



HIGHWAY MONITORING SYSTEM AND POWER SAVING

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Abstract:

The task of monitoring of aging highway bridges and overpasses is important not only from the point of preventing economic losses but also is a matter of preventing catastrophic failures and loss of human life. In recent years, wireless sensor technologies have been used extensively to develop highway monitoring platforms for bridges. A limitation of wireless sensors is the finite life span of batteries and high cost of battery replacements, which make such systems prohibitively expensive in many cases. The huge amount of electrical power of many countries is consumed in lighting the streets. In this paper, we propose a system that automatically reduces the intensity of the light for the parts of the streets having no vehicles and increases the intensity of light for these parts once there are some vehicles that are going to come. This system automatically controls and monitors the light of the streets by using Arduino uno, Infrared sensor, LDR, camera module. We are also proposing a street light with camera module to monitor the situations near the highways, also lonely areas. If the street light is turned on for more than the estimated time then the camera will be automatically turned on and features the images which are happened near the cameras. The image will be processed and further verified by the control room, if any accidents or violated acts are performed then the digital images will be sent to hospitals and alert the police stations.

Keywords: Arduino uno, Infrared Sensors, LDR, Camera module.

I. INTRODUCTION:

The electric power industry covers the generation, transmission, distribution and sale

of electric power to the general public and industry. The commercial distribution of electric power started in 1882 when electricity was produced for electric lighting. In the 1880s and 1890s, growing economic and safety concerns lead to the regulation of the industry. What was once an expensive novelty limited to the most densely populated areas, reliable and economical electric power has become an essential aspect for normal operation of all elements of developed economy.

Street lighting provides a safe nighttime environment for all road users including pedestrians. Providing street lighting is one of the most important and expensive responsibilities of a city. Lighting can account for 10–38% of the total energy bill in typical cities worldwide. Street lighting is a particularly critical concern for public authorities in developing countries because of its strategic importance for economic and social stability. Inefficient lighting wastes significant financial resources every year, and poor lighting creates unsafe conditions. Energy efficient technologies and design mechanism can reduce cost of the street lighting drastically. But the power consumption is reduced only by nearly 30%. There also project exists where power reduces by using controlled system, but the disadvantage is that it is not cost effective and initial investment is not economical.

This paper presents an automatic street light using LDR that adjusts it's intensity by detecting vehicle movement in order to save large amount of power. Accidents are increasing day by day due to high vehicle density, many people die due to delay in communication between victims and hospitals. Accidents occurs on night can be monitored and

informed to various departments to save the life of victim.

II. LITERATURE SURVEY

In past decade various systems to aid the mobility of the visually impaired people have already been created. The author in [8] has implemented with RFID based system to aid the blind in the job of grocery shopping. The system utilizes on the RFID tags that are placed at various areas in the store and gives the guides simply inside the store. Other system found in [9] uses GPS location information with building maps and relevant spatial information to provide directions to locations within a campus environment. A smart wheel-chair system that is designed with sensors for similar purposes was proposed in [10]. The system uses differential GPS location information to allow the people to navigate to a general area. The utilization of GPS innovations is getting increasingly across the board with blind individuals. One such system that is built around GPS is the Sendero system. The system is software that works with any Braille note product. This technology looks like a miniature computer and be worn easily on the individual. Like the previous technologies, a Street Talk GPS Solution was also introduced.

A smart cane has planned for something like the past systems using locally available sensors for obstruction evasion [6]. The system depends on a ultrasonic sensor wherein it recognizes obstacles and orders the two-wheeled steering axle. The visually impaired feels the guiding order through the deal with and follow the stick effectively with no conscious effort. Other system that utilizes the ultrasonic sensor expected to illuminate the user regarding the separation to the distinguished articles by methods for vibrations. The frequency of the vibrator is conversely corresponding to the separation between the ultrasonic sensor and the obstacle. The author in [11] proposed a intelligent guide stick that comprises of a ultrasound displacement sensor, two DC motors, and a microcontroller.

