International Journal of Engineering Science and Advanced Technology (IJESAT)

IJESAT (Enriching the Research)

Open Access Research Article

Volume: 23 Issue: 06

May, 2023

IMPLEMENTATION OF EFFICIENT POWER MANAGEMENT SYSTEM DESIGNED FOR STREETLIGHTS USING RASPBERRY PI

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ABSTRACT

Every day lot of energy is wasted due to the continuous glowing street lights, sometimes they glow during day time also and therefore it is essential to adapt an autonomous auto control system to reduce the energy wastage. Here an intelligent street light concept is presented that adapts logic control circuit such that depends up on the moving traffic, these lights will be controlled automatically. Means, initially all street lights will be glowing automatically during dark and these lights remain in dim light condition when no activity is detected, but brightens when vehicle movement is detected. The proposed system as Smart Street light system using raspberry pi is an intelligent system which can control the street light to optimize the problem of power consumption of the streets late in night. In this system, when the vehicle is approaching near street light, light will be turned to full intensity, when the vehicle is moved away, the street light automatically turns to low intensity. The street lights used in this system are LED lights which consumes less electricity. This type of lighting is different from traditional or stationary illumination. In addition to minimize the power consumption further, an automatic switch on and switch off circuit is also added to the system such the lights will be energized automatically during dusk and the same lights will be de- energized in the morning.

The proposed prototype model is with 4 small street lights and each street light is having a 2.5w high glow LED lamp. Supply to these lights is provided through relays interfaced with embedded system built with 89c51microcontroller chip. LDR is used as natural light sensor and it is wired with timer chip configured in trigger mode such that all lights will be energized during dark only. Moving traffic is detected through IR sensors, here 4 sets of sensors are used to control 4 street lights independently. In idle condition, street lights remain in dim condition, whenever any circuit detects approaching vehicle, corresponding street light will be glowing brightly. In this configuration, as each street light is having independent control circuit and as the vehicle moves, street lights will be brighten intensity wise, ie brighter when the object is detected and dims when the object moves away one after another in a sequence. Since it is a prototype module, 4 street lights are simulated in demo module, but for real time applications, entire street lights must be controlled independently.

I.INTRODUCTION

1.1 INTRODUCTION OF PROJECT:

Lights are essential and one of the most important components of building the environment. Lights are very important at night as it helps to maintain safety of people and to prevent crime. There are lights on each and every street, highways, parking lots etc. As for every 30 meters, there is a street light. So, we can imagine how many lights may be there in a city or in the country and worldwide. As these street lights are used by public widely consuming more electricity we thought of solution for saving electricity. With such a huge number of street lights and a huge amount of power consumption, there is a huge usage of electricity in cities and there is a lot of pollution and emission of carbon dioxide. As of now energy saving and environmental awareness is trending in current research, from the technical view, light emitting diode is commonly used as solid state light source

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technology in general applications, because of less power consumption, long life and no use of mercury gas as compared to conventional lamps.

Power consumption of street lighting system is a major component in the India. As per global trends survey, we pay 18-38% of the energy bill for street lighting. We need to pay our attention on this so that we can look for better power efficiency for effective utilization of power and therefore our ultimate aim can be achieved i.e., saving power. Simply it concludes with the wastage of electricity. Initially, the street lights were handled manually where in each of the street lamps, the control switch was set which was known as the first generation of the original street light. Alternate method that has been used was based on the optical control method in which the high-pressure sodium lamps were utilized. A good street lighting system can provide safety, good visibility and comfort to vehicles / pedestrians to travel along the roads thereby lowering many malfunctions that cause all along the night and enhance the appearance of the locality. Contrarily, the design of poor lighting systems can result to indigent visibility and this will not be useful for vehicles or pedestrians going along the roads. Street lighting is designed poorly very frequently and has scanty maintenance (e.g., many failed lights are there), and adopts outdated technology for lighting, thus it consumes high energy and more money (due to street lights glowing during the day time), while often failing to provide reliable lighting system.

The proposed system as Smart Street light system using raspberry pi is an intelligent system which can control the street light to optimize the problem of power consumption of the streets late in night. In this system, when the vehicle is approaching near street light, light will be turned to full intensity, when the vehicle is moved away, the street light automatically turns to low intensity. The street lights used in this system are LED lights which consumes less electricity.

This efficient power management system using IR sensors is controlled by raspberry pi pico microcontroller chip. It consists of IR sensors; model of street lights designed with high glow LED lights, etc. When the vehicle is passing through the street lights, the sensors arranged at the bottom of each street light will be interrupted in a sequence one after another.

