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Gsm Based Automatic Street Light Control System

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ABSTRACT— Energy consumption in cities is increasing day by day. In every city, large amount of electricity is being used for the purpose of street lighting system. Although some regions of the city have a low frequency of passers-by, it has been discovered that the quantity of energy consumed by street lights in these areas is the same as in places with a high frequency of passers-by. As a result, huge amount of energy is wasted without being used. In the proposed system, high intensity discharge lamps are replaced by LED's which can change its intensity based on the need. Movement of vehicles is sensed using PIR sensor and the intensity of the street light is reduced when not in use. This system also detects fault in the system and shows it to the base station using GSM (Global System for Mobile communication) technology by sending SMS (short message service)

The system explains the design and construction of automatic light control system. The developed electronic system removes the disadvantages of the existing systems. Based on the results the microcontroller calculates and automatically detects geographical area and recover relevant data for sunrise and sunset in the area, respectively ensures very precise ON/OFF mode of the lighting system. The circuit uses a LDR sensor to sense the light. It does not necessitate operator maintenance or initial setup. The developed electronic device increases bulb life in result of the reducing effect on the other hand, this reduction in light results in a reduction in energy usage. LDR sensors and micro controller, relay are the main components of the project. PIR sensor is like our eye which detect the presence of an object and Relay is an electromagnetic device which is used to isolate two circuits electrically and connect them magnetically.

Keywords— Microcontroller; Light Dependent Resistors (LDR); PIR Sensor; Relay

I. INTRODUCTION

The Street lights are the main requirements in today's life for safety purposes and avoiding accidents during night. One of a city's most significant and costly obligations is to provide street lighting. In average cities throughout the world, lighting can account for 10-38 percent of the overall energy bill. Street lighting is a mostly serious concern for public authorities in developing countries because of its strategic importance for Now, we need rise to make the system automated so that human intervention and manual work avoided and make the transparency in system. In our project we suggest the concept about to financial and social stability. The fixtures of street lights indirectly have helped the public and government in reduction of crime rate and accidents in the area. It also inspires social addition by providing an environment in which people feel they can walk in hours of darkness. Despite this, hardly one thinks to turn it off or on while not in use in today's fast-paced world. Incompetent lighting wastes important economic resources each year, and poor lighting makes unsafe conditions. The use of energy-efficient technologies and design can significantly reduce the cost of street lighting. The mainly consideration in the present field technologies are Automation, Power consumption and cost efficiency [1],[2]. Automation is future to reduce man power with the help of intelligent systems. Power saving is the main consideration forever as the sources of the power are getting reduced due to various reasons. Designing a cost-effective system is very important as the requirement is more. In order to overcome this problem, automatic street light control methods are presented. The major goal of our study is to find a better way to reduce power waste when operating street lighting, in this era of automation persons are restless and are not in a place to control the manual operations in any field, a quick improvement in embedded systems has surfaced path for the design and development of microcontroller based automatic control systems. Our project is an LDR-based automatic street light controller. This method eliminates the need for physical labour. When the sun dips below the viewable zone of human eyes, the street lights turn on automatically. When the street lights under illumination by sunlight then it automatically switches OFF. Switching on and off the

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street light system automatically is a simple yet effective approach. When the sun dips below the visible zone of our eyes, it automatically turns on the streetlight, and when there is enough sunshine, it turns off the streetlight. A Light Dependent Resistor is the component that detects light. we can operate the streetlight automatically by using the LDR, when there is enough light, the streetlight will be turned off, and when it is dark, the light will be turned on, implying that LDR resistance is inversely proportional to the quantity of light falling on it. When light shines on the LDR, it sends commands to the control circuit indicating that the streetlight should be turned off, and the streetlight is turned off.

