMEGA32).
D. To understand ADC interfacing on ATMEGA32.
E. To understand working of Stepper Motor.
F. To study about motor driver (L293D) interfacing with microcontroller.

III. LITERATURE REVIEW

For varying the incoming light intensity some obstructions have been used and due to inability, it makes it insufficient. Here, the theory of polarization of light is used where the two constituents of light beam have vibrations perpendicular and thus the same have different results depending on polarization.

An LDR is used that senses the surrounding light intensity, then using feedback loop concept sends relevant information to microcontroller and rotates the polaroid sheet with the help of stepper motor, so that the light intensity automatically by sensing surrounding illumination and varying incoming light.

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IV. WORKING MODULE

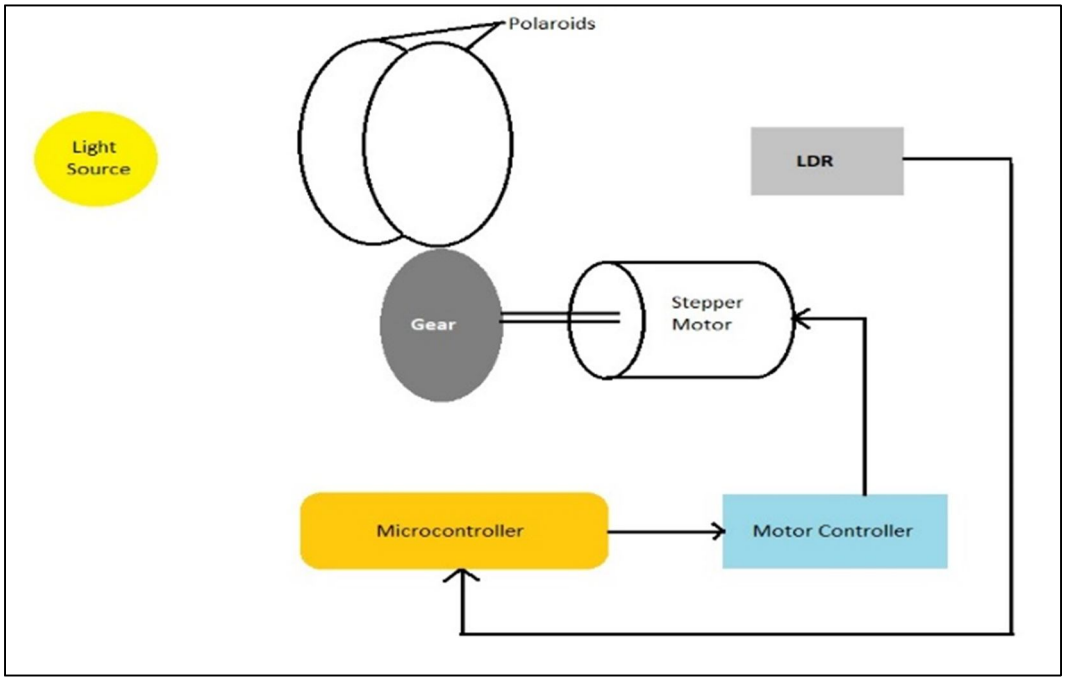


Fig. 1 Block diagram of accident detection and alertsystem

The LDR will sense the surrounding light and give the feedback to the microcontroller. According to it the microcontroller will give signal to motor controller, which will then rotate the stepper motor clockwise or anti-clockwise. This will rotate the gears and the Polaroid sheets which would affect the intensity of light as required.

1) *Light Source* – The light of the surroundings, like sunlight or street light or ambient light in the room.
2) *LDR* – Light Dependent Resister that converts the light into the electrical analog value.
3) *Microcontroller* – ATMEGA32
4) *Motor Controller* – L293D is used to increase the voltage and current ratings as microcontroller cannot provide enough current for the motor.
5) *Stepper Motor* – A bipolar stepper motor using 15° step angle is used to rotate in steps of 15°
6) *Polaroid (*2)* – Rotating one of the polaroids to vary the relative angle between the two polaroids will change the intensity of incoming light.

V. SOFTWARE

A. Proteus 8.11 Professional

Proteus is a proprietary software toll used primarily for electronic design automation. It has modules for schematic capture, simulation and PCB layout design. All PCB Design products include an auto-router and basic mode SPICE simulation capabilities. The 3D viewer module allows the board under development to be viewed in 3D together with a semi-transparent height plane that represents the board's enclosure. STEP output can then be used to transfer to mechanical CAD software for accurate mounting and positioning of the board.

B. Atmel Studios

Atmel studio provides a complete set of features including file management, task management and version control integration (CVS), a C/C++ editor with syntax highlighting, navigation and code compilation, a debugger supporting run control including source and instruction level stepping and break point.