The microcontroller used in the project work is playing dominant roll. Microcontrollers are increasingly being used to implement control systems. It is therefore important to understand Microcontroller-controlled system well. Today, microcontrollers have become an integral part of all control systems. Dedicated controllers that use microcontrollers, have certainly improved the functional, operational and performance-based specifications. The architectural changes in instrumentation and control systems where and are due to the computing and communication capability of the Micro controller devices. Micro controller must be treated as a tool for computing and communication.

Any Micro-controller, that functions according to the program written in it. Here the program is prepared in such a way, so that the system performs the function of a automatic ghat road signal system. The program is nothing but an instruction set, & according to the instructions received from the sensors, the controller unit carries out the specified task. The instruction set often prepared in binary code, & are referred as machine code, there by this software is called as machine language. Writing a program in such a code is a skilled and very tedious process. It is prone to errors because the program is just a series of 0's and 1's and the instructions are not easily comprehended from just looking at the pattern. An alternative is to use an easily comprehended form of shorthand code for the patterns 0's and 1's. Micro controller can read and it can store the information received from the remote-control unit. Micro-controllers are dedicated to one task and run one specific program. The program is stored in ROM (read-only memory) and generally does not change. If there are any modifications in the function, or errors in the software, the existing program must be erased from the chip & again modified program must be loaded in the chip through chip burner.

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The demo module is constructed with 4 small street lights and each street light is having a 2.5w high glow LED lamp. Supply to these lights is provided through relays interfaced with embedded system built with 89c51microcontroller chip. LDR is used as natural light sensor and it is wired with timer chip configured in trigger mode such that all lights will be energized during dark only.
Moving traffic is detected through IR sensors, here 4 sets of sensors are used to control 4 street lights independently. In idle condition, street lights remains in dim condition, whenever any circuit detects approaching vehicle, corresponding street light will be glown brightly. In this configuration, as each street light is having independent control circuit and as the vehicle moves, street lights will be brightened one after another in a sequence. Since it is a prototype module, 4 street lights are simulated in demo module, but for real time applications, entire street lights must be controlled independently.

1.2 PROBLEM STATEMENT:

The inefficient power management of street lights is a significant issue that needs to be addressed. Most of the street lights are still using traditional methods of powering up and down, which are not energy-efficient. This leads to wastage of power, which is not only harmful to the environment but also increases the operational costs of the street light system.
To solve this problem, an efficient power management system needs to be implemented for street lights. This system should be designed using Raspberry Pi, which is a low-cost and versatile single-board computer that can be used for a variety of applications. The system should be capable of monitoring the power usage of the street lights and regulating their brightness based on the ambient light conditions.
The proposed system should have the following features:
1) Efficient power usage: The system should be designed to consume minimum power, and it should also optimize the power usage of the street lights. This will not only save energy but also reduce the operational costs of the street light system.
2) Automatic brightness control: The system should be able to adjust the brightness of the street lights based on the ambient light conditions. This will ensure that the lights are not too bright during the day and not too dim at night.
3) Remote monitoring and control: The system should be designed to allow remote monitoring and control of the street lights. This will enable the authorities to monitor the status of the lights and make necessary changes from a centralized location.
4) Real-time data analysis: The system should be able to collect real-time data on the power consumption and brightness of the street lights. This data can be analyzed to identify any anomalies or issues with the system and take corrective actions.
By implementing an efficient power management system designed for street lights using Raspberry Pi, we can save energy, reduce operational costs, and improve the overall efficiency of the street light system..

1.3 MOTIVATION OF PROJECT:

The use of the Raspberry Pi to develop an effective power management system for street lighting is inspired by a number of factors, including:
It is essential to conserve energy wherever feasible given the rising cost of energy and the rising demand for electricity. An effective power management system may greatly minimise energy consumption, which is significantly influenced by street lighting.
Operating conventional street lighting systems is frequently expensive and inefficient. Municipalities and other organisations in charge of street lighting can significantly reduce their energy costs and maintenance expenses by putting in place an effective power management system.

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Energy waste not only raises expenses but also has a detrimental effect on the environment. We may lessen our carbon footprint and contribute to reducing the consequences of climate change by putting in place an effective power management system.

Quality of illumination is improved because of the automatic brightness adjustment function of the suggested system, which makes sure that the street lights aren't either too bright or too low. Drivers and pedestrians may feel safer and more secure as a result of this.