II. PROJECT IDEA

The main thought in the present field technologies is Automation, Power consumption and cost efficiency. Automation is future to reduce man power with the help of intelligent systems. Power saving is the main thought forever as the source of the power (Thermal, Hydro etc.) are receiving reduced due to various reasons. The main aim of the project is Automatic Street power saving system with LDR, this is to save the power. We need to save power automatically instead of doing manual. So, it's easy to make cost efficiency. This conserved energy can be put to good use in other situations. As a result, we may create intelligent systems for the use of street lighting in villages, towns, and other places. Switching ON and OFF does not require any manual effort. When there is a requirement for illumination. It can tell whether or not there is a requirement for light. When darkness rises to a positive value then automatically street light is switched the sensitivity of the street light can also be adjusted. In our project we have used four LED for indication of bulb but for high power switching one can connect Relay Then it will be possible to turn ON/OFF any electrical applications connected all the way through relay.

III. LITERATURE SURVEY

We want to save or conserve energy because maximum of the energy sources we depend on, like coal and natural gas can't be replaced. Once we use them up, they're absent forever. Saving power is very important, instead of using the power in needless times it should be switched off. In any city Street Light is one of the main power consuming factors. Maximum of the time we see street lights are ON even after sunrise thus wasting lot of energy. Here, we avoid the problem by using an automatic system that turns on and off the street lights at predetermined times or when the ambient light intensity falls below a certain threshold. Each controller has a light detection resistor (LDR) that detects ambient light. If the ambient light is below an exact value the lights are turned ON. The pic18f452 microcontroller is connected to an LDR, which is used to track the sun's light. When the sensors get dark, the LED is turned on, and when the sensor detects light, the LED is turned off. It clearly proves the working of transistor in saturation region and cut-off region. The operation of a relay is similar to that of a microcontroller, and the code is written in the C language in the MikroC IDE, with the resultant value visible through UART or LCD display. The Automatic Street Light Control System is a straightforward yet effective system that use a transistor as a switch. Manual labour is completely eliminated when this method is used. When the sun dips below the viewable region of human eyes, it automatically turns on the lights. This is accomplished through a sensor known as a Light Dependent Resistor (LDR), which detects light in the same way that our eyes do. When sunlight is visible to human eyes, it immediately turns off the lights. The goal of this project is to use LDR to control street lights. When the light is turned off, the resistance value changes. When there is no light, the resistance value shifts. The voltage variation may be calculated from the resistance change, and this value is fed into the PIC's ADC. The acronym PIC stands for periphery.

The present system is commonly used in all streets of street light system. However, this strategy results in a significant loss of electricity throughout the night. Furthermore, when there are no human motions in the roadway, the street light is not required. An actual local time is received from the GPS data and a daylight and nightfall time associated with the geographic location can then be determined. Street light is poorly designed and incompetently maintained, there are large number of burned-out lamps which leads to insecurity. Every zonal office's street light section has a complaint register. The line inspector is in charge of keeping it up to date. The complaint received from public, councillors and establishment officials either over phone is in person being recorded in the complaint register. The complaint thus entered is being handed over to the fieldwork man so as to correct the complaints. the field staff will have the rounds in the particular areas twice in a week and the complaints about non burning are also being attended then and there. But this is not the instant remedy on complaints and has many disadvantages like the repair work takes days/even months instead of taking few hours which results in delay, telephone line may be busy, sometimes no response. In all zones, the street light switches are manually turned on and off by the workers. As a result, manpower and time increase. It is prone to errors because it is a human function.

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IV. PROBLEM STATEMENT

The application is extremely useful for serving the purpose of automatic fault detection and generating alert messages which saves as well as improves power on a large scale. It can prevent and avoid a number of minor and major accidents this project helps to reduce the cost of man power and reducing power Consumption.

Present methods like registration the complaint, switching on/off the light manually is time consuming & requires man power. The new method automatic ON/OFF and fault detection without human involvement is easier when compared to the existing system. We projected an automatic light control system which removes the disadvantages of the present systems by taking date and time from the GPS, as it also gives information about the position of the system. Based on the results the microcontroller calculates and automatically detects geographical area and recover related data for sunrise and sunset in the area, respectively ensures very exact ON/OFF mode of the lighting System. It increases bulb life in result of the lowering effect.

