ISSN: 2321-2152

IJMECE

International Journal of modern electronics and communication engineering

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editor@ijmece.com

www.ijmece.com

ISSN 2321-2152
www.ijmece.com
Vol 13, Issue 3, 2025

Research Of Intelligent Street Light System Based On LDR

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Abstract

Efficient management of street lighting is crucial for energy conservation and enhancing public safety. This project proposes an intelligent street light system based on Light Dependent Resistor (LDR) and Infrared (IR) sensors. By integrating LDR sensors, IR sensors, an Arduino, LCD, and LEDs, the system can automatically adjust the street lights' brightness based on ambient light levels and detect pedestrian or vehicle movement. The LDR sensor monitors the surrounding light intensity, while the IR sensor detects movement. The Arduino processes this data to control the LEDs, ensuring optimal lighting conditions. The LCD displays real-time system status. This innovative system aims to reduce energy consumption and improve the effectiveness of street lighting.

I. Introduction

An automatic street lighting system is designed to automatically switch ON the street light alongside the roads or the light lamp just outside our house on the onset of dark weather or switch them off automatically after sunrise or during the light hours. We need to save or conserve energy because most of the energy sources we depend on, like coal and natural gas can't be replaced. Once we use them up, they're gone forever.Saving power is very important, instead of using the power in unnecessary times it should be switched off. In any city “STREET LIGHT” is one of the major power consuming factors. Most of the time we see street lights are controller has an LDR which is used to detect the ambient light. If the ambient light is below a specific value the lights are turned ON. A light dependent sensors is interfaced to the pic 18f452 microcontroller it is used to track the sun light and when the sensors goes dark the led will be made on and when the sensor founds light the led will be made OFF .It clearly demonstrates the working of transistor in saturation region and cut-off region.

The working of relay is also known Microcontroller and the code is written in c language inMikroC ide, the resulted value can be seen with the help of UART or LCD display. Automatic Street Light Control System is a simple yet powerful concept, which uses transistor as a switch. By using this system manual works are 100% removed. It automatically switches ON lights when the sunlight goes below the visible region of our eyes.This is done by a sensor called Light Dependent Resistor (LDR) which senses the light actually like our eyes. It automatically switches OFF lights whenever the sunlight comes, visible to our eyes.This project exploits the working of a transistor in saturation region and cut-off region to switch ON and switch OFF the lights at appropriate time with the help of an

electromagnetically operated switch.A street light, lamppost, street lamp, light standard, or lamp standard is a raised source of light on the edge of a road or walkway, which is turned on or lit at a certain time every night. Modern lamps may also have light-sensitive photocells to turn them on at dusk, off at dawn, or activate automatically in dark weather.

II. Literature Survey

Shreesh Mishra, Shivakant Gupta, Santosh Singh, Tripuresh Tiwari.

The main aim of this project is to utilize the application of the Arduino board to control the intensity of street light. As the traffic decreases slowly during late-night hours, the intensity gets reduced progressively till morning to save energy and so, the street lights switch on at the dusk and then switch off at the dawn, automatically. The process repeats every day. White Light Emitting Diodes (LED) replaces conventional HID lamps in street lighting system to include dimming feature. The intensity is not possible to be controlled by the high intensity discharge (HID) lamp which is generally used in urban street lights. LED lights are the future of lighting, because of their low energy consumption and long life. LED lights are fast replacing conventional lights because intensity control is possible by the pulse width modulation. [1] This proposed system uses an Arduino board and a rectified-power supply. String of LED are interfaced to the Arduino board with a MOSFET device. The intensity control of the LED light is possible by varying duty cycle from a DC source. A programmed Arduino board is engaged to provide different intensities at different times of the night using PWM technique. This project is also enhanced by integrating the LDR to follow the switching operation precisely.

S.Guru Priya, B.Abinaya.

