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Design and Control of Street Light Intensity for Fog and Rain

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ABSTRACT*:* This paper presents smart LED street light system which controls intensity of light during rain and fog. The system works first on colour sensor and then LASER beam light is used to detect the fog,according to that the intensity of LED light has been varied.If the beam of LASER light received by the color sensor is very less then brightness of LED will be increased and when there is no fog or rain the intensity of light will remain low. This system is achieved by using ARDUINO, LED lights and LED dimming control PWM circuit. The power consumption by using LED and intensity variation graph of street light has been shown through MATLAB. By using PWM circuit, current and voltages values are presented. The mechanism of circuit depends on pulse width modulation and analog to digital convertor features of microcontroller**.**

KEYWORDS*:* Arduino Uno board, Color sensor, LASER light, LEDs.

I.INTRODUCTION

Street lighting system is the bulkiest energy outlay for number of city. A smart street lighting system can minimize the municipal street lighting cost as much as 50% to 70%. An intelligent street light system is a system that calibrates the light output on the basis of utilisation and abidance. An accurate street light system intends the installation of the wireless system and overcome the definite energy consumption which will also control the intensity of the street light.The proposed smart street light system is a hardware application in which fog or rain sensor detects the fog and according to it the intensity of light can be controlled throughcontroller. We are using methodology for intensity control is arduino software and for power consumption MATLAB software is used to show the graphs that how much energy is consumed. Street lightening systems are important facilities for modern city. This system will sort night life more suitable, safe and eco- friendly. Currently, the integrity ofthe street lights and fog detection has been studied for the road safety and security. Firstly the fog sensor is made which can detect the fog during winter season and when the fog is detected the intensity of street light can be varied depending on the fog density. The variation of intensity of street light can be done by using potentiometer so that led cannot be fused .It is a fully automated system. Automated process is not very easy task to perform but it is very powerful technique .The main purpose of this project to increase the visibility on the roads so that the road accidents can be reduced. This project firstly develops the night or day fog detection using colour sensor and LED street light. The street light controller should be installed on the pole lights and on the opposite pole onecolour sensor and LDR is also installed so that by these two the fog detection process can be done properly so that required amount of led light can be glow on the road. [1]In this paper authors defines the assimilation of new technologies proposing simplicity of preservation and comprise of spatially using independent devices using vibrant grid topology.[2] In this paper author describes the proposal of a autonomous system for illumination street lights consuming piezoelectric renewable vitality source. [3]In present times, renewable drive sources are more anticipated because of the absence of more conventional sources of energy. In this project, author uses of piezoelectric resources to create basically usable electrical energy from wasted mechanical drive.[4] Piezoelectric.

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reapers are becoming progressively current because the formed piezoelectricity now can amount up to10–100's of W of accessible power. [5].In this paper author describe the system presentation comprising the output and the communication time is also examined. It is inspected that high broadcast power origins neighbour network intervention, and that the output enhancement reduces as the broadcast power increases of numerous street light control systems and examined its features and needs, particularly for communiqué characteristics. [6]This gives improved appreciative about controller and comprehend the state of the controller.[7]In this paper authors explain the Traffic Signal light. [8]Depend on the extent of traffic in precise path, essential monitoring activities could be taken. Also exigency vehicles and VIP groups can be handed proficiently.[9] Furthermore, events is made to certify that the whole system is independent on nonconventional drive means like solar power .[10]Demand Side Management (DSM) is a selection of procedures to advance the energy method at the side of consumption. This paper gives an summary and a classification for DSM, examines the numerous forms of DSM, and gives an viewpoint on the newest demo tasks in this domain.[11].