V. PROPOSED METHODOLOGY

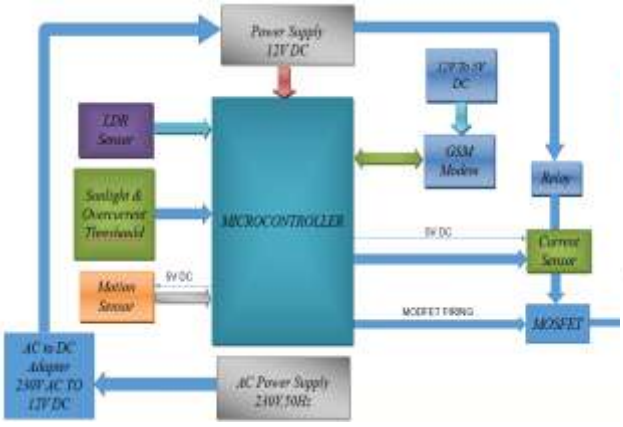

Fig 1 Block diagram of GSM based automatic street light control system

This project is continuously monitoring and controlling the device present on the street light. This project to control the street light automatic ON/OFF by using LDR.

When the sunlight falling on the LDR then the resistance of LDR will be changed and the LDR send the command logic 1 to the microcontroller and the microcontroller Turn OFF the street light. When the LDR sense the darkness then the resistance of the LDR will be changed and the LDR send the command logic 0 to the microcontroller and the microcontroller Turn ON the street light.

The current sensor used in this project for fault detection. The current is continuously sending the command logic 1 to the microcontroller, but in case of fault occurs on the pole then the current sensor sent the command logic 0 to the microcontroller. The particular street light failure then the microcontroller will automatically send the massage to cut off the power supply, this massage is sent through the GSM Modem.

The PIR sensor used in this project to detect the motion of vehicle and human. When there is any vehicle or human on the road it is detected by the PIR sensor whenever the PIR sensor is detected it just indicated the microcontroller. MOSFET used in this project for controlling the voltage. The PIR sensor detected any object then the PIR sensor send the command logic 1 to the microcontroller then the increased the voltage bu using MOSFET and the brightness of the street light also increased 100% intensity. When the no one object detected on the PIR sensor is sent the logic 0 command to the microcontroller to decreased the voltage by using MOSFET to decreased the voltage then the brightness of street light also decreased 50% intensity.

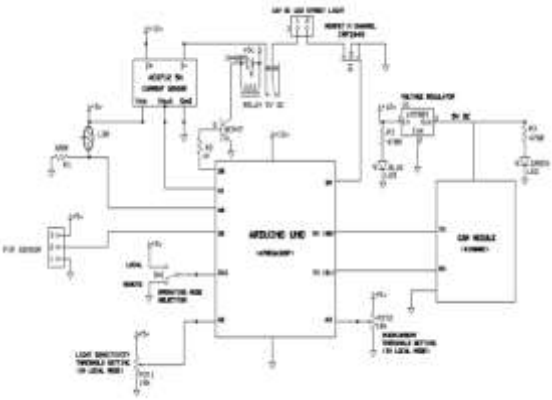

Fig.2 Circuit Diagram

A. Microcontroller

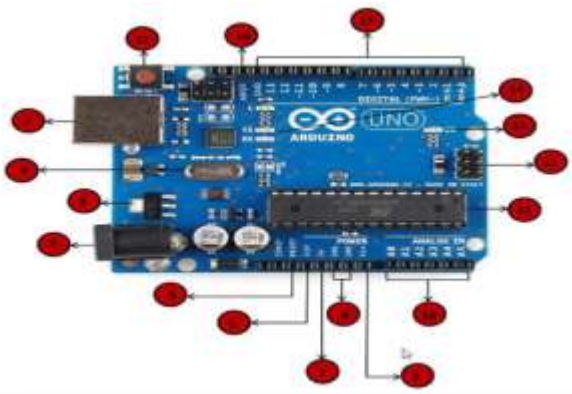

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Fig. Microcontroller

The ATmega328P microprocessor is used in the Arduino Uno microcontroller board. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonant circuit (CSTCE16M0V53-R0), a USB connection, a reset button, an ICSP header, and a power jack It comes with everything you need to get started with the microcontroller; Simply plug it into a computer through USB or to power it, use an AC-to-DC adapter or a battery.

