Auto Street Light Intensity Controller

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ABSTRACT: ***White Light Emitting Diodes (LED) replaces traditional street lighting network HID lamps to provide dimming features. The intensity cannot be controlled by the high intensity discharge (HID) lamp which is generally used in street lights in urban areas. Driven lighting is the future of lighting, regardless of its small. Long life and energy consumption. LED lights are easy to replace traditional lights because pulse width modulation allows for intensity control. This paper demonstrates a street light intensity control system that is easy, tough and energy-efficient and doesn't require much maintenance. The concept is to senses brightness in the surrounding environment and accordingly control the intensity of street lights. To feel the luminosity in the area, LDR Sensor is affixed. The machine uses Arduino, using a MOSFET to monitor the strength of the LEDs. One LED cluster serves as a streetlight. The system is more robust than time slot systems, and needs less perpetuation compared to other systems available.***

KEYWORDS: intelligent Street light, LDR (Light depending Resistor), IR Sensor (Infra-red Sensor).

INTRODUCTION

Automation, resource usage and cost-effectiveness are the key factors in the area of technologies. With the help of intelligent systems, automation is intended to reduce man power, power saving is the main consideration for ever as the source of power is decreasing due to various reasons. The project's main objective is to save electrical energy which is used automatically in street light by applying power-saving elements such as LDR. Instead of doing manual, we want to save power automatically, so making cost-effectiveness simple. For certain other uses, such as irrigation, farms, towns and many other areas, this saved power can be used. With Arduino we can design intelligent systems to control street light intensity. The concept of developing a modern streetlight network utilizing LEDs that don't consume massive quantities of electricity and illuminate wide areas with the maximum light intensity whenever required. Providing street lighting is one of the most important and expensive energy expenses in a community. In typical cities around the world, lighting can account for 40-60 per cent of the total energy bill. Due to its strategic significance for economic and social stability, street lighting is a especially important concern of public authorities in developing nations. Inefficient lighting waste annually provides significant financial resources and poor lighting can cause accidents. The use of energy-efficient technologies can drastically reduce street lighting costs and also provide excellent efficiency[1].

Manual control is susceptible to errors and contributes to energy wastage, so it is impractical to manually dim at midnight. Two types of sensors which are light sensors like LDR[2] and photoelectric sensor will be used in this article. The sensed light will detect darkness to trigger the ON / OFF switch, so that the streetlights are able to turn on and the photoelectric sensor will detect movement to trigger the streetlights. LDR, which varies depending on how much light falls on its surface, provides an induction for whether it is day or night. The photoelectric sensor will only be turned on in the evening. If any object passes the photoelectric beam, a particular light will automatically be ON. Use this as a basic concept will build the intelligent device for the optimal use of streetlights everywhere. The lighting device is made up of board Arduino, LDR, photoelectric sensor and other electrical equipment. We can operate the lights by using the LDR, i.e. when the light is available then it will be in the OFF state and when it is dark the light will be ON. It means that LDR is inversely proportional to light, when the light falls on the LDR it sends the Arduino board the commands that it should be in the OFF state, then it

switches off the light, the photoelectric sensor will be used to turn the light on or off according to the object's presence or absence[3].

The rising energy demand and the limited supply of conventional energy sources have become a problem for developed and developing countries alike. For this reason, energy efficiency and sustainability are given the first priority for any installation of any project in the policy makers' agenda. Solar street lighting system is an efficient way of reducing power usage and affecting CO2 on the environment by preserving road safety standards. Electric street lighting consumes 114 TW h per annum, leading to 69 million tons of CO2 emissions. Thus there is a need to provide a system which is used to control the intensity of the street light according to the outdoor condition in order to save electricity[4].

