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SMART STREET LIGHT SYSTEM

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ABSTRACT

Today's modern world people preferred to live the sophisticated life with all facilities. The science and technological developments are growing rapidly to meet the above requirements. With advanced innovations, Internet of Things (IoT) plays a major role to automate different areas like health monitoring, traffic management, agricultural irrigation, street lights, class rooms, etc., Currently we use manual system to operate the street lights, this leads to the enormous energy waste in all over the world and it should be changed. In this survey we studied about, how IoT is used to develop the street lights in the smart way for our modern era. It is an important fact to solve the energy crises and also to develop the street lights to the entire world. In addition, with the study on smart street lighting systems we analyzed and described different sensors and components which are used in IoT environment. All the components of this survey are frequently used and very modest but effective to make the unswerving intelligence systems.

Keywords: Smart Street Light Systems, Internet Of Things, IR Sensors, Arduino UNO, LED, Wires, Resistors.

I. INTRODUCTION

An IR sensor or infrared sensor is a type of electronic device that emits light in order to detect certain aspects of its surroundings. The sensor module is ambient light adaptable, with a pair of infrared emitting and receiving tubes**.** At a specific frequency, the transmitting tubes emit infrared. When the direction of an obstacle is detected (reflective surface), the receiving tube receives the infrared reflected. After a comparator circuit processing, the green light turns on. And the signal output interfaces a digital signal (a low-level signal). The sensor's effective distance range is 2 ~ 30cm. The sensor's detection range can be adjusted by adjusting the potentiometer.

1.1 Problem Statement

Smart street light system typically involves traditional lighting infrastructure, which operates on predefined schedules or manual controls. These systems often lack flexibility and adaptability to real-time conditions, resulting in inefficient energy usage and maintenance challenges. Furthermore, conventional street lighting systems do not have thecapability to autonomously adjust illumination levels based on environmental factors or vehicular traffic patterns.

1.2 Objective

Develop a system that significantly reduces energy consumption by ensuring street lights are only on when needed, using sensors to detect ambient light and motion.

Implement an automated control system using Arduino Uno to manage street lighting, eliminating the need for manual intervention.

II. NEED OF SMART STREET LIGHT SYSTEM

Traditional street lighting systems consume a significant amount of energy. A smart system can reduce energy usage by ensuring lights are only on when necessary, thus conserving energy. Reduces energy consumption which leads to lower electricity bills. Additionally, smart street lights can reduce maintenance costs by indicating when lights need attention, preventing unnecessary checks and prolonging the life of the bulbs. Smart street lights improve safety for pedestrians and drivers by providing adequate lighting when motion is detected, thus reducing the likelihood of accidents and deterring criminal activities. By reducing energy consumption, smart street light systems contribute to lower greenhouse gas emissions and a smaller carbon footprint, promoting environmental sustainability. By turning off lights when they are not needed, smart street lighting can help reduce light pollution, preserving the natural night environment.

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III. LITERATURE SURVEY

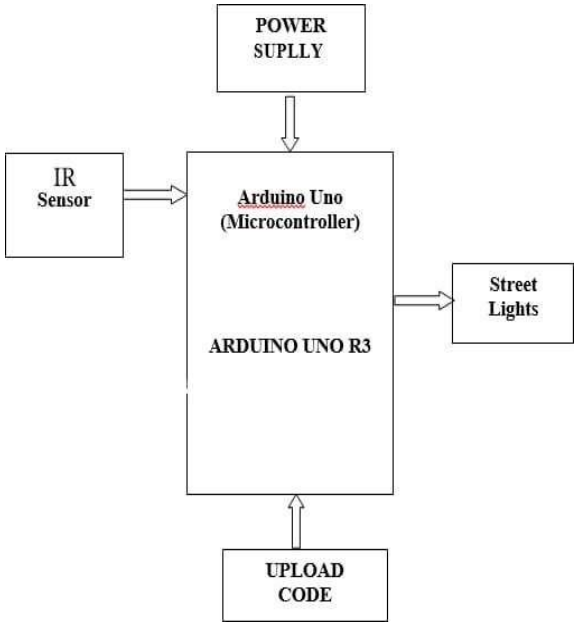
A comprehensive literature survey for a Smart Street Light IoT project encompasses various aspects, including technological advancements, implementation strategies, energy efficiency, and environmental sustainability. Research in this field has focused on optimizing street lighting systems through the integration of Internet of Things (IoT) technology, leading to improved functionality and resource management. Studies have explored sensor-based approaches for detecting pedestrian and vehicular traffic patterns, thereby enabling adaptive lighting schemes tailored to real-time conditions.