Power USB

Your computer's USB cable can be used to power the Arduino board. All you want to do is connect the USB cable to the USB connection.

Power (Barrel Jack)

By connecting the Arduino board to the Barrel Jack, it may be powered directly from the AC mains power supply.

Voltage Regulator

The purpose of the voltage regulator is to control the voltage given to the Arduino board and stabilize the DC voltages used by the processor and other elements.

Crystal Oscillator

The crystal oscillator helps Arduino in dealing with time matters. How does Arduino calculate time? Using a crystal oscillator is the answer. The number 16.000H9H is written on the top of the Arduino crystal. It specifies a frequency of 16,000,000 Hertz (16 MHz).

Arduino Reset

You can reset your Arduino board, which will allow you to restart your programme from the beginning. There are two methods for resetting the UNO board. To begin, press and hold the reset button (17) on the board. Second, you can use an external reset button to connect to the RESET Arduino pin (5).

Pins (3.3, 5, GND, Vin)

- 3.3V (6) 3.3V output voltage
- 5V (7) – Provide a 5-volt output voltage
- The majority of the components on the Arduino board are compatible with both 3.3 and 5 volts.
- GND (8) (Ground) On the Arduino, there are many GND pins that can be used to ground your circuit.
- Vin (9) This pin can also be used to power the Arduino board from a separate source, such as an AC mains power supply.

Analog pins

The Arduino UNO board has six analog input pins A0 through A5. These pins can read the signal from an analog sensor like the humidity sensor or temperature sensor and convert it into a digital value that can be read by the microprocessor.

Main microcontroller

Each Arduino board contains a microcontroller of its own (11). You can think of it as your board's brain. The Arduino's core IC (integrated circuit) differs slightly from board to board. ATMEL is a well-known manufacturer of microcontrollers. Before you load a new programme from the Arduino IDE, you need to know what IC your board has. This information can be seen on the IC's top. For more information, go here.

ICSP pin

ICSP (12) is primarily an AVR, which is a small programming header for the Arduino that includes MOSI, MISO, SCK, RESET, VCC, and GND. It's commonly referred to as an SPI (Serial Peripheral Interface), and it's a kind of output "extension." In reality, you're slaving the output device to the SPI bus master.

Power LED indicator

When you plug your Arduino into a power source, this LED should light up to show that your board is powered up properly. If the light does not come on, there is a problem with the connection.

TX and RX LEDs

TX (transmit) and RX (receive) are two labels on your board (receive). They can be found on the Arduino UNO board in two places. To begin, the digital pins 0 and 1 are used to signify the serial communication

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pins. Second, the TX and RX took the lead (13). While delivering serial data, the TX led flashes at different speeds. The baud rate utilised by the board determines the flashing speed. The RX flashes.

Digital I/O

The Arduino UNO board contains a total of 14 digital I/O pins (15), with 6 of them providing PWM (Pulse Width Modulation) output. These pins can be set up as digital input pins to read logic values (0 or 1) or as digital output pins to control various modules such as LEDs and relays. PWM can be generated using the pins labelled "".

AREF

Analog Reference is abbreviated as AREF. It is occasionally used to set an external reference voltage (between 0 and 5 Volts) as the analogue input pins' upper limit.

B. LDR

A photoresistor, sometimes known as a light dependent resistor, is a light-sensitive electrical component. The resistance changes when light shines on it. The resistance of the LDR can vary by many orders of magnitude, with the resistance decreasing as the amount of light rises. It's not unusual for an LDR or photoresistor's resistance to be several megohms in darkness and then drop to a few hundred ohms in intense light. LDRs are simple to use because they have such a wide range of resistance, and there are many LDR circuits available. The wavelength of incident light affects the sensitivity of light dependent resistors or photoresistors.