PROPOSED SYSTEM

The solution to the above mentioned problem is to create a system not consisting of any expensive hardware that could be easier to replace if it fails. Another solution is to make a device that detects the ambient brightness and changes the intensity as per the same. It would delete time slot because there would be no need as the duration would be in keeping with the setting. The lights only need to be specified when to turn OFF. The definition used to assess the intensity of the street light is the visibility of the atmosphere surrounding it. To feel the luminosity, sensors are affixed. For controlling intensity the system uses Arduino, MOSFET based driver circuit. One LED cluster serves as a streetlight. HID lamps will be replaced by LEDs the same as in systems based on the time slot available. The circuit diagram for this proposed solution is shown in Figure 1. Worldwide questions have been raised about the measurement of force devoured by HID lights and by extension, the measurement of air CO2 emitted as a result of such power usage. Instead of this brightening of the LED cluster, consideration has been given as late as a diminishing light source of vitality.

Driven street brightening needs around 33 per cent of the electric force required for HID lighting. An LED's life cycle can be more than 3 times the length of a HID light. Driven brightening could reduce the expected amount of time to trade in damaged devices and it is normal that an LED framework would be almost free of support. This means, therefore, that the LED system can be considered ideal for use on isolated islands or in extremely rough areas. Within such a context and as a consequence of recent crucial improvements to luminescent effectiveness, LED lighting can be counted on to supplant completely the light sources used beforehand within our lives. The expected improvement of LED brightening occurs in lighting frameworks, particularly within people in the general region, is still outlined according to the previous guidelines of unwavering quality and as a rule they do not benefit from the latest mechanical improvements. In any case, as of late, the increasing weight associated with the cost of crude materials, in addition , the growing capacity to impact socially on CO2 emanations is prompting new systems and advances to develop, allowing substantial cost reserve funds and greater appreciation for the planet. This approach still saves partial electricity, but comparatively retains more than the current systems.

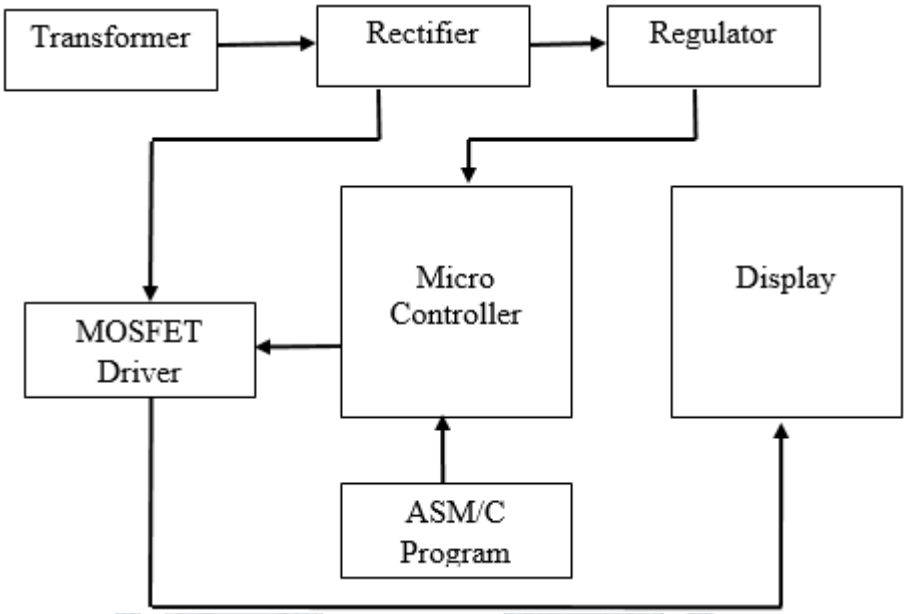

Figure 1: Microcontroller Based System Block Diagram

Transformer

A transformer is a passive electrical device, or multiple circuits, that transfers electrical energy from one electrical circuit to another. A variable current in any of the transformer's coils produces a variable magnetic flux in the core of the transformer which induces a variable electromotive force across any other coils wound around the same core. Without a metallic (conductive) connection between the two circuits, electrical energy can be transferred among separate coils. Faraday's induction law, discovered in 1831, explains the effect of induced voltage in any spiral due to a rising magnetic flux encircled by the spiral[5].