Since the above innovation is intended to recognize and stay away from objects or items situated before the user, a fuzzy controller is required to decide the directions that will be executed, for instance to turn right, left or stop. Another necessity is the RFID label that ought to be set in a several areas to explore the users

in chance that the RFID joined to the blind body. Regularly, RFID is set inside a pack that ragged by the user. The bag supplies electricity power to the system and illuminates the user through a speaker. In case that the users do not have the ability to hear, there are special gloves that will vibrate at every finger, in which different vibrations in each finger have different meanings.

III. SYSTEM IMPLEMENTATION:

In this section we have to discuss the complete system architecture and working flow of the project. The blocks wise representation of the architecture has been shown below.

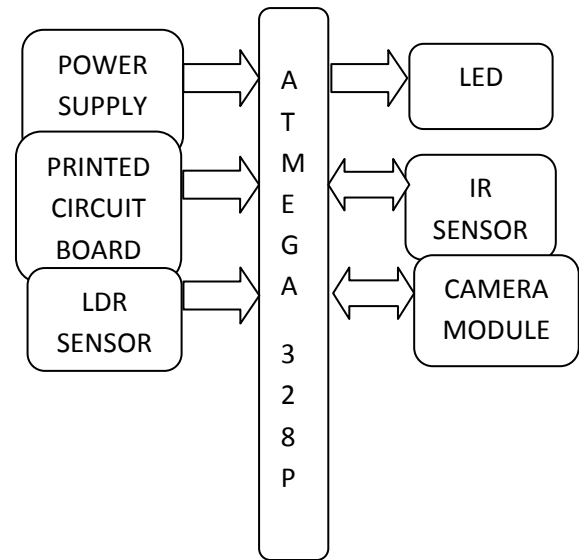


Fig: Block Diagram of the system
WORKING PRINCIPLE:

The automatic on and off of street lights are switched on the basic of sunlight present. The sunlight was sensed by the LDR circuit used in the network. In general the group of sensors are used and average the sensors output will decide the switching state of the street lights. Whenever the natural sunlight decreases then automatically the streetlights are turned on section by section using matrix method and automatically turned off when the sun is on.

Generally the lams are glows in nights. In many places the traffic density during mid nights is very less and sometimes it should be zero that means no traffic. During this time of no traffic condition a large amount of power being wasted. A novel technique is introduced in order to save the power as well as economy.

In nights the object sensing sensors are activated along with street lights and sense the object

present or not on roads and communicate the date to microcontroller every time. Under no object (vehicle, person) condition a portion of street light is glows with high intensity and remaining in off condition. This will lead the low illumination condition and this illumination is sufficient for visibility of path. Under the object present condition the sensors communicate to microcontroller and microcontroller send the signal to relay switch to turn on the remaining portion of lams to glow with full illumination.

For a particular section of roads, a number of street lights are present depends on the type of road. Generally the span of a street lights are lies between 40-80mts. Sensors are installed for every 500mts. The smart monitoring operation of sensors is based on the average walking speed of human being. For a specified time (average walking speed human being) the vehicle crosses the in sensor to out sensor otherwise sensors send the sate to microcontroller to turn on the cameras for smart monitoring.

FLOW CHART:

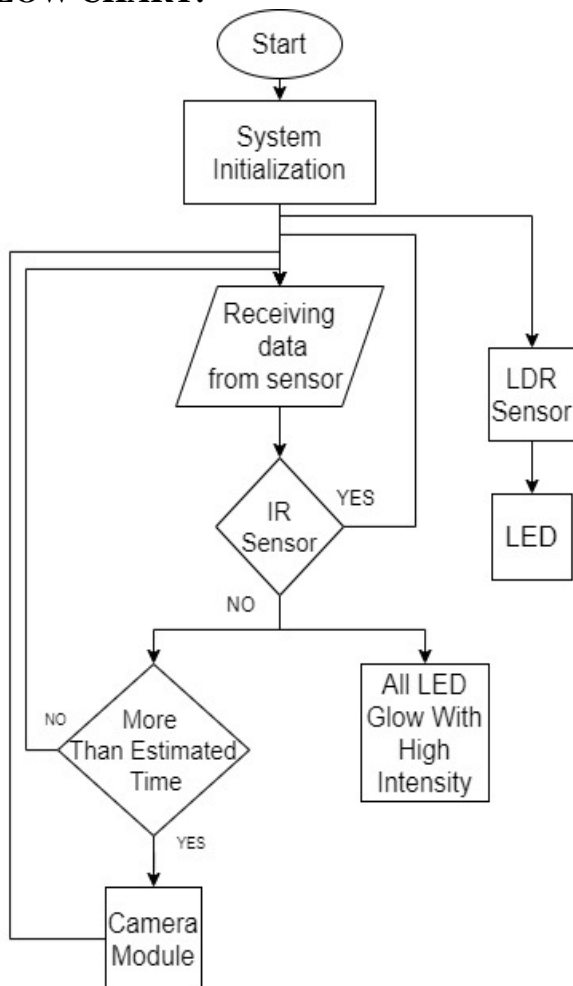


Fig: Flow Chart

IV.HARDWARE DESCRIPTION:

As shown in block diagram the architecture of the system mainly consists of eight parts: Arduino micro controller, LDR sensor, IR sensor, center tapped transformer, transistor, voltage regulator, relay, PCB, LED, rectifier and camera module. In this part we describe the features of all components consist in the designing system and explain how these components are connecting together, as shown in block diagram.

ARDUINO UNO

The ATmega328 based micro controller board is used in this project. It has 14 virtual enter/ output pins (of 6 pins used as PWM pins), along with 16 MHz ceramic oscillator with a USB connection, a single power jack, an ICSP header, and a push type reset switch. It incorporates the entire thing expected to control the microcontroller; completely go along with it to a USB supported power, inbuilt conversion of an AC-to-DC connector or supported power.

The arduino Uno differs from every single past board that doesn't use the FTDI USB-to- serial driver circuit. However this contains Atmega16U2 USB-to-sequential converter. The arduino board has default resistor dismantling the 8U2 HWB line to floor, that makes less confounded to position into DFU mode. This Arduino board has some specific specialities :

- 1.Zero pinouts: conveyed SDA and SCL pins which may be near to the AREF pin and two other new pins are near to the RESET pin, the IOREF pin that is used to set the voltage gave from the power supply board. In destiny, the AVR family of micro controllers use 5V and the arduino utilize the less voltage 3.3V.



Fig: ARDUINO UNO

Transistor:

NPN transistor is one of the Bipolar Junction Transistor (BJT) types. The NPN transistor consists of two n-type semiconductor materials and they are separated by a thin layer of p-type semiconductor. Here the majority charge carriers are the electrons. The flowing of these electrons from emitter to collector forms the current flow in the transistor. Generally the NPN transistor is the most used type of bipolar transistors because the mobility of electrons is higher than that of holes. The NPN transistor has three terminals: emitter, base and collector. The NPN transistor is mostly used for amplifying and switching signals.

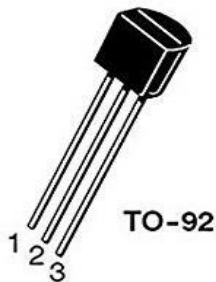


Fig: Transistor

Infrared Sensor:

Infrared sensor is a digital sensor which is used to detect the obstacles with less distance range certain characteristics of its surroundings. The transmitter in IR always emits an infrared beam. This IR beam is received by an IR receiver when an obstacle is near the transmitter. This module contains an internal comparator circuit for comparing receiver values. These values are given to the microcontroller. The onboard comparator circuitry does the processing and the green indicator LED comes to life. The module features a 3-wire interface with Vcc, GND, and an OUTPUT pin on its tail. It works fine with 3V3 to 5V levels. Upon hindrance/reflectance, the output pin gives out a digital signal (a low-level signal). The onboard preset helps to fine-tune the range of operation, effective distance range is 2cm to 80cm.