To achieve their light-sensitive capabilities, LDRs are composed of semiconductor materials. Many materials can be employed, but cadmium sulphide, or CdS, is a popular choice for these photoresistors. However, usage of these cells is presently limited in Europe due to cadmium-related environmental concerns.Similarly, cadmium CdSe is also restricted. Other materials that can be used include lead sulphide, PbS and indium antimonide, InSb.

Although these photoresistors are made of semiconductor material, they are totally passive devices since they lack a PN junction, which distinguishes them from other photodetectors such as photodiodes and phototransistors. Without diving into technical explanations, the foundations of how an LDR works are pretty simple to grasp. To begin, it's important to realise that an electrical current is made up of electrons moving through a substance. A high number of free electrons in a good conductor can wander in a given direction when a potential difference is applied. Insulators with a high resistance have a small number of free electrons, making it difficult to move them and hence cause a current to flow. Any semiconductor material with a high resistance can be used to make an LDR or photoresistor. It has a high resistance because there are only a few free electrons that can move; the vast majority of electrons are trapped in the crystal lattice and unable to migrate. As a result, there is a lot of LDR resistance in this state.

Light photons are absorbed by the semiconductor lattice and some of their energy is transferred to the electrons as they fall on the semiconductor. This provides enough energy for some of them to break loose from the crystal lattice and conduct electricity. As a result, the semiconductor resistance and thus the overall LDR resistance are reduced.

As more light shines on the LDR semiconductor, more electrons are freed to conduct electricity, lowering the resistance.

The photoresistor is a light-sensitive resistor with a horizontal body that is exposed to light in terms of structure.

The following is the fundamental format for a photoresistor:

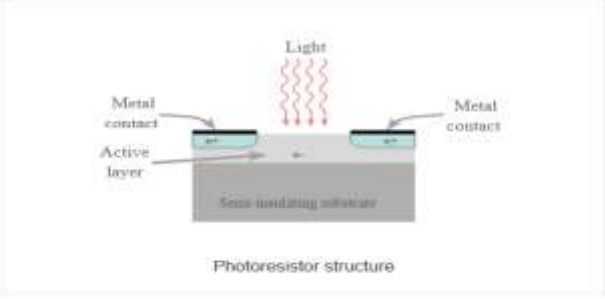

Fig 4 Photoresistor Structure

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Normally, the active semiconductor region is placed onto a semi-insulating substrate and is minimally doped.

An interdigital pattern is utilised in many discrete photoresistor devices to enhance the area of the photoresistor that is exposed to light. The pattern is carved into the metallisation on the active area's surface, allowing light to pass through. The resistor's two contacts are the two metallized regions. Because of the resistance of the contact to the surface, this area must be quite large.

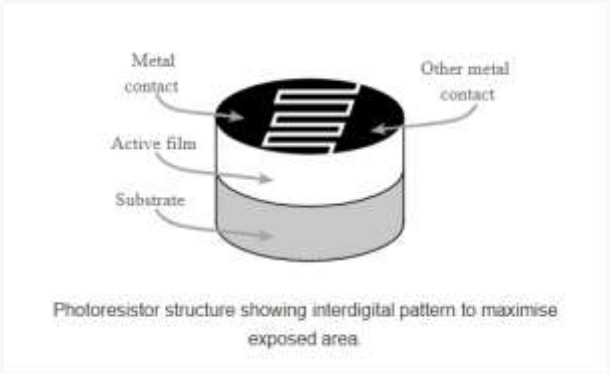

Fig 5 Photoresistor structure shoeing interdigital pattern to maximise exposed area

Many small photoresistors or light-dependent resistors that are seen use this type of construction. The interdigital pattern is easily identified.

