SMART STREET LIGHT

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ABSTRACT

Urban areas in the entire world are dealing with increasing energy consumption and carbon emissions, a known contributor to climate change. Due to inadequate dimming control and low efficiency, current street lighting is wasteful in terms of energy spending, accounting for a major part of governmental electricity costs. Therefore, it has become desirable and of great importance to design a new smart lighting system that is more efficient and environmentally friendly.

The main objective for this project is to design a smart lighting system which targets the energy saving and autonomous operation on economical affordable for the streets. This project is based on the embedded system and microcontroller 8051. An embedded system is combination of computer hardware and software, either fixed in capability or programmable, that is designed for specific functions with a larger system.

The project is designed to detect vehicle movement to switch ON only a block of street light ahead of it(vehicle), and to switch OFF the trailing lights to save energy. Integrated sensors and controllers are used to design this project. Sensor identifies the movement of any object and offer command to the microcontroller to glow the road lights with 100% intensity and without any movement in the street give command to the microcontroller to glow with 10% of its maximum intensity.

The proposed system is appropriate for street lighting in remote as well as urban areas where traffic is low at times. Along with energy saving it also tackles with the problem of power theft.

Keyword: - *IR (Infrared) motion sensor, LDR (Light Dependent Resistor), LEDs (Light Emitting Diode), Resistor, 8051 microcontroller.*

1. INTRODUCTION

Automation plays an increasingly important role in the world economy and in daily life. Automatic systems are being preferred over manual system. The research work shows automatic control of streetlights as a result of which power is saved to some extent. In the scope of industrialization, automation is a step beyond mechanization [1]. Whereas mechanization provided human operators with machinery to assist the users with muscular requirements of work, automation greatly decreases the need for human sensory and mental requirements as well. Basically, street lighting is one of the important parts. Therefore, the street lamps are relatively simple but with the development of urbanization, the number of streets increases rapidly with high traffic density. There are several factors need to be considered in order to design a good street lighting system such as night-time safety for community members and

road users, provide public lighting at cost effective, the reduction of crime and minimizing it is effect on the environment. At the beginning, street lamps were controlled by manual control where a control switch is set in each of the street lamps which is called the first generation of the original street light. After that, another method that has been used was optical control method done using high pressure sodium lamp in their system. Nowadays, it is seen that the method is widely used in the country. The method operates by set up an optical control circuit, change the resistance by using of light sensitive device to control street lamps light up automatically at dusk and turn off automatically after dawn in the morning. Due to the technological development nowadays, road lighting can be categorized according to the installation area and performance, for an example, lighting for traffic routes, lighting for subsidiary roads and lighting for urban center and public amenity areas. The WSN helps in improving the network sensing for street lighting. Meanwhile, street light system can be classified according to the type of lamps used such as incandescent light, mercury vapor light, metal halide light, high pressure sodium light, low pressure sodium light, fluorescent light, compact fluorescent light, induction light and LED light. Different type of light technology used in lighting design with their luminous efficiency, lamp service life and their considerations. The LED is considered a promising solution to modern street lighting system due to its behavior and advantages. A part from that, the advantages of LED are likely to replace the traditional street lamps such as the incandescent lamp, fluorescent lamp and High Pressure Sodium Lamp in future but LED technology is an extremely difficult process that requires a combination of advanced production lines, top quality materials and high-precision manufacturing process. Therefore, the research work highlights the energy efficient system of the street lights system using LED lamps with IR sensor interface for controlling and managing.

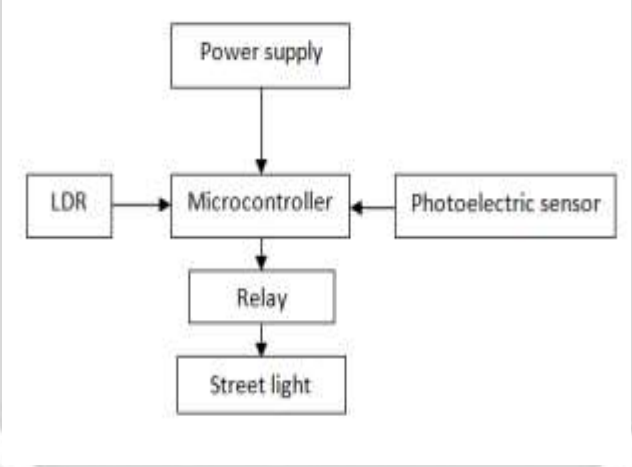

Fig 1:- Block diagram of street light system

2. SMART STREET LIGHT CIRCUIT DESIGN

The system basically consists of a LDR, Photoelectric sensor, Power supply, Relays and Micro controller.

2.1 LDR

The theoretical concept of the light sensor lies behind, which is used in this circuit as a darkness detector. The LDR is a resistor as shown in Fig. 2, and its resistance varies according to the amount of light falling on its surface. When the LDR detect light its resistance will get decreased, thus if it detects darkness its resistance will increase.