II. PROPOSED SYSTEM

In this energy efficient street light project cycle, first the requirement of the lightening system in the streets are examined. Then a best technology has been implemented so that a good energy efficient system can designed. The operation and maintenance is required for a system.The values obtained by the mechanism from thesensor can be measured and evaluated from the values that are already given. The values obtained from the sensor during the task performance and then these values are compared with the given values and the errors can be found out. The measured values show the efficiency of system. The projected intellectual LED system of street light for the detection of fog includes ARDUINO software strategy, LED and colour sensor. The inclusive action can be done by using MATLAB software. The data is received by sensor. The graph is shown between time and intensity. The prototype of intelligent LED street light system is developed. Means switching set of rules is intended to make the selecting system that usage of resources commencing the battery, but it correspondingly automatically switches to electricity network resources while battery capability is under the lesser threshold. The resources mechanism medley can be done by using the analog, the digital values and PWM features of the microcontroller. A large no. of serialized pile-up accidents takes place when visibility is low due to fog. The peril of these accidents can be reduced significantly with a system holding visibility sensors and flexible speed-limit. The present system is not very cost effective. So it is required to make a fog sensor which is cost effective at low budget and can install at every street of a country.

III. CIRCUIT DESIGN AND METHODOLOGY

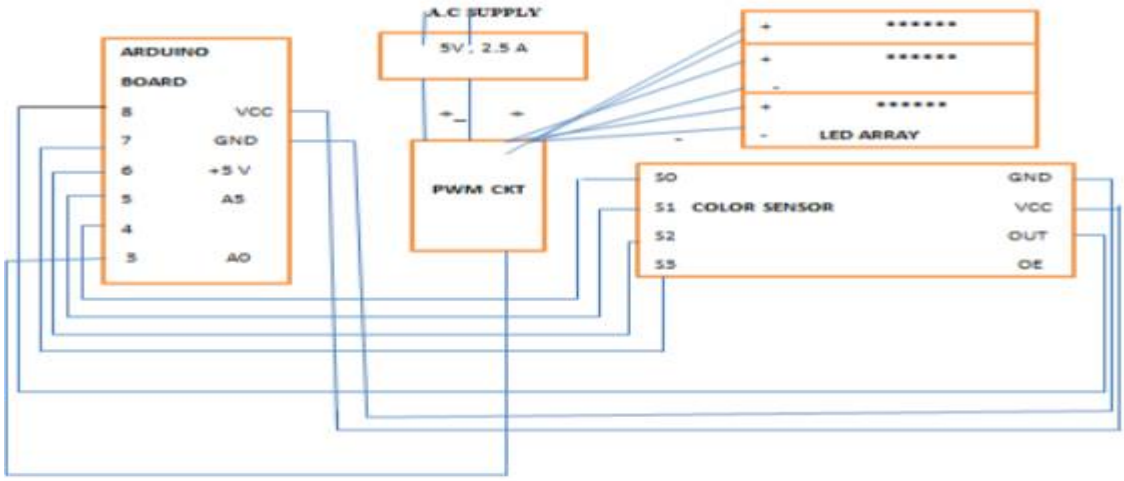

Fig.1 Circuit Design

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In the above shown Fig.1, it is a simple adjustable current regulator. While adjustable voltage works, the limits of voltage are not clearly defined and there can be a lot of dead band on the adjustment. The current regulator, on the other hand, has good range of adjustment, low dropout voltage and minimal dead band. The power device is a composite PNP /NPN pair that acts as a high gain PNP transistor. This could also be done with a PNP Darlington, but the dropout (saturation) voltage would be a little higher. This function could also be done with an NPN /PNP composite pair, but in this circuit the LEDs has to be grounded to the negative bus for possible future enhancements. It is essentially an emitter follower with a 0.6Ω emitter (shunt) resistor. The voltage across this resistor is determined by the base voltage at Q1. The collector (LED load) current is essentially the same as the emitter current. Since the voltage at the base of Q1 is adjustable, the load current is also adjustable. Schottky diode D1 provides a fixed 0.3V drop in order to reduce potentiometer dead band. A standard diode could prevent Q1 from turning off completely. This is important because the potentiometer is also employed as an On /Off switch. It does not completely remove power from the circuit, but the losses in the Off mode are far less than the magnetic and winding losses of the continuously operating wall wart. C1 is a bypass capacitor that helps to prevent oscillation.