Rectifier

A rectifier is an electrical system that converts alternating current (AC) to direct current (DC), which flows in one direction only, and occasionally reverses direction. Rectifiers have many applications, but are mostly used to act as components of DC power supplies and direct current high voltage transmission systems. Rectification can serve in roles other than direct current generation for use as power source. As noted, radio signal detectors serve as rectifiers. Flame rectification is used in gas heating systems to detect the presence of a flame.

The output voltage may require additional smoothing to produce a uniform, steady voltage, depending on the type of alternating current supply and the arrangement of the rectifier circuit. Many rectifier applications, such as power supplies for radio, TV, and computer equipment, require a steady constant DC voltage (as a battery would produce). In these applications, the rectifier's output is smoothed by an electronic filter that can be a condenser, choke, or set of capacitors, chokes, and resistors, possibly followed by a voltage regulator to generate a steady voltage[6].

Regulator

Voltage regulator, any electrical or electronic device which keeps a power source voltage within appropriate limits. The voltage regulator is required to maintain voltages within the specified range which the electrical equipment will tolerate using that voltage. Such a device is commonly used in all forms of motor vehicles to adjust the generator's output voltage to the electric power and battery charging specifications. Voltage regulators are also used in electronic equipment where excessive voltage variations would have a negative effect[7].

MOSFTE Driver

A gate driver is a power amplifier that accepts a low-power input from a controller IC and generates a high-current drive input for a high-power transistor gate, such as an IGBT or power MOSFET. Gate drivers can be either mounted on-chip or as a separate module.

A gate driver consists essentially of a level shifter combined with an amplifier. As an interface between control signals (digital or analog controllers) and power switches (IGBTs, MOSFETs, SiC MOSFETs and GaN HEMTs), a gate driver IC serves. An integrated gate-driver solution reduces design complexity, time for development, materials billing (BOM), and board space while improving reliability over discreet gate-drive solutions.

OBSERVATION

The system hardware implementation comprises of one MOSFET, 3 resistors, one LDR (Light Detecting Resistor), one Arduino module, one LED cluster (Light Emitting Diodes). The MOSFET is wired to two resistors, one grounded and the other 5 volt, the same way LDR is wired to one grounded end resistor and another 5 volt. LEDs[8] are mounted on a MOSFET. The MOSFET is connected to pin 9 of the Arduino board and pin A0 is connected to the LDR

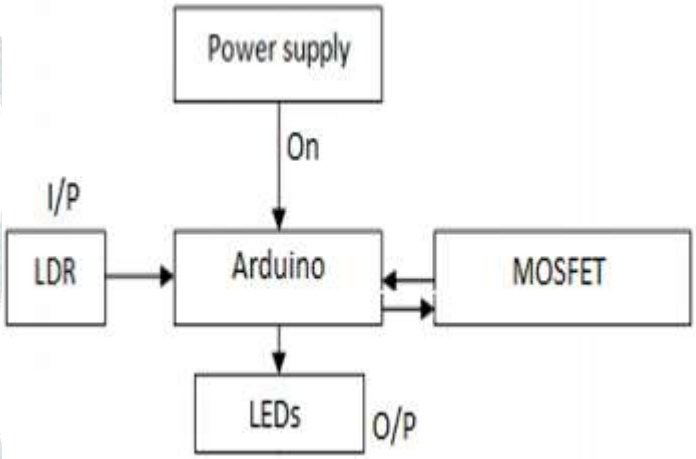

Figure 2: Flow Chart of Proposed System

Figure 2 illustrates system flow. When power is supplied, the LDR senses the brightness in the surrounding environment and sends the value to Arduino, then the Arduino sends the value to MOSFET in PWM signals and the MOSFET then decides the voltage quantity to be sent to the LEDs and sends that value to Arduino. Then after Arduino gives the LEDs too much voltage. The intensity depends on the voltage the LEDs provide.

READINGS

The following are the readings taken in various conditions of the system's functioning. The graphs made from the tables help us understand more about the method.