IV. PROPOSED SYSTEM

The major goal of our "Smart Street Light System," which we proposed, leveraging IoT technologies introduces several key advancements. Firstly, it incorporates a network of interconnected sensors deployed throughout the urban landscape to collect data on various parameters such as ambient light levels, presence of pedestrians or vehicles, and weather conditions.

These sensors enable the system to gather real-time information and make intelligent decisions regarding the systems.

4.1 Smart Street Light System



(Use an image from Google) Smart street light system leveraging IoT technologies, IR Sensors detect objects by emitting infrared light and detecting the reflection. When an object is detected, the IR sensor outputs a LOW signal; otherwise, it outputs a HIGH signal. Arduino Uno Reads the IR sensor's output and controls the LEDs (street lights) accordingly. The LED will turn on when an object is detected by the IR sensor and turn off otherwise.

IR Sensor helps when an object comes within the sensor's range, it outputs a LOW signal, which the Arduino reads.

Arduino checks the IR sensor's output in the loop and controls the LED based on the sensor value. LEDs Represents the street lights, which lights up when an object is detected.

4.2 Data Flow Diagram

A data flow diagram (DFD) is a graphical or visual representation using a standardized set of symbols and notations to describe a business's operations through data movement. They are often elements of a formal methodology such as Structured Systems Analysis and Design Method (SSADM).

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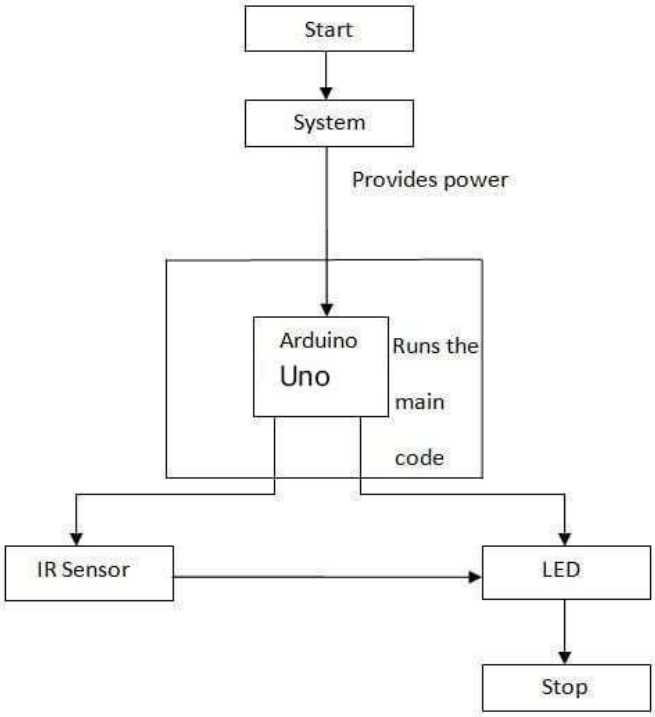

Fig 4.2: Data Flow Diagram

(Use an image from Google) A data flow diagram (DFD) models the process features of an information system by graphically depicting the "flow" of data through it. A DFD is frequently used as a first step to develop a system overview without going into great depth that can then be developed. DFDs can also be used for structured design, which visualizes data processing.