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VI. FLOWCHART

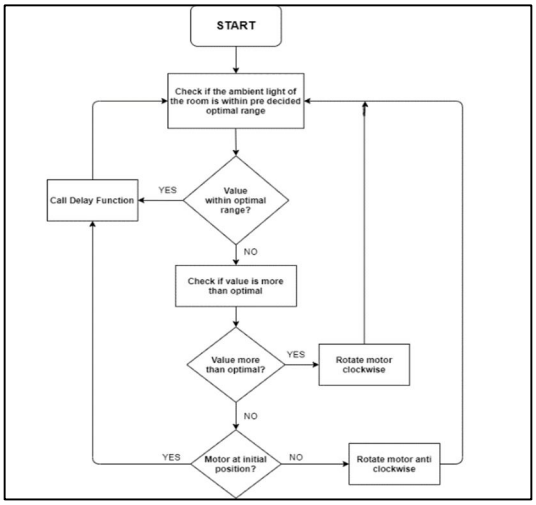


Fig. 2 Flowchart

When the program starts, the light first falls on the LDR, it checks whether the intensity of the ambient light is within the pre decided optimal range and if it is in the optimal range, a delay is being called and otherwise if the value is more than optimal range then the stepper motor will rotate in clockwise direction. The check for the ambient light intensity value is done again. If the value is not more than the optimal range, then it checks whether the motor is at the initial position. If yes it calls the delay function and the checking of the light intensity takes place. If it isn't at the initial position, it rotates the motor anti clockwise and then the checking of light intensity takes place.

VII. RESULTS AND DISCUSSIONS

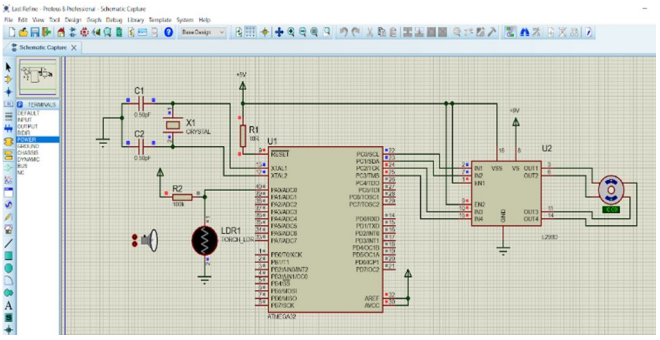


Fig. 4 Initial Position

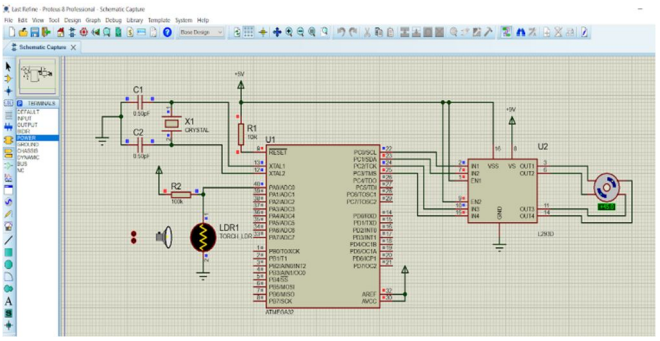


Fig. 5 When surrounding light is more, the polaroid rotates to 45 degrees

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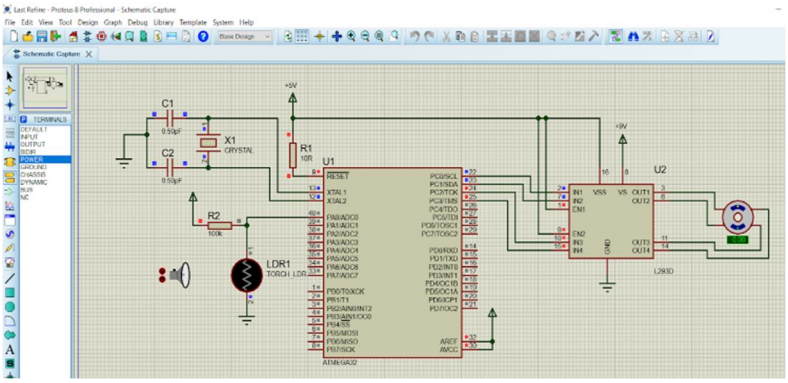


Fig. 6 When surrounding light decreases, motor rotates back to 0 degrees

The LDR is a sensor which will detect the light intensity falling on it. To simulate the surrounding light intensity, we have used a torch that acts like a source of light. As the torch moves near the LDR, the LDR resistance goes on decreasing.
After the resistance decreases below a certain value, the signals sent to the stepper motor will be changed and that will be controlled by the Embedded C code Hex file. This change in the signal from Port C will excite different stators of the stepper motor, which will cause its rotation. When the light is less, the motor rotates in the counter clockwise direction, when it is bright, it rotates in the clockwise direction.