Features:

- Onboard detection indication
- Effective distance range of 2cm to 80cm
- A preset knob to fine-tune distance range
- There is an obstacle, the green indicator light on the circuit board
- Detection distance: 2 ~ 30cm
- Detection angle: 35 °
- Comparator chip: LM393
- 3mm screw holes for easy mounting
- Dimensions: 48 x 14 x 8 mm (LxWxH)
- Weight: 3gm



Fig: Infrared sensor

LDR sensor:

LDR is also known as Light Dependent Resistor. A photo-resistor is made of a high resistance semiconductor. If light falling on the device is of high enough frequency, photons absorbed by the semiconductor give bound electrons enough energy to jump into the conduction band. The resulting free electron (and its hole partner) conduct electricity, thereby lowering resistance.

Features of Light Dependent Resistor

- Miniature open frame package.
- Proxy coated.
- Moisture resistant.
- Spectral response similar to the human eye.

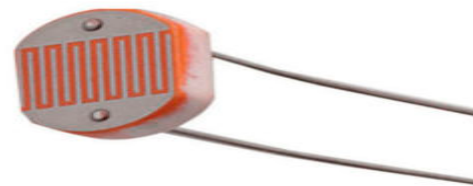


Fig: LDR sensor

Center Tapped Transformer:

One of the greatest advantages of alternating currents over direct currents is that, the alternating currents can be easily transferable from low voltage to high or high voltage to low alternating voltages can be raised or lowered as per requirements in the different stages of electrical network as generation, transmission, distribution & utilization. This is possible with a device called as Transformer.

“Transformer is a static device, which transfers the electrical power or energy from one alternating current circuit to another with the desired change in voltage or current and without any change in the frequency”

A centre-tapped transformer also known as two phase three wire transformer is normally

used for rectifier circuits. When a digital project has to work with AC mains a Transformer is used to step-down the voltage (in our case, to 24V or 12V) and then convert it to DC by using a rectifier circuit. In a center-tapped transformer the peak inverse voltage is twice as in bridge rectifier hence this transformer is commonly used in full wave rectifier circuits.

Specifications of Center Tapped Transformer:

- Step-down Centre tapped Transformer
- Input Voltage: 220V AC at 50Hz
- Output Voltage: 24V, 12V or 0V
- Output Current: 1A
- Vertical mount type
- Low cost and small package

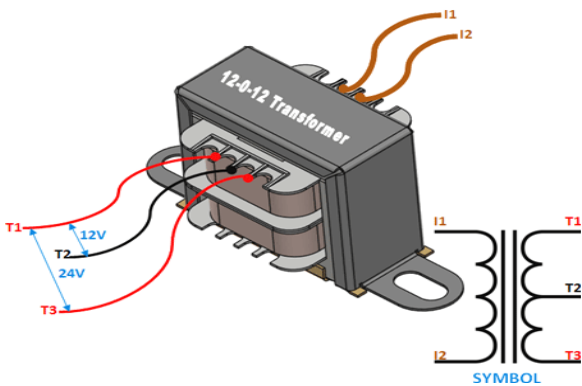


Fig: Liquid indicator sensor

7805-Voltage Regulator:

Voltage sources in a circuit may have fluctuations resulting in not providing fixed voltage outputs. A voltage regulator IC maintains the output voltage at a constant value. 7805 IC, a member of 78xx series of fixed linear voltage regulators used to maintain such fluctuations, is a popular voltage regulator integrated circuit (IC). The xx in 78xx indicates the output voltage it provides. 7805 IC provides +5 volts regulated power supply with provisions to add a heat sink.

A voltage regulator is a system designed to automatically maintain a constant voltage level. A voltage regulator may use a simple feed-forward design or may include negative feedback. It may use an electromechanical mechanism, or electronic components. Depending on the design, it may be used to regulate one or more AC or DC voltages.