A single-board computer with many uses, including IoT devices, the Raspberry Pi is inexpensive and adaptable. The use of a Raspberry Pi to construct an effective power management system shows how technology has the ability to enhance the effectiveness and efficiency of public services.

In conclusion, the installation of an effective Raspberry Pi-based power management system for street lights is driven by the desire to reduce energy consumption, cut expenses, address environmental issues, enhance lighting quality, and take advantage of technology improvements.

1.4 BLOCK DIAGRAM

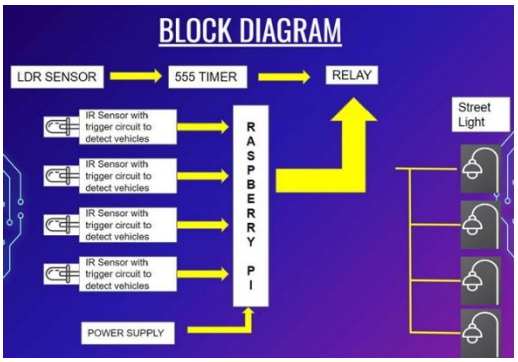

Fig. 1.1 Implementation Of Efficient power management system designed for street lights using Raspberry Pi

Figure 1.1 depicts the block diagram of our project.

The arrows indicate whether the components feed the signal to the microcontroller or accept the signal given by the microcontroller. In our project, IR sensor and inputs whereas LED acts as output.

LDR Sensor act as

Each block has separate function to do and all the blocks work with the central brain of project i.e the microcontroller Raspberry Pi. Power supply, connecting wires, a circuit board are used to complete the circuit. The control circuit is designed with LDR (Light Dependant Resistor) and 555 timer IC. The LDR is a kind of optical sensor, which acts as a variable resistor according to the light intensity. This device is used to monitor the natural light continuously, and it is wired with timer IC. The circuit is designed to control the lights automatically depending up on the availability of natural light. The detailed description is provided in the following chapters. This project work is intended to control the street lights automatically by sensing the natural light and traffic density. The main intention of the system is to control the power consumptions at the streets and eliminating manpower. Means these street lights will be energized automatically by sensing the absence of natural light during dark and the same street lights will be switched off in the morning by sensing the natural light. This includes controlling a circuit of street lights with specific Sensors, LDR and Microcontrollers during day and night.

Street lights are the major requirement in today's life of transportation for safety purposes and avoiding accidents during night. Despite that in today's busy life no one bothers to switch it off/on when not required. The project introduced here gives solution to this by eliminating manpower and reducing power consumption. This requires three basic components i.e. LDR, Sensors and

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microcontroller. During daytime there is no requirement of street lights so the LDR keeps the street light off until the light level is low.

For detecting the passing vehicle, IR sensors are used and these sensors are interfaced with IC567 functions as trigger circuit. When the sensors are interrupted due to the passing vehicle, circuit will be triggered and generates logic low signal for the microcontroller chip. Based on this signal, the microcontroller chip used here is programmed to energize the corresponding street light at full brightness. This efficient power management system using IR sensors is controlled by raspberry pi pico microcontroller chip. It consists of IR sensors; model of street lights designed with high glow LED lights, etc. When the vehicle is passing through the street lights, the sensors arranged at the bottom of each street light will be interrupted in a sequence one after another.

II.LITERATURE SURVEY

S[1] "Annareddy Sravani, P.Malarvezhi, R. Dayana (2018 IEEE) " "dimmer based smart street lighting system using raspberry Pi and IoT". Light dependent resistor (LDR) sensors are used to sense the darkness and Passive Infrared (PIR) sensors are to detect the objects. Raspberry Pi (Master node) and Arduino (Slave node) will communicate each other and they help the proposed system to work more effectively. Current sensor and Voltage sensor are used to measure the current and voltage respectively. By reducing the intensity at these times, energy can be saved to some extent and the data is uploaded to the cloud. We can monitor and control the street lights in a smart way as per our requirement. Fault detection, minimization of cost, reducing the loss of electricity and man power are also possible. Hence, this proposed smart street lighting system will be helpful to the society in cost effective way

S[2] "Chaitali Manani, Prem Gandhi, Shweta Gade, Chetan Bansode, Dr. Sandhya Kadam K. J. Somaiya Institute of Engineering and Information Technology Sion, Mumbai, India (2018 IEEE)" "Smart Street Light System Using Raspberry pi"

Smart street light system using raspberry pi as the proposed system focuses on minimizing the power consumption as well as to detect the velocity or speed of the vehicle. The system is designed using LED, PIR sensor, LDR sensor, SD card, camera module, with all this components which are connected and controlled using raspberry pi. This system will detect the vehicle and it turns the street light to full intensity when the vehicle passes and the street lights are automatically turned to low intensity if not required and it also detects speed and distance of the vehicle from street light.