METHODOLOGY

The Fig. 2flowchart clearly explains how the system is designedand how system works and the methodology applied to obtain desired result i.e. street light intensity control as per weather condition system for energy saving and road safety

1. The system is an automatic LED street light system which can increase visibility during foggy and rain condition.
2. First of all,LASERlight is taken asainput. Color sensor is used for fog detection. Color sensor is installed on the poles with LED light .LASER light is placed on the other opposite side of the pole. Color sensor senses and LASER light transmits the specific wavelength toward the color sensor.
3. If the laser light intensity received by the color sensor is less, this means the fog is detected .Fog sensor is used to detect the foggy condition. Data is collected from the sensor, according to that data the intensity is controlled. The led will glow with full brightness.
4. The intensity can be varied according to required visibility on the road. Through MATLAB software the graph of intensity variation between time and intensity is plotted according to the current and voltages values.
5. Power consumption is tracked through the amount of energy used in illumination of LED street light.
6. At last the intensity in light variation can be measured.
7. The hardware is designed to make a fog sensor which will work on desired environmental conditions.
8. The intensity variation circuit is designed so that desired results can be obtained in foggy or rainy condition. The circuit is also called as pwm circuit in which pulsated output is obtained in the arduino. By this isolation is done so that the system will not burst.
9. By using this system energy consumption is reduced and road safety is also improved.

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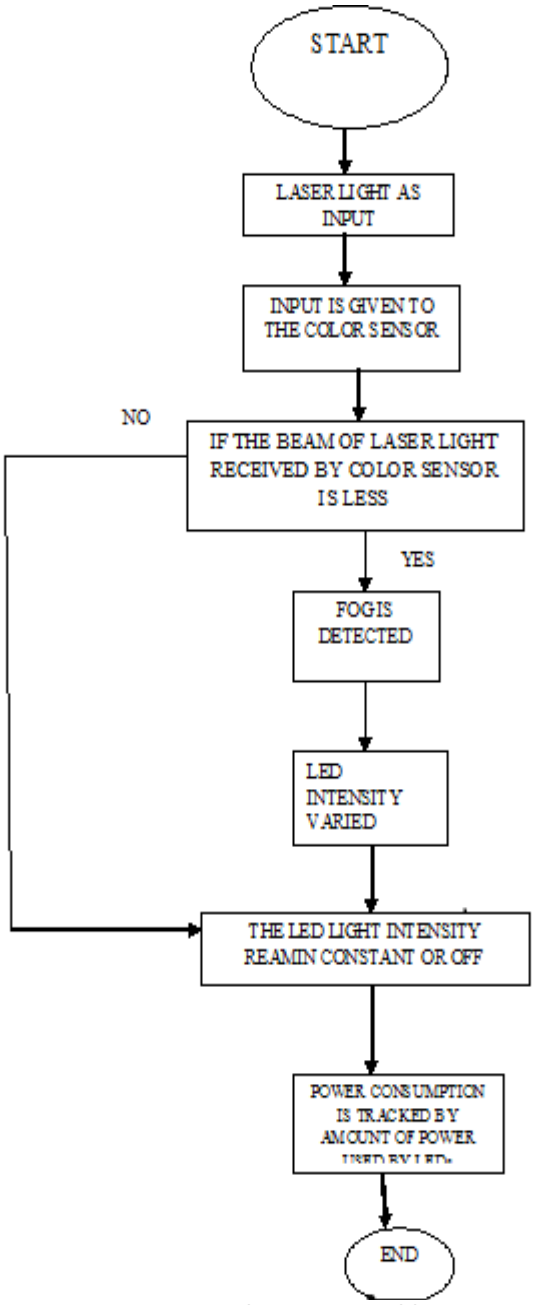

Fig. 2 Flowchart for designing of fog sensor

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IV. RESULTS AND DISCUSSION

The results have been presented through Figures 3 to 6 which are obtained from the designof fog sensor.