Applications of Voltage Regulator:

- Fixed-Output Regulator
- Positive Regulator in Negative Configuration

- Adjustable Output Regulator
- Current Regulator
- Adjustable DC Voltage Regulator
- Regulated Dual-Supply
- Output Polarity-Reversal-Protection Circuit
- Reverse bias projection Circuit

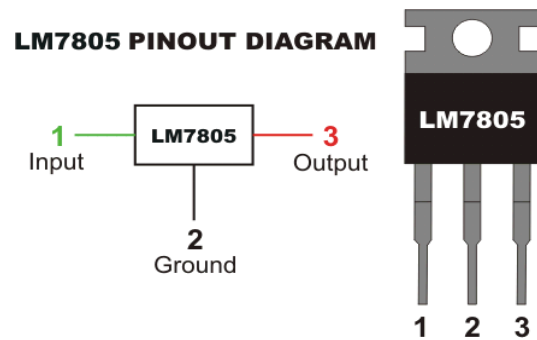


Fig: 7805-Voltage Regulator

Relay:

A relay is an electrically operated device. It has a control system and (also called input circuit or input contactor) and controlled system (also called output circuit or output contactor). It is frequently used in automatic control circuit. To put it simply, it is an automatic switch to controlling a high-current circuit with a low-current signal.

Applications of Relay:

- Lighting control systems
- Telecommunication
- Industrial process controllers
- Traffic control
- Motor drives control
- Protection systems of electrical power system



Fig: Relay

Printed Circuit Board:

PCBs can be single-sided (one copper layer), double-sided (two copper layers on both sides of one substrate layer), or multi-layer (outer and inner layers of copper, alternating with layers of

substrate). Multi-layer PCBs allow for much higher component density, because circuit traces on the inner layers would otherwise take up surface space between components. The rise in popularity of multilayer PCBs with more than two, and especially with more than four, copper planes was concurrent with the adoption of surface mount technology. However, multilayer PCBs make repair, analysis, and field modification of circuits much more difficult and usually impractical.



Fig: Printed Circuit Board

Light Emitting Diode:

LED (Light Emitting Diode) LED is a pn-junction diode that mainly used as a replacement of incandescent lights. It is based on the electroluminescence effect – A process where diode converts electric current to light when electrons change their state inside the LED semiconductors.



Fig: Light Emitting Diode

Rectifier:

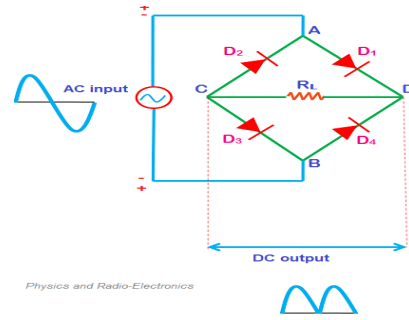


Fig: Rectifier

A rectifier is an electrical device that converts alternating current (AC), which periodically reverses direction, to direct current (DC), which flows in only one direction. The process is known as rectification, since it "straightens" the direction of current. ... As noted, detectors of radio signals serve as rectifiers. Rectifiers are mainly classified into three types: "Half-wave rectifier, Centre tapped full-wave rectifier" and Bridge rectifier.

Web Camera:

A webcam is a video camera that feeds or streams an image or video in real time to or through a computer to a computer network, such as the Internet. Webcams are typically small cameras that sit on a desk, attach to a user's monitor, or are built into the hardware. Webcams can be used during a video chat session involving two or more people, with conversations that include live audio and video.



Fig: Web Camera

V. RESULTS:

The real time view of the system has been shown below. The project is successfully implemented in many areas based on the

experimental verification proving that it can save the electrical power and the system became the origin for upcoming advanced intelligent system in saving both human and electrical power.



Fig: Real time view of the system

VI. CONCLUSION:

This article presented the prototype of highway monitoring system that deals with preliminary developing an accident detection in highways using an artificial sensing unit along with the power saving techniques based on density of vehicles. Large amount of power can be saved by using automatic street light systems and also we can save the lives of the victims who met with accidents that occurs on the highways by using webcams. From webcams, accidents and improper issues can be detected and alert to concerned departments like ambulance service, police service, and highway patrolling service. From there, further actions like monitoring and communicating the victims can be done. The system will focus on saving life and saving power.

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