Photoresists are made of semiconductors such as CdSe, CdS, CdTe, InSb, InP, PbS, PbSe, Ge, Is, and GaAs. Each material has its own set of features, such as wavelength of sensitivity and so on.

Light-dependent resistors, often known as LDRs or photoresistors, are divided into two categories:

Intrinsic photoresistors: Undoped semiconductor materials such as silicon or germanium are used in intrinsic photoresistors. When photons strike the LDR, electrons are excited, and they move from the valence band to the conduction band. As a result, these electrons are no longer restricted in their ability to carry electricity. More electrons are freed and the level of conductivity increases when more light falls on the device, resulting in a lower level of conductivity and a lower level of conductivity.

Extrinsic photoresistors: Extrinsic photoresistors are made from semiconductor materials that have been doped with impurities. Above the present valence band, these impurities or dopants produce a new energy band. As a result of the narrower energy gap, electrons require less energy to transfer to the conduction band.

With increasing levels of incident light, both types of light dependent resistors and photoresistors exhibit an increase in conductivity or a decrease in resistance.

Photoresistors' sensitivity is proven to fluctuate depending on the wavelength of the light that strikes the sensitive portion of the device. The effect is strong, and it is discovered that if the wavelength is outside of a certain range, there is no discernible effect.

Different materials react differently to different wavelengths of light, which means that different electronics components can be utilized for different applications.

Extrinsic photoresists are also found to be more sensitive to longer wavelength light and can be employed for infrared imaging. When dealing with infrared, however, caution must be exercised to avoid heat build-up induced by the radiation's elating effect.

The latency, or the time it takes for the electrical component to respond to any changes, is an important feature of photoresistors or light dependent resistors. This is especially true in the case of circuit design.

Because any changes in light level take a notable length of time before the LDR / photoresistor attains its final value for the new level of light, the LDR / photoresistor is not a viable solution where light values change quite quickly. The light shifts, on the other hand, are more than adequate when they occur over time.

The resistance recovery rate is the pace at which resistance changes. When light is applied after utter darkness, the LDR / photoresistor generally responds in a few tens of milliseconds, but when light is removed, the resistance can take up to a second to reach its final level.

As a result, one of the most common criteria for photo-resistors in electrical component datasheets is the dark resistance after a certain amount of time, usually measured in seconds. Frequently, two values are given: one for one second and one for five

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seconds. These provide information about the resistor's delay.

C. PIR Sensor

Because there are several variables that affect the sensor's input and output, PIR sensors are more sophisticated than many of the other sensors covered in these courses (such as photocells, FSRs, and tilt switches). To begin, we'll use this really good diagram to show how a basic sensor works.

The PIR sensor itself contains two slots, each of which is built of a unique IR-sensitive substance. Because the lens utilised here isn't doing anything, we can see that the two slots can'see' out past a certain distance (basically the sensitivity of the sensor). When the sensor is turned off, both slots detect the same quantity of IR, which is the ambient amount emitted by the room, walls, or outside. When a warm body, such as a human or animal, passes by, one half of the PIR sensor is intercepted, resulting in a positive differential change between the two halves. When the warm body departs the sensing area, the sensor generates a negative differential change, causing the sensor to generate a negative differential change. These pulses of change are what are detected.

Fig 6 PIR Sensor

D. Current Sensor

Fig 7 Current sensor

Hall Effect Sensors are transducer-type components that can convert magnetic data into electrical signals for further processing in an electronic circuit. The Hall Effect is commonly used in current sensors to convert current inputs to voltage outputs. Electrons from an electric current flow through a magnetic field plate in the Hall effect. The electrons are then "pushed" to one side of the plate, resulting in a voltage differential between the two sides. The sensor's output is the difference in voltage from the plate's side.