S[3]" Energy Efficiency On Smart Street Lighting Using Raspberry Pi Based On Scada And Internet Of Things (IoT)" (2019) One of the criteria of a city categorized as Smart city is the ability to manage infrastructure, property and human resources intelligently. A reliable, sustainable and customable electric energy source is an absolute requirement for a smart city. However, the management of electrical energy must be economically so that it does not burden the local government budget. From a number of infrastructures that consume a lot of electrical energy under the authority of the responsibility of the local government, namely Public Street Lighting (PSL). Lighting from PLS that emits too much light when unnecessary is useless. At present, conventional PLS systems are synonymous with energy waste. Monitors and controls only do locally without having the ability to monitor and control remotely so that if there is damage or theft, it is slow to handle. The solution is to build a smart PSL system and its management. This paper presents a real-world proven solution that relies on aRaspberry Pi, SCADA, and Internet of Things (IoT). This system provide an energy efficiency. Smart PSL will work intelligently in accordance with their environmental conditions. Lighting and illumination are arranged based on the presence of people and vehicles so that they can avoid over lighting and glare. SCADA and IoT technologies are used for work process monitoring systems and data viewers that are carried out continuously and in real time. The result is the smart PLS mode is 43% more efficient than conventional PLS modes.

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III.HAREWARE DESCRIPTION

3.1 TECHNICAL DESCRIPTION

3.1.1 RASPBERRY PI PICO:

Fig : Raspberry Pi Pico

A Raspberry Pi Pico is a low-cost microcontroller device. Microcontrollers are tiny computers, but they tend to lack large volume storage and peripheral devices that you can plug in (for example, keyboards or monitors).

A Raspberry Pi Pico has GPIO pins, much like a Raspberry Pi computer, which means it can be used to control and receive input from a variety of electronic devices.

Raspberry Pi refers to a series of small single-board computers developed in the United Kingdom by the Raspberry Pi Foundation in association with Broadcom. The boards have been made keeping in mind the promotion of teaching basic computer science to kids. The latest offering by Raspberry Pi is the Raspberry Pi Pico, a new flexible IoT board. Essentially, it is a microcontroller board built on silicon and designed at the Raspberry Pi Foundation.

3.1.2 IR SENSOR:

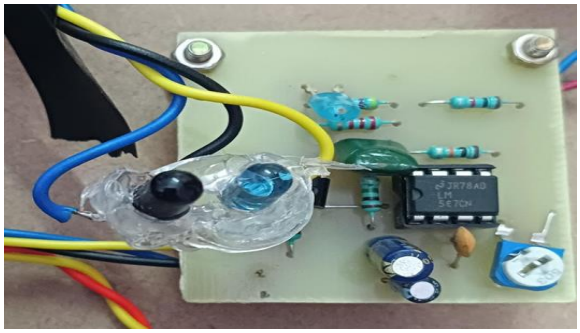

Fig. IR Sensor

An infrared proximity sensor or IR Sensor is an electronic device that emits infrared lights to sense some aspect of the surroundings and can be employed to detect the motion of an object. As this is a passive sensor, it can only measure infrared radiation.

An infrared sensor is an electronic module which is used to sense certain physical appearance of its surroundings by either emitting and/or detecting infrared radiation. IR sensors are also capable of determining the heat being emitted by an object and detecting motion. Now lets learn the interfacing of IR Sensor and Arduino.Here we are using an IR sensor for detecting obstacles. IR transmitter transmits IR signal, as that signal detects any obstacle in its path, the transmitted IR signal reflects back from the obstacle and received by the receiver.

Initially the process begins with IR (infrared) sensors; here 4 sets of IR sensors are used for detecting the approaching vehicles. This circuit is constructed with IR signal transmitting (Tx) LED and IR signal detecting LED. The IR signal or IR energy radiated from the IR Tx LED will be transmitted in uni direction up to certain distance in the air. How long the IR energy can be transmitted is depends up on its energy transmitting power of IR led which can be measured in mill watts, means the voltage applied to the LED and its current consumption. Since it is a prototype module, low IR LED is used

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for demonstration purpose. For real time applications high power LED's or laser guns can be used to detect the vehicle.