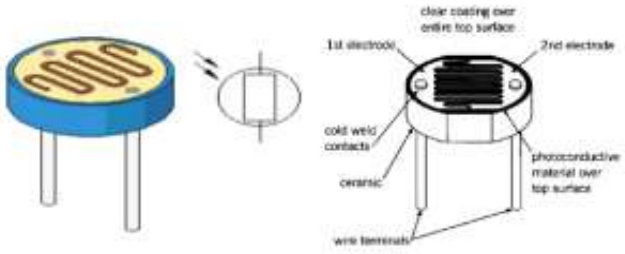

Fig 2:-LED

2.2 IR SENSORS

An infrared sensor is an electronic device that emits in order to sense some aspects of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion. These types of sensors measures only infrared radiation, rather than emitting it that is called as a passive IR sensor. Usually in the infrared spectrum, all the objects radiate some form of thermal radiations. These types of radiations are invisible to our eyes that can be detected by an infrared sensor. The emitter is simply an IR LED and the detector is simply an IR photodiode which is sensitive to IR light of the same wavelength as that emitted by the IR LED. When IR light falls on the photodiode. The resistances and these output voltages, change in proportion to the magnitude of the IR light received.

Fig 3:-IR SENSOR

2.4 PHOTOELECTRIC SENSOR

To detect the movement in the street, the photoelectric sensors have been used in this paper, where emitter and receiver are in one unit as shown in fig 4. Light from the emitter strikes the target and the reflected light is diffused from the surface at all angles. If the receiver receives enough reflected light the output will switch states. When no light is reflected back to the receiver the output returns to its original state. In diffuse scanning the emitter is placed perpendicular to the target. The receiver will be at some angle in order to receive some of the scattered (diffuse) reflection.

Fig 4:-Photoelectric Sensor

2.5 REGULATED POWER SUPPLY

Usually, we start with an unregulated power supply ranging from 9volt to 12volt DC. To make a 5volt power supply, KA8705 voltage regulator IC as shown in Fig. 5 has been used. The KA8705 is simple to use. Simply connect the positive lead form unregulated DC power supply (anything from 9VDC to 24VDC) to the input pin, connect the negative lead to the common pin and then turn on the power, a 5 volt supply from the output pin will be gotten.

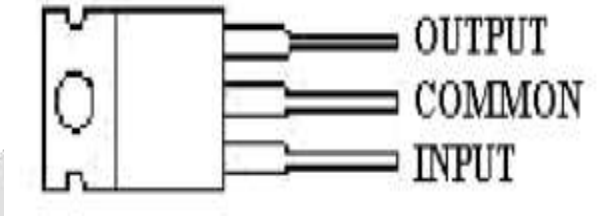

Fig 5:-Regulated Power Supply

2.6 8051 MICROCONTROLLER

A microcontroller is a computer control system on a single chip. It has many electronic circuits built into it, which can decode written instructions and convert them to electrical signals. The microcontroller will then step through these instructions and execute them one by one. As an example of this a microcontroller we can use it to controller the lighting of a street by using the exact procedures. Microcontrollers are now changing electronic designs. Instead of hard wiring a number of logic gates together to perform some function we now use instructions to wire the gates electronically. The list of these instructions given to the microcontroller is called a program. There are different types of microcontroller, this project focus only on the 8051 Microcontroller where it's pins as shown in Fig. 6.

Fig 6:- 8051 microcontroller

3. Working Procedure

The working procedure of the Smart street light using IR sensors is explained below.
The following are the different steps included in building a Smart street light.
1. LDR pin 1 is connected to A0 port of 8051 microcontroller.

2. Connect all the IR sensors to port numbers 2, 3, 4, 5 and 6 respectively (digital) to the microcontroller.
3. Connect the ground of all the sensors to GND port.
4. The LED's which are the output signals, are connected to port number 8, 9, 10, 11 and 12 respectively.
5. Again connect the ground of all the sensors to GND port.
6. Power is passed to the microcontroller.