The ACS712 is a current sensor that can work in both AC and DC environments. This sensor runs on 5 volts and outputs an analogue voltage proportionates to the current recorded. A collection of precision Hall sensors with copper lines make up this gadget. When the current through the copper principal conduction line increases, the output of this instrument displays a positive slope (from pins 1 and 2 to pins 3

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and 4). The conduction path's internal resistance is 1.2 m. With an input current of 0A and a 5V Vcc power source, this sensor produces an output voltage of Vcc x 0.5 = 2.5. Based on the readable current range, there are three types: 5A, 20A, and 30A, with output sensitivity of 185mV / A, 100mV / A, and 66mV / A, respectively. Because the current sensor's output is analogue, we may read it by directly measuring the output voltage with a voltmeter or using a microcontroller like Arduino's Analog Read pin or ADC pin.

E. MOSFET

Because the IRFZ44N is an N-channel MOSFET, the Drain and Source pins will be left open while the gate pin is not energised. If the MOSFET must be switched with Arduino, a simple driving circuit based on a transistor will give the appropriate gate voltage to fully open the MOSFET.

Fig 8 MOSFET

F. Voltage Regulator 7805

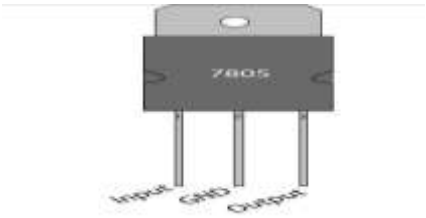

Fig 9 Voltage Regulator

A voltage regulator is designed to automatically maintain a constant voltage level. A voltage regulator may be a basic "feed-forward" design or may contain negative feedback control loops. An electromechanical mechanism or electrical components could be used. Depending on the design, it may be used to regulate one or more AC or DC voltages. Voltage sources in a circuit may fluctuate, resulting in voltage outputs that are not constant. The output voltage of a voltage regulator IC is kept constant. The 7805-voltage regulator integrated circuit (IC) is part of the 78xx series of fixed linear voltage regulator ICs that are used to keep such fluctuations at bay The xx in 78xx denotes the unit's fixed output voltage. The IC 7805 provides a +5-volt regulated power supply with space for a heat sink. Let's have a look at some of the fundamental ratings to get a sense of what they mean.

G. Potential Divider

Fig 10. Potential Divider

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A three-terminal resistor with a sliding or revolving contact that forms an adjustable voltage divider is known as a potentiometer, or simply a pot. It operates as a variable resistor or rheostat when only two terminals, one end and the wiper, are employed. A potentiometer is a measuring instrument that is essentially a voltage divider that is used to measure electric potential (voltage); the component is an embodiment of the same idea, hence its name. Potentiometers are commonly used to control electrical devices, such as volume controls on audio equipment. In a joystick, potentiometers operated by a mechanism can be used as position transducers. as an example, Potentiometers are rarely used to directly regulate significant power since the power dissipated in the potentiometer is comparable to the power dissipated in the controlled load (greater than a watt).

The proposed of this project will eliminate this anomaly and improve efficiency and controllability of the city poles that prove to be an essential aspect for the wellbeing and safety of the citizens

The small-scale working model produced the results as shown in Fig.11, Fig.12. Initially Because the intensity of the street lamps is low (i.e., 50%), we can observe that they all glow at the same time (Fig.11). Whenever a vehicle approaches near a specific lamp, only that lamp's intensity is increased to maximum (i.e., 100%). As far as pedestrians are concerned, the system functions at its lowest intensity even when there is no vehicular movement detected in the road. As a result, even for slow-moving users such as pedestrians and cyclists, this approach is adequate. As a result, the total system is effective while conserving energy.

VI. RESULT

Fig 11 Street lamps glowing at its initial intensity 50% **Fig.12 Street light glowing at maximum intensity100%**

VII. CONCLUSION

We devise and execute an automated system for dimming street lights that are not in use during the night. Additionally, the lighting ambiance is examined, with lights turned on while it is dark and off throughout the day. Our government is working hard to ensure that customers have access to electricity. As a result, if this research is widely adopted, it can result in significant savings in the amount of energy used by street lighting. With this modern technology, we are able to save a significant amount of energy without wasting any.

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