Whenever the IR energy hits an object, some of the energy will be reflected, this reflected energy will be detected by IR sensor. The same principle is used here, whenever the IR energy hits a passing vehicle, the IR beam will be interrupted, by which a logic low signal will be generated from the trigger circuit output. Based on this signal, the microcontroller unit built with 89C2051 microcontroller chip energizes the corresponding street light. Means whenever any vehicle approaches from any direction the corresponding sensor will be interrupted and corresponding red light will be energized automatically.

3.1.3 LDR SENSOR:

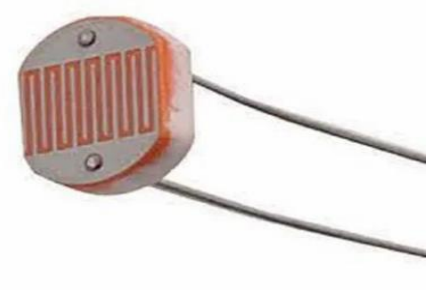

Fig : LDR Sensor

LDRs are tiny light-sensing devices also known as photoresistors. An LDR is a resistor whose resistance changes as the amount of light falling on it changes. The resistance of the LDR decreases with an increase in light intensity. This property allows us to use them for making light sensing circuits. The resistance of the LDR will vary from minimum to maximum according to the natural light fallen on it. The dark resistance of the LDR will be more than 100K□ and the light resistance will be less than 1K□. Hence, whenever light falls on the LDR, the resistance will come down and this makes a trigger signal to the IC 555 timer. Thereby the output of the timer becomes high and energizes the relay. During the night the resistance of the LDR will be very high by which the output of the timer remains in zero state, in turn de-energize the relay. At this condition by using normally closed contact of the relay streetlights are energized automatically.

The outdoor lighting can be energized/ de-energized automatically depends on the natural light / sun light. The idea of dependence on the sunlight is, the control can be made automation.

The LDR will have two resistances, i.e., dart resistance and light resistance. The dark resistance is the resistance, when no light falls on the LDR. This resistance will be more than 100K. The light resistance is the resistance, when light falls on the LDR i.e., if the LDR is exposed to the bright light or Sun light then the resistance of the LDR will become less than 1K□. The resistance of the LDR will vary according to the light intensity (Inversely proportional).

An LDR or light dependent resistor is also known as photo resistor, photocell, and photoconductor. It is a one type of resistor whose resistance varies depending on the amount of light falling on its surface. When the light falls on the surface of the LDR its resistance will be changed accordingly. These resistors are often used in many circuits where it is required to sense the presence of light. These resistors have a variety of functions and resistance. For instance, when the LDR is in darkness, then it can be used to turn ON a light or to turn OFF a light when it is in the light.

3.1.4 TRIGGER CIRCUIT – IC 555:

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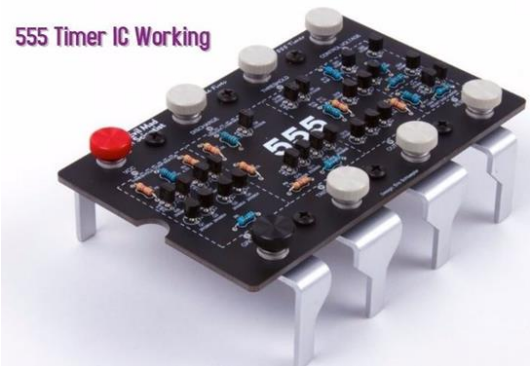

Fig : IC 555

In this circuit IC555 timer is used as Schmitt trigger mode of configuration. The resistance of the LDR will vary from minimum to maximum according to the natural light fallen on it. The dark resistance of the LDR will be more than 100K□ and the light resistance will be less than 1K□. Hence, whenever light falls on the LDR, the resistance will come down and this makes a trigger signal to the IC 555 timer.

Thereby the output of the timer becomes high and energizes the relay. During the night the resistance of the LDR will be very high by which the output of the timer remains in zero state, in turn de-energize the relay. At this condition by using normally closed contact of the relay streetlights are energized automatically.

The outdoor lighting can be energized/ de-energized automatically depends on the natural light / sun light. The idea of dependence on the sunlight is, the control can be made automation.

3.2 METHODOLOGY:

The methodology of this project design includes implementation of the proposed method. There are some basic steps involved in the Methodology of the product. The first major step is setting up the IR Sensors The methodology for implementing an efficient power management system designed for street lights using Raspberry Pi can be divided into several steps:

Design the System Architecture: The first step in designing an efficient power management system is to determine the system architecture. This includes identifying the key components of the system, such as the Raspberry Pi, sensors, and relays. The system architecture will also determine how the various components will interact with each other.