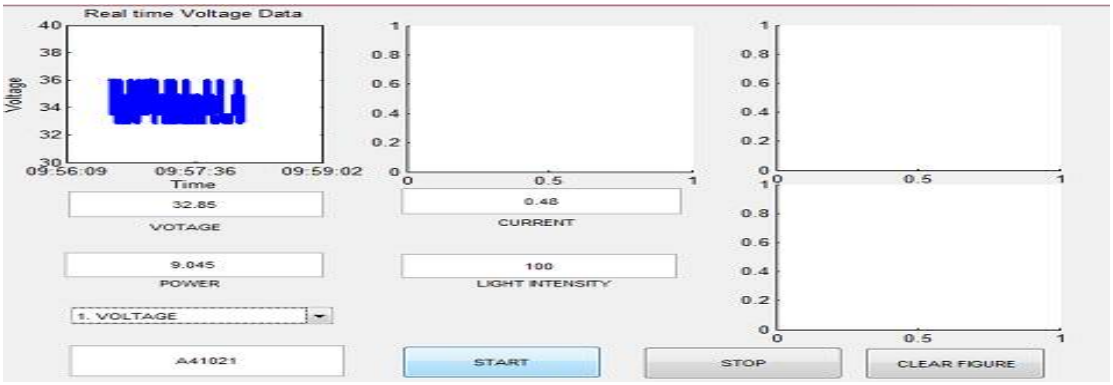

Fig.3Showing voltages values

In the above Fig.3, the voltages values are obtained with respect to the time as the LED requires dc for glowing but the ac current is present on the main line from which the electricity is given. If ac current is given then LED will not work so adapter is used to convert ac to dc power so that it can work .Isolation is done because the power is very high otherwise system will burst .The voltage values are given according to the pwm circuit. If the voltages valuesare greater than the required, the system will not work properly.

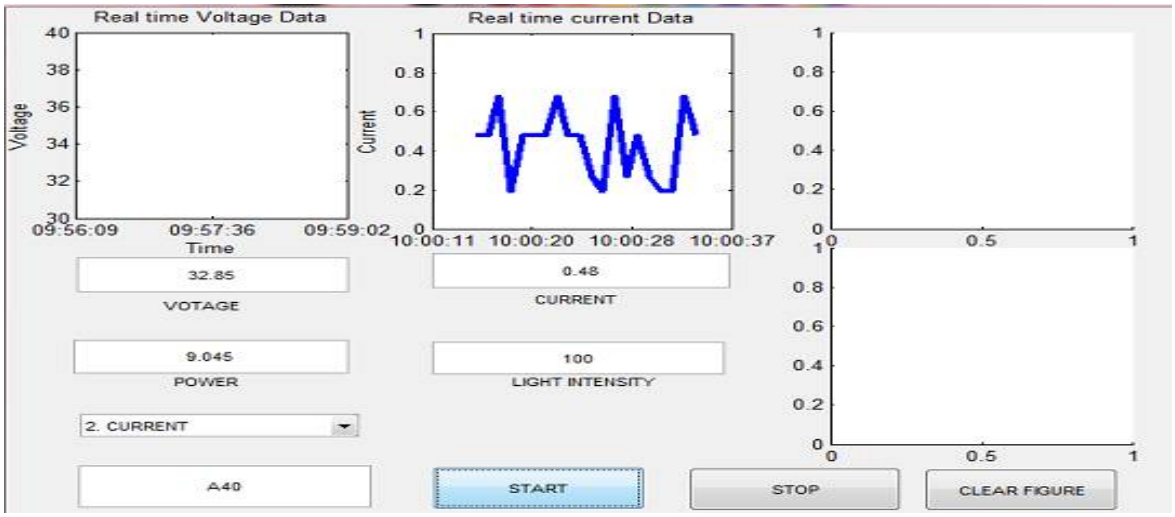

Fig. 4Showing current values

In the above Fig. 4, the current obtained from adapter is given to the PWM circuit which is transferred to the LED so that it can glow. The graph is plotted with respect to the time. There are in built current values in the pwm circuit by which the LED glows i.e. 2 ampere. This current is transmitted by the circuit.