4.3 Flow Chart

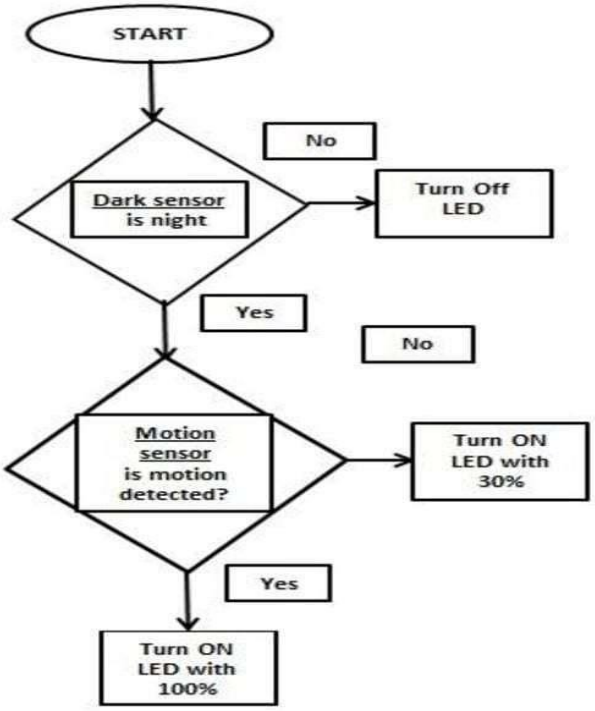

Fig 4.3: Flow Chart

(Use an image from Google) A diagrammatic illustration of a solution model for a specific problem is shown in Figure. In many different industries, flowcharts are used for process analysis, design, documentation, and programmed management.

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In a Flowchart, the two most frequent box kinds are:

i) a processing step, which is typically referred to an activity and is shown by a rectangular box; and ii) a choice, typically represented by a diamond. The Arduino Uno is set up, and IR sensors are configured. The street lights are initialized and set to their default state (usually off). iii) The system continuously checks for any movement using the IR sensors. If movement is detected, the system moves to the next step to turn on the light.

vi) If no further movement is detected within the delay period, the light is turned off. The system loops back to check for movement again, maintaining a continuous operation cycle.

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V. SYSTEM IMPLEMENTATION

The Hardware and Software utilized in this project are explained as follows:

5.1. Hardware Equipment

5.1.1 Arduino Uno

(An image from Google) Arduino UNO board is a popular microcontroller board that was introduced by the Italian company Arduino in 2005. It is based on the ATmega328P microcontroller and has 14 digital input/output pins, 6 analog input pins, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header, and a reset button. It is compatible with a wide range of sensors, actuators, shields, and other peripherals, making it easy to prototype and build complex systems. The board can be programmed using the Arduino Integrated Development Environment (IDE), a simple and user- friendly software that allows you to write, upload, and debug your programs. Its versatility, ease of use, and large community make it an ideal choice for anyone who wants to learn about microcontrollers, electronics, and programming.

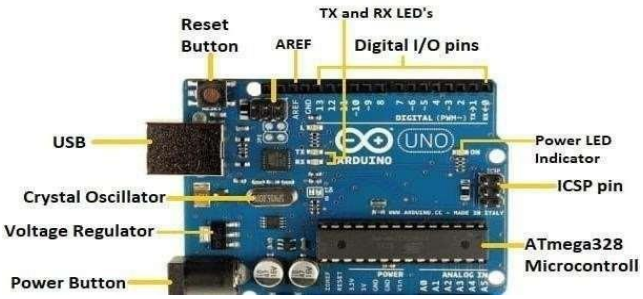

FIG: Arduino Uno

5.1.2 IR Sensors

(Use an image from Google) The IR sensor or infrared sensor is one kind of electronic component, used to detect specific characteristics in its surroundings through emitting or detecting IR radiation. Thesesensors can also be used to detect or measure the heat of a target and its motion. In many electronic devices, the IR sensor circuit is a very essential module. This kind of sensor is similar to human's visionary senses to detect obstacles.