Determine Sensor Requirements: Once the system architecture has been designed, the next step is to determine the sensor requirements. This will involve identifying the types of sensors that are needed to monitor the street lights, such as light sensors, motion sensors, and temperature sensors. The sensors will provide data to the Raspberry Pi, which will then make decisions about how to manage the power consumption of the street lights.

Install and Configure the Sensors: After determining the sensor requirements, the sensors need to be installed and configured. This will involve physically installing the sensors in the appropriate locations and configuring them to provide accurate data to the Raspberry Pi. By following these three important steps and verification of code, the implementation of the proposed system is going to be done.

3.3. PROCEDURE:

The project begins when a vehicle is detected by the IR Sensor and also the LDR Sensor detects whether it is day or night time and depending on that the LED/ Street light

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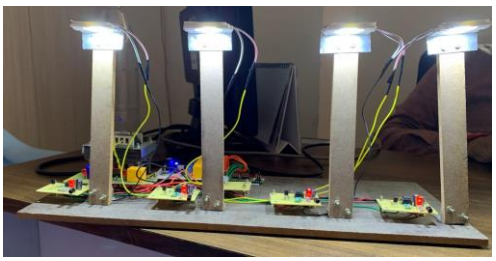

Fig. Project Model

IV.SYSTEM ANALYSIS

4.1 EXISTING SYSTEM

Street light is ineffectively designed and deficiency kept up, there is huge number of scorched out lights which prompts instability. There is a complaint register in every zonal office street light section. Presently street light management is done through manual process such as a physical activity is required to switch on and off the street lights according to their needs. It is so hard to maintain the activity in physical methodology because once the manual process fails there will be no lightening into the respective streets. As well as the manual process is time consuming for fault finding and corrections hence takes more and more time to manipulate each and every activity such as failures of lamps and either it is on or off. And it is difficult to identify the light in the respective location because of the present system doesn't use any advanced devices such as Global position System [GPS] and internet facilities, so that it is very difficult to identify and inform the control messages to the control room as well as these kind of street light mechanism cannot receive the control messages from the control room.

For all the entire manual process will cause poor efficiency and cost & time wastages in both performance wise as well as efficiency wise. At the state level, a large part of the Electricity Boards are reeling under enormous losses by virtue of a combination of assistance and under- recoveries. The National Tariff Policy of 2006 stipulates that the State Electricity Regulatory Commission (SERC) settle tax inside +/ - 20% of the cost of supply. Unfortunately, most states fail to meet this.

Disadvantages:

• Performance is low because of manual operations and controls.
• Cannot monitor the street light from remote places, physical intervention is required at every point of time.
• Wastage of Power
• Expensive process.

Existing techniques like enlisting the objection, turning on/off the light physically is tedious and requires labour. The new strategy programmed ON/OFF and fault recognition without human intercession is less demanding when contrasted with the current system.

4.2 PROPOSED SYSTEM

A proposed system for implementing an efficient power management system designed for street lights using Raspberry Pi includes the following enhancements over the existing system.

The proposed system can include wireless connectivity such as Wi-Fi or Bluetooth, enabling the street lights to communicate with each other and the central control unit. This can allow for better coordination between the street lights, leading to improved energy efficiency and better management of the street lighting system. The proposed system can include remote monitoring capabilities that allow the system to be monitored and managed remotely using a web interface or mobile app. This can provide real-time information about the status of the system and allow for rapid response to any issues that may arise.

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The proposed system can incorporate solar panels and battery backup systems, allowing the street lights to be powered by renewable energy sources. This can reduce reliance on the grid and help to reduce greenhouse gas emissions. The proposed system can also include smart street light poles that are equipped with sensors, cameras, and other advanced technologies that can monitor traffic, detect accidents, and provide real-time data to the central control unit. This can enable better management of the street lighting system and improve safety and security in the surrounding area.

Overall, the proposed system can provide a more advanced and efficient power management system for street lights using Raspberry Pi, leading to cost savings, energy efficiency, and improved safety and security in the surrounding area.

V. RESULTS

How the project set-up looks!