Thanks to the maximum ambient light, no LEDs are ON at daytime, and the LDR intensity remains nearly constant. The strength varies with changing times. Time and intensity could be seen under full day brightness.

During night all LEDs are ON during their maximum strength due to zero environmental visibility and the importance of LDR here too remains almost unchanged as the LDR does not experience any light all night.

Table 1 shows the power value, and the intensity value, on the other hand. We got a graph as shown in Figure 3, with the aid of Table 1. By looking at the graph we could say that when full 5 volt is applied, as the power increases the intensity of the LEDs also increases and peaks reach.

Table 2 shows the LDR value referred to as external brightness, and the intensity value, with the help of Table 2. By looking at the graph we could say that the intensity of the LEDs decreases as the external brightness increases, and as the external brightness decreases the value of the LEDs increases. When outside the Intensity reaches the peak completely dark.

Table 1: Power vs. Intensity

Power (in volt)	Intensity (in watt/square meter)
0	O
1	109
2	230
3	340
4	449
5	679

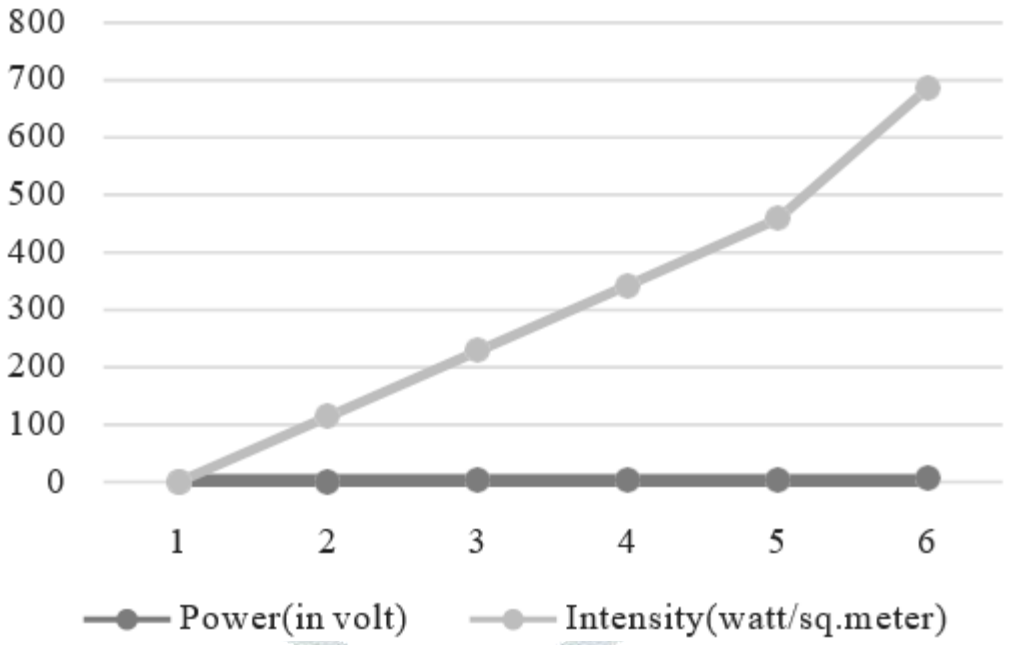

Figure 3: Power Vs Intensity Graph

Table 2: External Brightness vs. Led Intensity

External Brightness	LED Intensity
59	520
55	540
49	550
209	120
220	119

CONCLUSION

This paper works out the design and development of an auto intensity control device circuit based on Arduino LED Street light. Circuit works properly to turn street light LED ON / OFF. The two main components working in the circuit are after designing the circuit which controls the intensity of street light as shown in previous sections of the LDR sensor and the photoelectric sensors. If the two conditions

are met the circuit should perform the desired function according to the particular software. Each sensor controls the street light column turning ON or OFF. The energy saving solution is to remove time slot and install a device that could sense brightness environment and function accordingly so that seasonal change does not impact street light intensity. However, due to their dimming function, LEDs can replace HID lamps, but another explanation is that they are more efficient.

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