The system is mainly used for smart and weather adaptive lighting in street lights. The project is implemented with smart embedded system that controls the street light based on detection of sunlight. During the night time the street light gets automatically ON and during the day time it gets automatically OFF. The ON/OFF can be accessed anywhere anytime through internet. A camera is placed on top of the street light to track the actions performed on the road where the footages are stored in a server. In addition to this, a panic button is placed on the pole, in-case of any emergency or danger, the person in danger can press this button which raises an alarm at the nearby police station. Whenever the panic button is pressed, the footage at that time recorded by the camera is sent directly to the cloud account. The access of the account is given to the particular police station by which they can view the incident's spot. Each area's street lights are connected to the particular area's police station and each of them has a cloud accessible account. The manual operation using GSM technology is

ISSN 2321-2152
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completely eliminated. Thus the system is mainly designed to ensure safety and to prevent energy wastage.

III. Implementation

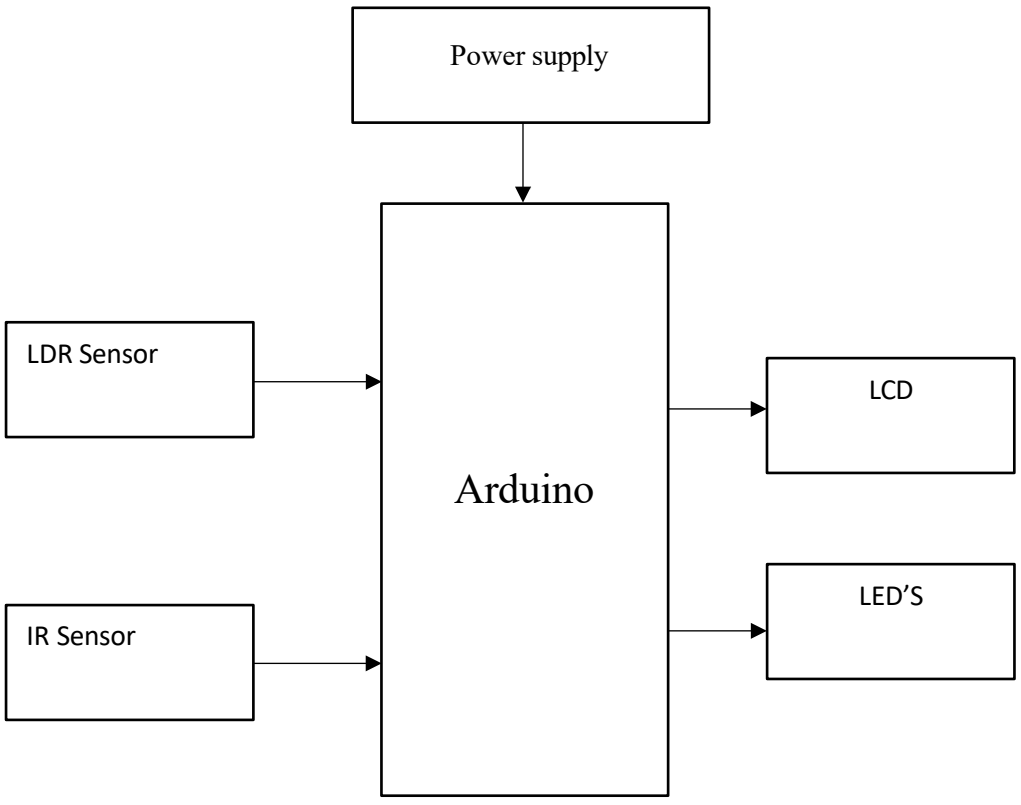
Existing System:

Current street lighting systems often rely on manual operation or fixed timers, which do not adapt to the actual lighting requirements or pedestrian and vehicle movement. These systems can lead to excessive energy consumption or inadequate lighting, impacting both energy efficiency and public safety. .

Proposed System:

To overcome the limitations of existing systems, we propose an intelligent street light system utilizing LDR and IR sensors. The LDR sensor adjusts the light intensity based on ambient light levels, while the IR sensor detects movement and ensures the lights are only active when needed. The Arduino processes the sensor data to control the LEDs, and the LCD provides a real-time display of system status. This system offers significant advantages, including energy savings, improved safety, and automatic adaptation to environmental conditions.