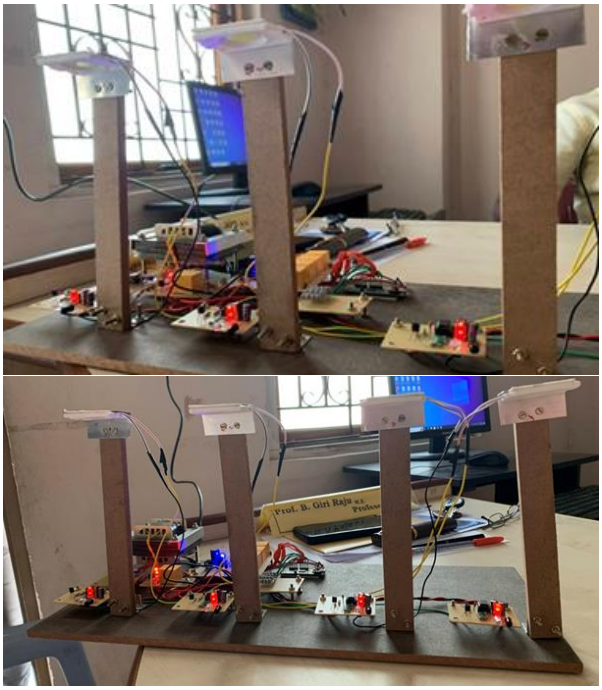

Fig :Project Kit

Actual result verification:

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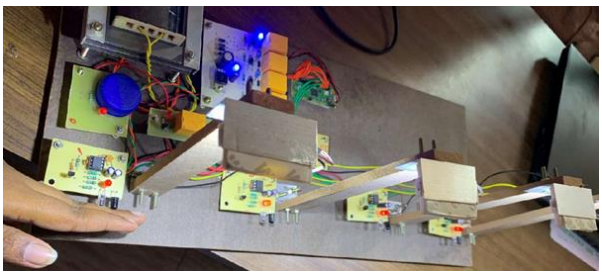

Fig : LED/street light glows when object/vehicle detected at night

The LDR Sensor first detects whether it is night or day. Next the IR sensoe detects for vehicle and if any vehicle is detected then immediately it is sent to raspberry pico which acts like a microcontroller and the street kight glows.

Advantages:

- **Non-contact sensing:** IR sensors detect objects without coming into contact with them, making them ideal for use in applications where contact with the object being sensed is either impossible or undesirable.
- **High precision:** IR sensors can detect even small changes in temperature, making them ideal for use in applications where high precision is required.
- **Cost-effective:** IR sensors are generally more affordable compared to other types of sensors, making them a cost-effective solution for many applications.
- **Easy integration:** The Raspberry Pi has built-in support for IR sensors, making it easy to integrate them into your projects.
- **Wide range of applications:** IR sensors can be used in a variety of applications, such as detecting the presence of an object, measuring temperature, and even detecting motion.
- **Wide range of applications**: LDR sensors can be used in a variety of applications, such as detecting light levels in a room or measuring ambient light levels in a garden.
- **Energy efficient:** LDR sensors consume very little power, making them ideal for use in battery-powered devices.
- **Real-time data:** LDR sensors provide real-time data on changes in light levels, which can be used to trigger events or automate processes.

Disadvantages:

- **Initial cost:** The installation of the power management system can be expensive, requiring significant investment upfront.
- **Complexity:** The system requires specialized technical knowledge and expertise to install and maintain, which can be a barrier for some communities.
- **Dependence on technology:** The system is dependent on technology components, which can be vulnerable to failures.

Applications:

- **Automated On/Off control**: The Raspberry Pi can be programmed to turn the street lights on and off automatically based on a predetermined schedule, or by using a light sensor to detect ambient light levels.
- **Dimming control:** The Raspberry Pi can be used to adjust the brightness of the street lights based on the time of day, the amount of ambient light, or other criteria. This can help to reduce energy consumption and improve visibility.
- **Remote Monitoring and Control:** The Raspberry Pi can be connected to a network, allowing the street lights to be monitored and controlled remotely. This can help to improve maintenance efficiency and reduce the cost of repairs.

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- **Fault Detection and Diagnosis**: The Raspberry Pi can be programmed to detect faults in the street lights, such as a bulb failure or a broken wiring, and to report the issue to a central control system. This can help to improve the reliability of the street lights and reduce the cost of repairs.
- **Energy Monitoring**: The Raspberry Pi can be used to monitor the energy consumption of the street lights and to provide data on energy usage and cost. This can help to identify areas where energy savings can be made and to track the progress of energy-saving initiatives.
- **Smart Lighting**: The Raspberry Pi can be used to implement smart lighting, which adjusts the brightness and color of the street lights based on the time of day, weather conditions, and other factors. This can help to reduce energy consumption and improve visibility.
- **Intelligent Traffic Management:** The Raspberry Pi can be used in conjunction with sensors and cameras to implement intelligent traffic management systems that optimize the use of street lights based on traffic patterns and congestion. This can help to reduce energy consumption and improve road safety.