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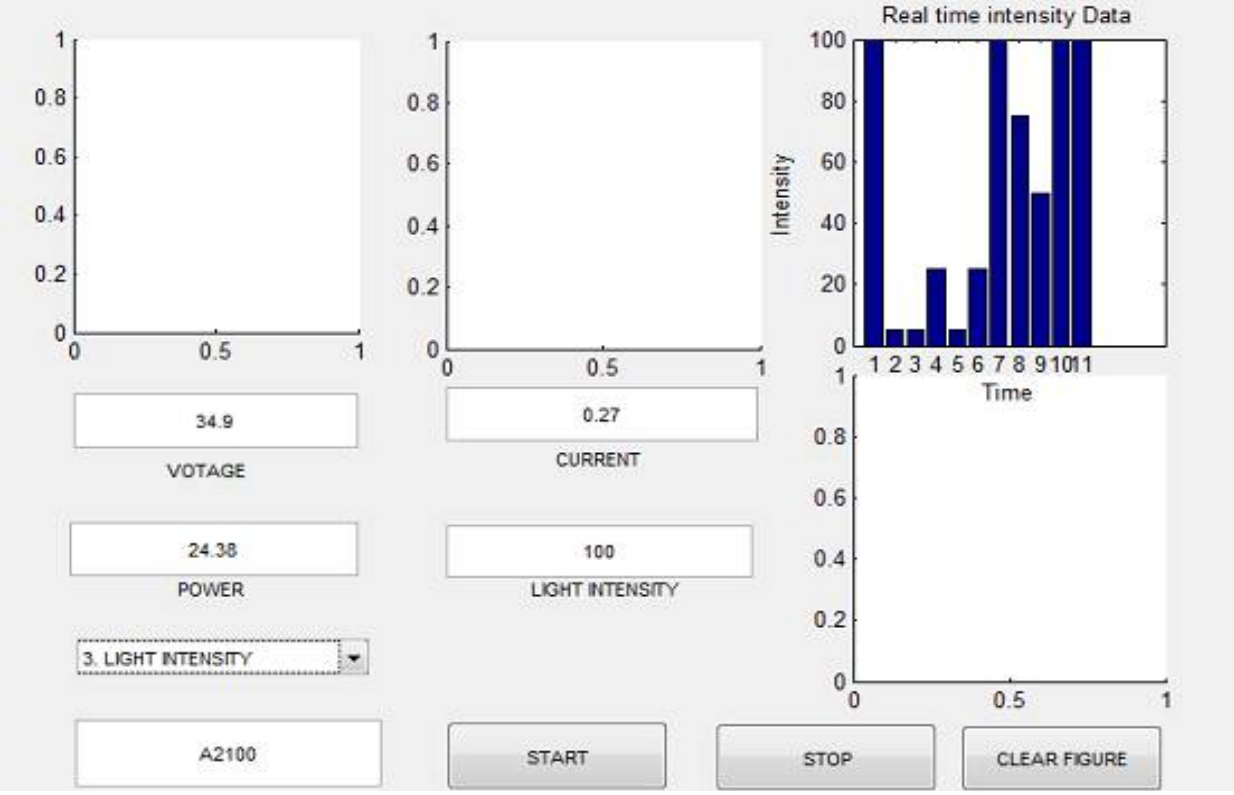

Fig.5Showing intensity variation using bar graph

The result shown by Fig.5 i.e. intensity variation during fog and rain which has four set values. At 100, the intensity of light will be very bright. At 75, the intensity of light will be less brighter. At 50, the intensity of light will be dim and at 0, the light will be off .These conditions will depend on the laser light received by color sensor. If the light is received by color sensor, this means there is no fog. The light will be off and if the less amount of light received by color sensor, then intensity variation of light can be done . By the graph we could say that as the external brightness increases the intensity of the LED decreases and as the external brightness decreases the intensity of LED increases. When, it is totally dark outside, the Intensity reaches to the peak. This graph shows the intensity variation between time and intensity, depending upon the current and voltages value .The values are set in the program of MATLAB, according to it the variation of intensity of street light can be shown through graph.