IV. Block diagram:



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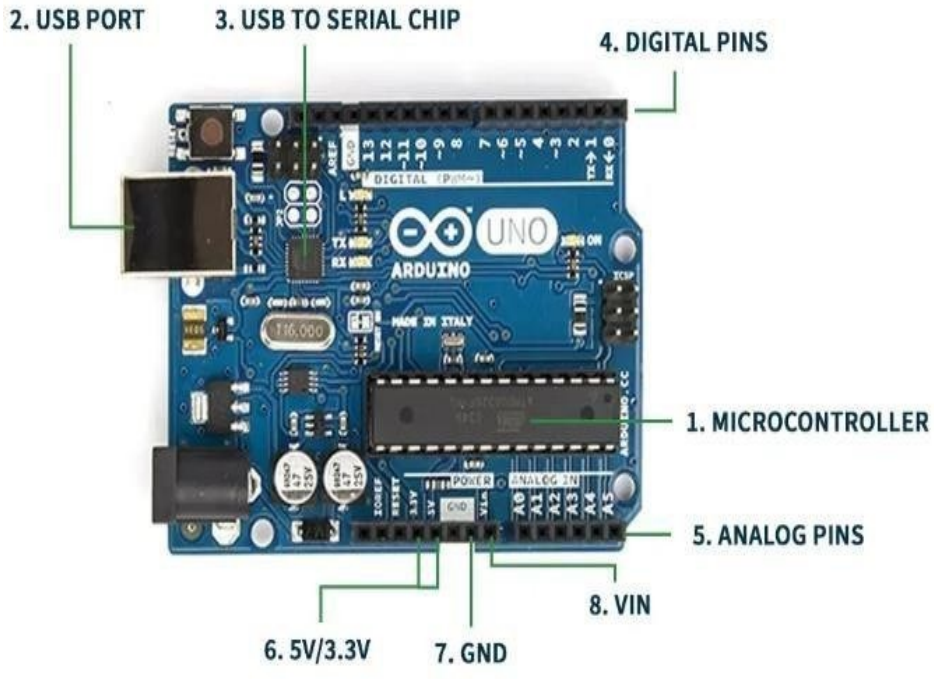
V. Arduino Hardware:

Let us look at the hardware components of Arduino:

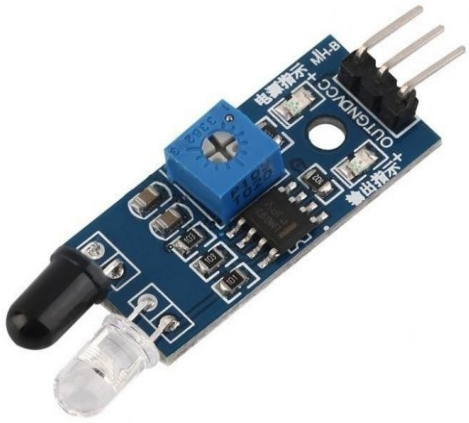


- **Microcontroller: The** Microcontroller controls the execution of all the programs and codes uploaded on Arduino. The microcontroller is equipped with components that can perform different functions.
- **USB port:** This port is used to establish a connection between the computer and the Arduino board.
- **USB to Serial chip: The** USB to Serial port is used for adding data from the computer to the microcontroller. This is how the code is uploaded from the computer to the Arduino board.
- **Digital pins**: These pins are used for turning the LEDs on and off by using digital logic ('0' and '1').
- **Analog pins:** These pins are used for taking analog input.
- **5V / 3.3V pins**: These pins are used for supplying power to devices.
- **GND:** This pin is used for setting a reference level.

VI. IR Sensor

IR sensor is an electronic device that emits the light in order to sense some object of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion. Usually, in the infrared

spectrum, all the objects radiate some form of thermal radiation. These types of radiations are invisible to our eyes, but infrared sensor can detect these radiations.