VIII. ADVANTAGES

A. Easy controlling of light in closed surroundings.
B. Energy saving
C. Versatile
D. Automated process
E. Obtaining variable light intensity for the same source.

IX. APPLICATIONS

A. In dark rooms or laboratories or factory areas
B. Greenhouse establishments
C. Airplane windows
D. Automated Curtain system in smart housing

X. CONCLUSION

We achieved the probable simulation of the system designed and were able to rotate the stepper motor using motor driver L293D and microcontroller AT328 and thus in a hardware manner we would be able to rotate the Polaroid sheets and then would achieve the varied intensity of light.

XI. FUTURE SCOPE

We can enhance the future scope of this device system by using IoT with the current design so that it can be completely automated and also used remotely. Our idea is unique because of its intensity variation. Thus, it would be able to achieve the goal in devices where it is required. For e.g., if the light outside is too bright the window shades down to keep interior temperature and brightness at a tolerable level. Using IoT based devices it can be easily automated to achieve ease and comfort.

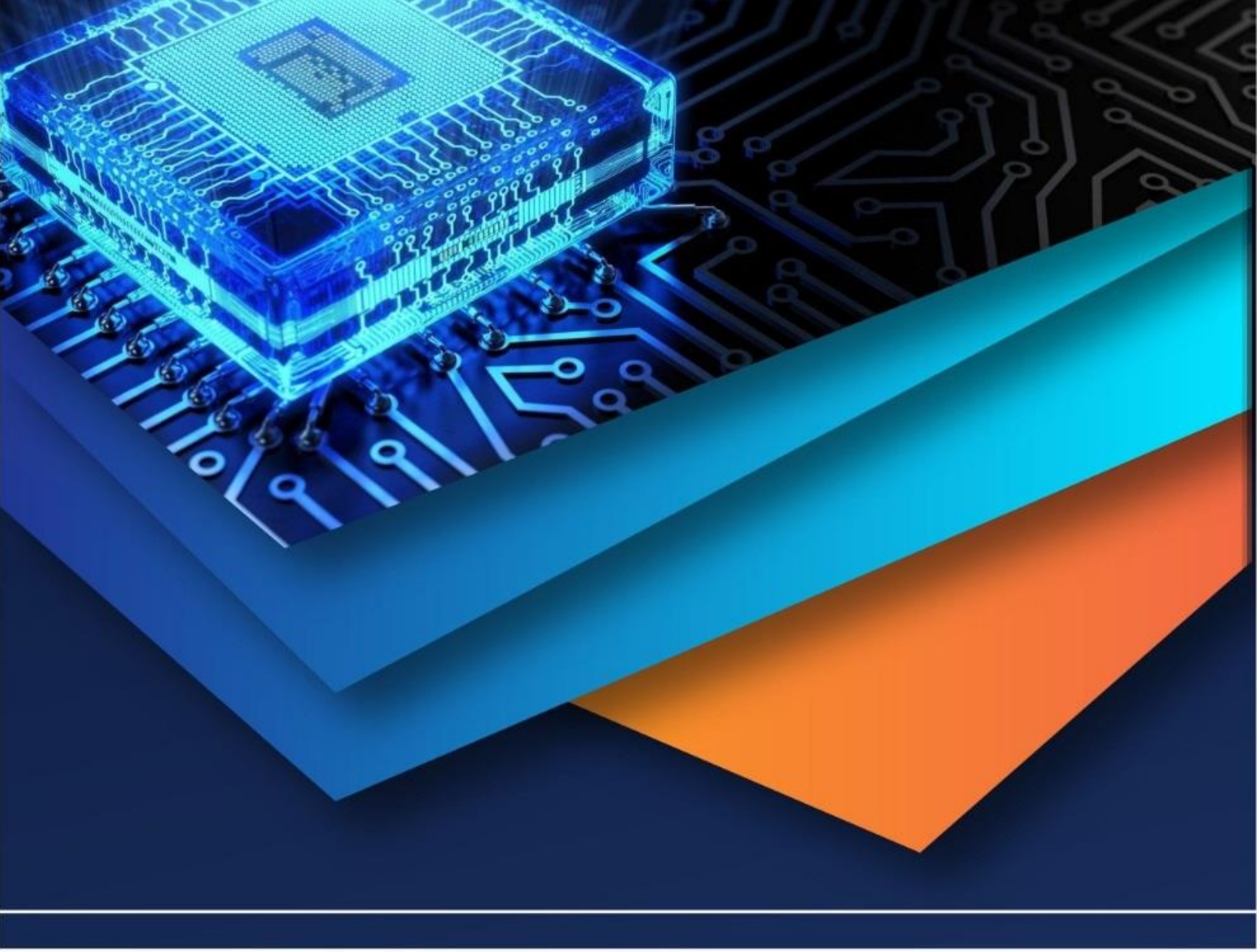
XII. ACKNOWLEDGEMENT

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