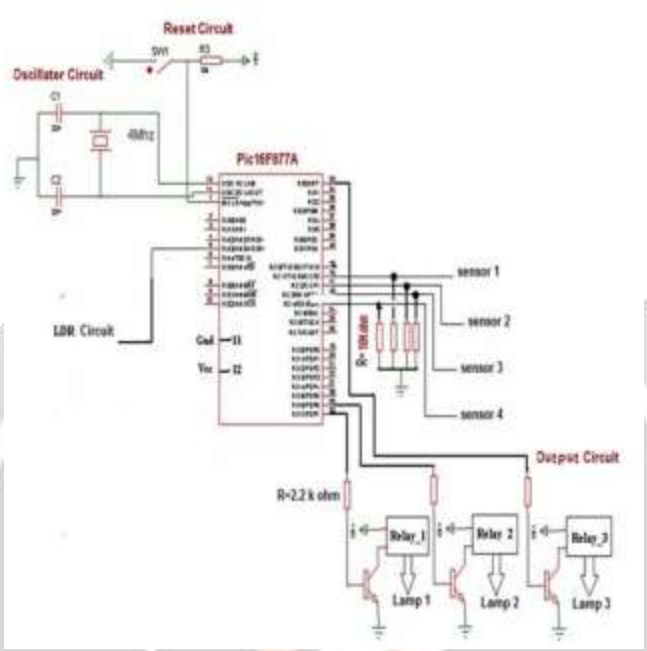

Fig 7:- Schematic circuit of the street light system

The Fig 7 is the diagram of the Smart streetlight. It works in accordance with the varying density. Whenever there is movement on the street with the varying density the street lights will glow accordingly.LDR exhibits high resistance and acts as an insulator, while in darkness this LDR behaves as low resistance path and allows the flows of electricity, this LDR's operates with the help of IR sensors, these sensors are activated under low illumination conditions and these are controlled by a 8051 micro controller, every basic electronic circuit will operate under regulated 5v DC, so need to step down the 230v AC into 12v AC by means of an step down transformer, this 12v AC is to converted into 5v DC by using an bridge rectifier, and the controlled output from the voltage regulator is sent to the operational kit. This project actually detects the varying density and does according to that the amount of light is being given out. The friction produced by the movement of vehicles with lead to the generation of more energy thus more lighting. As the vehicle passes off the lights will automatically gets dim and gets lower down to 90%. The project is successfully implemented in many areas based on the experimental verification proving that it can save the electrical power to greater extent removing the manual work completely; the system became the origin for upcoming advanced intelligent systems in saving both human and electrical power.

4. SCREENSHOTS

In this section, the setup of the whole research work is depicted in a step by step manner. Sample screenshots are displayed once the components are fixed and connected to each other. All the components are connected to each other and thus complete the system setup which helps one to understand the steps in a and easy way. With these steps, even when a person who is trying to implement the same, it makes it simple, clear and easy.
The following are the screenshots in an orderly way:

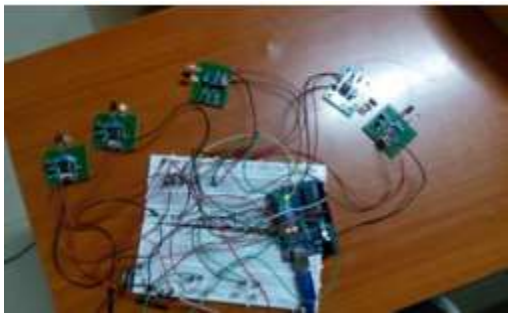

Fig 8:- Initial Setup Phase 1

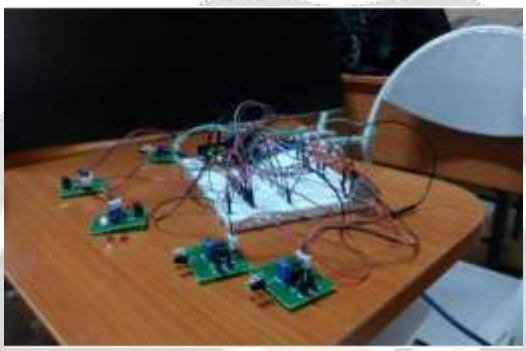

Fig 9:-Initial Setup Phase 2

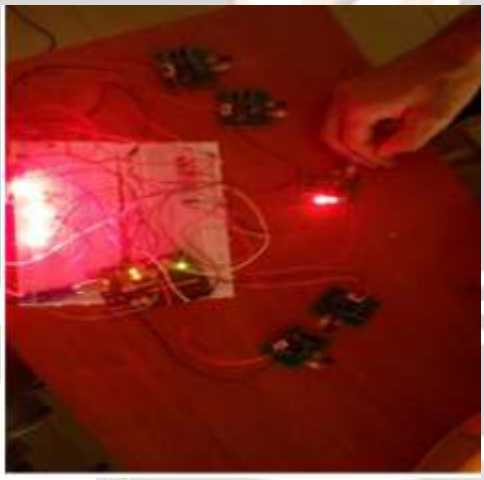

Fig 10:- Object Detection

5. CONCLUSIONS

By using Smart Street light, one can save surplus amount of energy which is done by replacing sodium vapor lamps by LED and adding an additional feature for security purposes. It prevents unnecessary wastage of electricity, caused due to manual switching of streetlights when it's not required. It provides an efficient and smart automatic streetlight control system with the help of IR sensors. It can reduce the energy consumption and maintains the cost. The system is versatile, extendable and totally adjustable to user needs.

- The system is now used only for one way traffic in highways.
- Continuous use of LDR and IR sensors even in day time.

- Not switched on before the sunset

The Smart light system can be further extended to make the current system in two-way traffic, making the system more flexible in case of rainy days and introduction of ways to control the lights through GSM based service.

6. REFERENCES

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