The emitter is simply an IR LED **(Light Emitting Diode)** and the detector is simply an IR photodiode. Photodiode is sensitive to IR light of the same wavelength which is emitted by the IR LED. When IR light falls on the photodiode, the resistances and the output voltages will change in proportion to the magnitude of the IR light received. There are five basic elements used in a typical infrared detection system: an infrared source, a transmission medium, optical component, infrared detectors or receivers and signal processing. Infrared lasers and Infrared LED's of specific wavelength used as infrared sources. The three main types of media used for infrared transmission are vacuum, atmosphere and optical fibers. Optical components are used to focus the infrared radiation or to limit the spectral response.

VII. LDR Sensor

LDR (**Light dependent resistor**) also known as **photocell**, **photoresistor** or **Photo Conductive Cell** is a light-sensitive resistor whose resistance varies with the intensity of light. It is a type of variable resistor whose resistance varies with the light. Its resistance varies inversely with the change in light intensity i.e. its resistance increases with a decrease in light intensity and decreases with an increase in light intensity.

It is a type of photo sensor that works on the principle of photoconductivity. Its electrical conductivity changes with the intensity of the falling light. Its resistance also depends on the frequency and wavelength of the incident light. Although its sensitivity depends on the design and Semiconductor material of the device.

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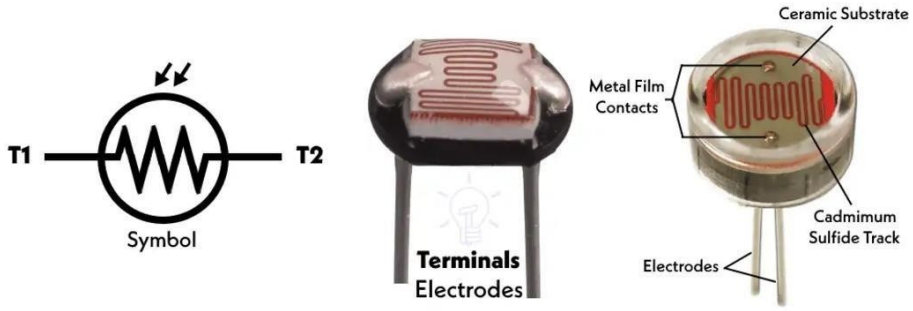
*LDR is also known as Photocell & Photoresistor



It is used in light sensing circuit that operates based on light and dark conditions such as street lights, solar panels, solar tracker, etc.

VIII. LCD

LCD is a flat display technology, stands for "Liquid Crystal Display," which is generally used in computer monitors, instrument panels, cell phones, digital cameras, TVs, laptops, tablets, and calculators. It is a thin display device that offers support for large resolutions and better picture quality. The older CRT display technology has replaced by LCDs, and new display technologies like OLEDs have started to replace LCDs. An LCD display is most commonly found with Dell laptop computers and is available as an active-matrix, passive-matrix, or dualscan display. The picture is an example of an LCD computer monitor.

The Liquid Crystal library allows you to control LCD displays that are compatible with the Hitachi HD44780 driver. There are many of them out there, and you can usually tell them by the 16-pin interface.

Output of the sketch on a 16x2 LCD

The LCDs have a parallel interface, meaning that the microcontroller has to manipulate several interface pins at once to control the display. The interface consists of the following pins:

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Schematic diagram:

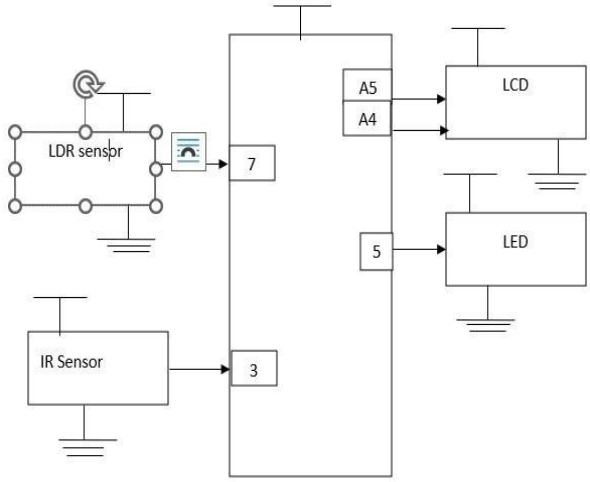


FIG: Schematic diagram of proposed system

IX: Result

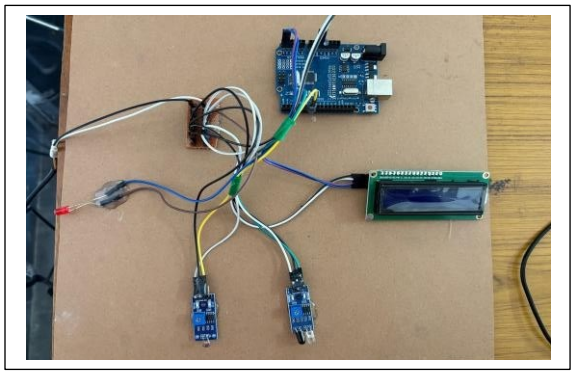


Fig:Hardware Kit When in Off State

Fig:On Condition

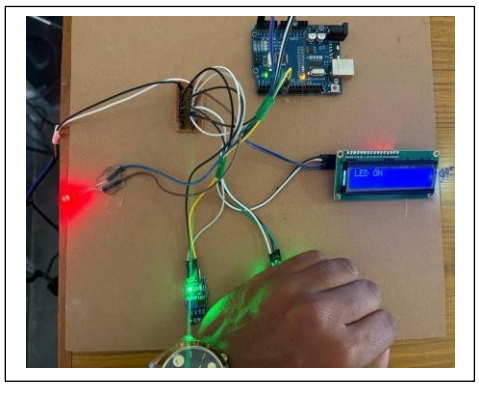
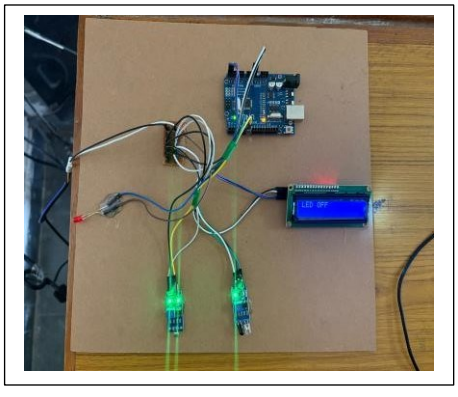


Fig:Off Condition



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Result:

In the first image, the hardware setup of the Intelligent Street Light System is shown in its initial state. The components, including the Arduino, LDR sensor, LED, and the LCD screen, are connected and powered. At this point, the LDR is exposed to ambient light, and as a result, the system does not activate the LED, indicating that it is functioning correctly during daylight conditions.

In the second image, the LDR sensor and the other components are fully operational, with their status LEDs indicating proper connections. The LCD screen displays the message “LED OFF,” confirming that the sensor has detected enough ambient light and, accordingly, kept the street light (LED) turned off. This verifies the system’s ability to save energy when natural light is available.

In the third image, an object (a hand) is placed over the LDR sensor to block the ambient light, simulating night- time conditions. In this state, the LDR’s resistance increases due to the absence of light, prompting the Arduino to turn on the LED, acting as the street light. The LCD screen now displays “LED ON,” demonstrating that the intelligent system can reliably detect darkness and respond by automatically lighting up the area.

X: Future Scope

- Integration with IoT: The project can be integrated with IoT platforms to enable remote monitoring and control of street lights.

- Energy Harvesting: Energy harvesting techniques can be used to power the street lights, reducing reliance on traditional energy sources.

- Advanced Sensors: Advanced sensors like motion detectors and cameras can be used to enhance the functionality of the street lighting system.

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