VI.CONCLUSION

In Lighting is a vast and quickly developing area of energy management and ozone harming substance outflows. In the meantime, the saving capability of lighting power is high even with the present innovation, and there are new energy effective lighting advances going ahead the market.
Energy proficient lighting additionally incorporates considerations of the control of light and the utilization of natural light. A supportable lighting arrangement incorporates perceptive theory, high aspect and energy productive lighting model appropriate for the application. In this paper Smart Road lighting system is depicted that combines new advances offering simplicity of maintenance and power is saving. It handles the issue of energy wastage which thus decreases control utilization, builds safety of roads and gives proficient approach to deal with controlling on/off streetlight by utilizing programmed approach. The use of new technology opens new perspectives toward the developing of high efficiency systems, which allow saving energy and money.
For its reliability, simplicity and low cost, the proposed system makes itself a serious candidate to efficiently manage a set of sensors applicable in different fields including monitoring of energy consumption, smart grids and smart cities which need to a sensor network to realize an efficient management of the system under control. A smart remote street light system outlined in our project, facilitate the application by overcoming the errors and consequently monitoring and controlling which results in power saving. This is achieved by the use of highly economical LED technology. Remote urban and rural areas are the suitable places for implementation of such street lighting system where the traffic is low most of the times. The system can be extended easily, is flexible and also adjustable according to the need of user. Use of GSM technology made the system wireless, less complex. In this proposed paper an automatic street light is designed using Wireless Sensor Network to detect the vehicle, human movements and atmospheric condition. This system also helps to increase and decrease the intensity of LED.
Results are found to be satisfied, since it is a prototype module, the system is designed with only 4 street lights & to simulate street lights 4 metal poles are provided in the demonstration module. For the real applications, any number of street lights can be controlled and they can be monitored effectively. To achieve this, the same system with enhanced technology and with required modifications can be implemented. The LDR used for sensing the natural light can be kept in a suitable glass container and it can be kept at outdoor, the arrangement of LDR is very important, care must be taken that the street light intensity should not fall on this LDR, otherwise entire system may misbehave. The system developed here is cost effective, practical oriented, ecofriendly and the safest way to save the energy. It clearly tackles the two problems that world is facing today, saving of energy

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and also disposal of incandescent lamps, very efficiently. According to statistical data we can save more that 40 % of electrical energy that is now consumed by the highways. Initial cost and maintenance can be the draw backs of this project. With the advances in technology and good resource planning the cost of the project can be cut down and also with the use of good equipment the maintenance can also be reduced in terms of periodic checks.

The LEDs have long life, emit cool light, donor have any toxic material and can be used for fast switching. For these reasons our project presents far more advantages which can over shadow the present limitations. Keeping in view the long-term benefits and the initial cost would never be a problem as the investment return time is very less. The project has scope in various other applications like for providing lighting in industries, campuses and parking lots of huge shopping malls. This can also be used for surveillance in corporate campuses and industries.

Future Scope:

The implementation of an efficient power management system designed for street lights using Raspberry Pi has a lot of future scope. Here are some of them:

- Integration with IoT: With the integration of IoT, the street light system can be controlled remotely, and data can be sent to the cloud for analysis. This can help in efficient power management and reduce maintenance costs.
- Artificial Intelligence: The use of Artificial Intelligence can help in predicting the energy consumption of the street lights and optimizing the power management system accordingly. It can also help in identifying faulty street lights and automating maintenance.
- Use of renewable energy sources: The power management system can be designed to work with renewable energy sources like solar panels, wind turbines, etc. This can help in reducing the dependence on the power grid and make the system more sustainable.
- Real-time monitoring: Real-time monitoring of the street light system can be done to identify faulty lights, dimming of lights, and energy consumption. This can help in reducing energy wastage and save costs.
- Integration with smart city systems: The power management system can be integrated with smart city systems to optimize traffic flow, improve public safety, and reduce environmental pollution.

Overall, the implementation of an efficient power management system designed for street lights using Raspberry Pi has a lot of future scope. With the integration of advanced technologies like IoT, AI, and renewable energy sources, the system can become more efficient, sustainable, and cost-effective.

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