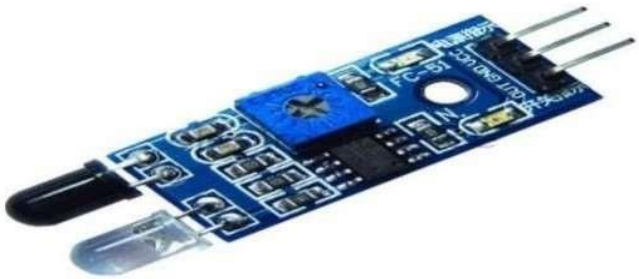

FIG: IR Sensors

5.1.3 LEDs

(Use an image from Google) LED (Light Emitting Diode) is an optoelectronic device which works on the principle of electro- luminance. Electro-luminance is the property of the material to convert electrical energy into light energy and later it radiates this light energy. In the same way, the semiconductor in LED emits light under the influence of electric field.

FIG: LEDs

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5.1.4 Jumper Wires

(An image from Google) A jump wire (also known as jumper, jumper wire, DuPont wire) is an electrical wire, orgroup of them in a cable, with a connector or pin at each end which is normally used to interconnect the components of a breadboard or other prototype or test circuit, internally or with other equipment or components, without soldering.

FIG: Jumper Wires

5.1.5 Resistors

(An image from Google) Resistor is defined as A passive electrical component with two terminals that are used foreither limiting or regulating the flow of electric current in electrical circuits.

The main purpose of resistor is to reduce the current flow and to lower the voltage in anyparticular portion of the circuit. It is made of copper wires which are coiled around a ceramic rod and the outer part of the resistor is coated with an insulating paint.

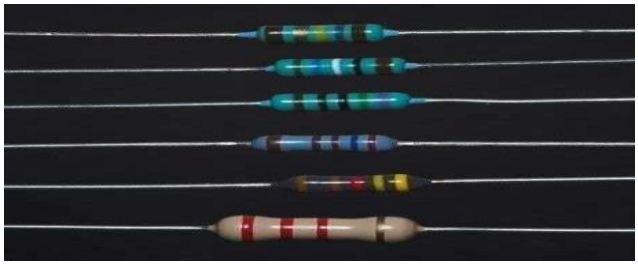

FIG: Resistors

5.2 Software Equipment

- **Arduino IDE**

5.3 Application of project

- In residential neighborhoods and urban areas, the system can provide dynamic lighting that adjusts based on pedestrian and vehicular traffic, enhancing safety while conserving energy.
- On highways, the system can adjust lighting based on traffic flow, ensuring that lights are bright when traffic is heavy and dimming them when traffic is light, thus reducing energy consumption.
- Improved lighting conditions can help reduce the number of accidents, especially in areas where lighting is crucial for visibility.
- By providing lighting only when people are present, the system can enhance safety and security in parks and recreational areas, making them more inviting and safer to use after dark.

VI. FUTURE SCOPE

The future of infrared sensors will mostly depend on the development of technologies behind those sensors, such as quantum dot infrared photo detectors (QDIPs) and Type-II super lattice structures. Also, future IR sensor technology will have photo detectors integrated with highly effective smart algorithms. Experts are working towards IR arrays with each pixel sensing the entire IR spectrum. This might lead to bio- inspired sensing and production of a complete IR retina.

VII. CONCLUSION

In this survey, we analyze that IoT has groomed rabidly with our day to day life. Smart Street light System is one of the major parts which use IoT concepts. Smart Street Lighting System clearly tackles the major problems like Energy wastage, Crime detection, disposal of incandescent lamps, maintenance cost etc., This system ensures traffic safety and the security to the people which can stop from women annoyance,

burglaries and further intimidations.

The Energy crises occur in the cities may be reduced because 50 to 60 percent of electricity is saved and these energies were used in other important purposes. This system is entirely adaptable to the requirements of users and creates safe environment. This approach requires minimum hardware with simple software. To control street light decisions were taken by the system; it is possible to avoid negligence factors by human operatives. It will also helpful in making our city as the Smart City.

VIII. REFERENCES

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