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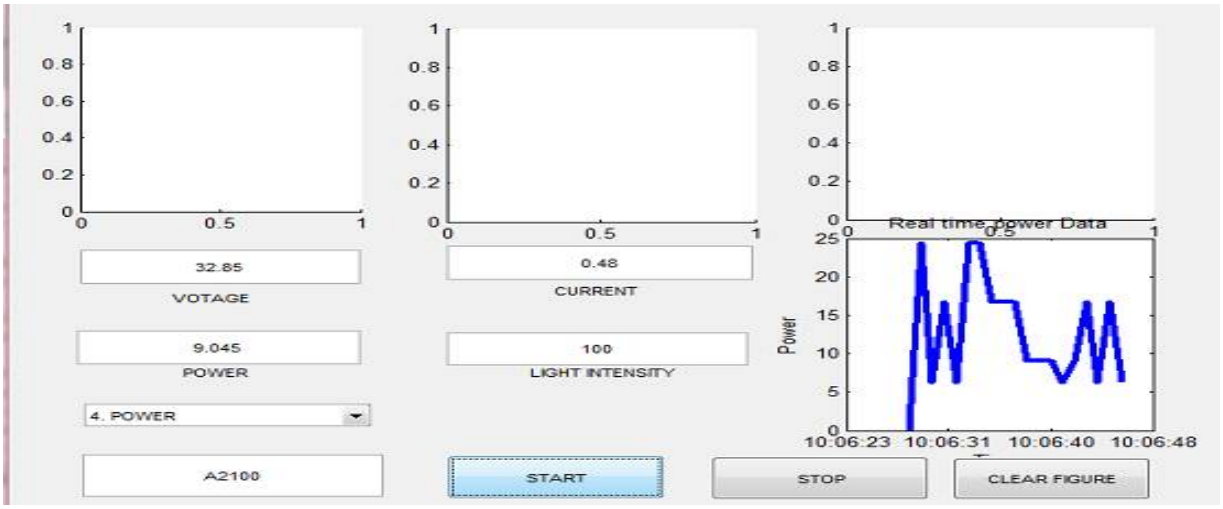

Fig.6Showing power consumption

In the above Fig.6, the value of power is referred as external brightness. By the graph we could say that as the external brightness increases the intensity of the LED decreases and as the external brightness decreases the value of LED increases. When it is totally dark outside the Intensity reaches to the peak. The power consumption is also shown. The desired amount of power can be consumed by using this system. By this the visibility of light can maintained according to the needs and requirement on the roads during fog and rain. By looking at the graph we could say that as the power increases, the intensity of the LED also increases and reaches to peak, when 5 volt is applied. This is fog sensor prototype which is designed with the arduino board and pwm circuit.

Table 1.Comparison of Power Consumption

Sodium Lamp	LED
70W[1]	30W
150W[2]	70W
250W[1]	100W

From the above Table 1, it shows the comparison between the power consumption by sodium lamp and LED light. Energy consumed by LED light is less, compared to the sodium lamp.

V. CONCLUSIONS

TheLED street light system has been designed implemented and then tested. The concept is based on fog sensor detection and sense the brightness in the surrounding environment and controls the intensity of street lights accordingly. Colour sensor is affixed on the poles and on the opposite side of pole laser light is installed. This is pointed towards the colour sensor. If the projected LASER light is transmitting toward the colour sensor and the luminosity received by the colour sensor is full then it means there is no fog. The light required by the environment is less. If the less amount of light is received by the colour sensor, it means the fog is detected and the required amount of light will glow on the street and desired amount of luminosity will be maintained in the environment .The system is cost effective and simple in designing as compared to network based wireless sensor systems. It is more efficient and reliable as compared to the existing systems.

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