Automatic Street Lightning System with PIR

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ABSTRACT:
Energy consumption due to street lights needs proper monitoring and control to reduce wastage of power. Conventional street light systems suffer from certain drawbacks as they are manually controlled and are powered through the electrical broad power station. This may lead to more power consumption if not monitored properly. The automatic street lightning system that we have implemented provides automatic control and fault detection of street lights and to monitor the typical situations occurring in the walkway. The ON/OFF condition of street lamp is controlled using LDR sensor and brightness of the lamp is controlled using IR sensor. If there is any malfunctioning in the street lamp the relay senses and generates a signal to the authority using IOT. The system also provides security alerts using Digital cam. Hardware implementation has been done and the results are also provided.
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KEYWORDS: Internet of Things, Photoconductivity, TNB, Pedestrians, MARG Sensors.

1. INTRODUCTION

A street light or street lamp is a proposed source of light on the side of a road or walkway, which is turned on or lit at a certain time every night. Significant benefits of street lightning include prevention of accidents and increase in safety. Studies have shown that darkness results in a considerable number of crashes and accidents, especially those involving pedestrians; pedestrians accidents are 3 to 6.75 times more prone in the dark than in day. Street lightning has been found to reduce walker crashes by nearly fifty percent. Street light monitoring and control is an automated system designed to increase the efficiency and accuracy of an enterprise by automatically timed controlled switching of street lights. In the present system the street lights are consuming more power so to avoid this problem we have introduced the automatic street lighting system which reduces consumption of power.

Every day, there is fault which occurs in to our street lighting system. When the fault occurs, TNB workers cannot detect the fault instantaneously, what type of fault and which part the fault occurs. It causes problems for the customers that they could not get the services for several hours and days. At the same time, if any fault occurs it will take a lot of time to maintain it again while the same fault occurs again and again. So, the objectives of this project are to avoid the problem which occurs during the fault and to monitor what type of fault it is. In the increasing population there is an increase in the crime rate so to avoid this we have introduced a digital cam. So these problems can be solved by using IOT.

2. LITERATURE REVIEW

The function of street light is to provide safe environment during dark hours. The lights operate nearly more than 12 hours. To turn ON all lights present on road indeed require large electrical power. The proposed system is designed to implement the power saver street light system by saving 30% of the total electrical power of any country is consumed in lighting the roads and the streets. Automation is the parameter in present field of technologies so that we can reduce the man power with the help of intelligent systems. As we all know the sources of power are getting diminished, power saving is also have to consider. Thus we need a system that automatically controls and monitors the street light. So that we can have full brightness at the time of any motion object arrives using an IR sensor.

In this paper we are saving power automatically instead of doing it manually, with LDR. As all cities growing rapidly, the automation system is also growing so using automation we can clear the fault easily by sending intimation to the line man. And if there are any typical situations during the late nights then an immediate action is taken by taking a snapshot using a Digital cam. This system is designed to implement the power saver street light system. Initially the street

lights are in DIM condition whenever the IR sensor detects the motion object the intensity of the LED increases to full brightness.

3. INTERNET OF THINGS

The Internet is one of the most important and powerful creations in all of human history. The Internet of Things (IOT) sometimes referred to as the Internet of Objects, will change everything including ourselves.

The Internet of Things (IOT) is a scenario in which objects, animals or people are provided with single identifiers and the capability to automatically transfer data more to a network without requiring human-to-human or human-to-computer communication. IOT has evolved from the meeting of wireless technologies, micro-electromechanical systems (MEMS) and the internet.

All web application is developed natively in Java Programming Language. It includes java technologies similar to JSP, servlets, hibernate, and web services etc., latest version of net beans IDE is basically used for web applications development. Additional technologies like bootstrap, java script, jQuery etc are used to handle UI and client side validations.
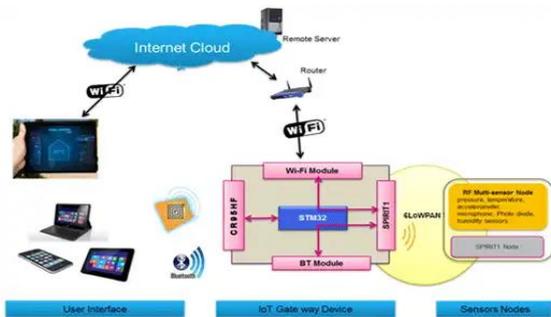
4. IMPLEMENTATION

This system makes use of three sensors (IR sensor, LDR sensor, PIR sensor). The three sensors capture the data in the form of analog signals. The concept is to provide a fully automated street light control which will definitely affect mankind. The basic block diagram is shown below:
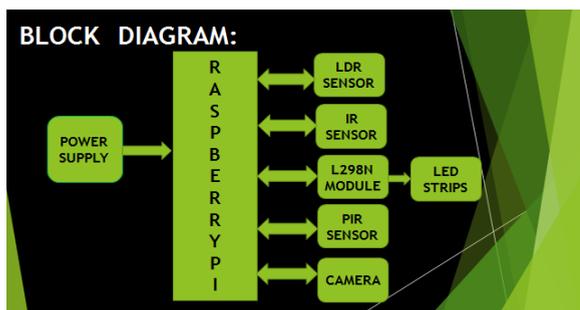
4.1. Raspberry PI

The history of the Raspberry Pi was basically introduced in 2006. Its main concept is based on Atmel ATmega644 which is particularly designed for educational use and intended for Python. A Raspberry Pi is of small size i.e., of a credit card sized single board computer, which is developed in the United Kingdom(U.K) by a foundation called Raspberry Pi. The first generation of Raspberry (Pi 1) was released in the year 2012, that has two types of models namely model A and model B. Launching today, the new Pi Zero W (the W stands for wireless) has been rejigged to fit both Bluetooth and Wi-Fi capabilities onto its board. It means the computer will now be able to communicate with more external devices than ever before, without adding wireless access points to be able to do so. The features in the tiny Raspberry Pi Zero W are similar (full specs at the bottom of the article) to the Raspberry Pi 3, which was the first Pi to add such wireless functions.

4.2. Sensors

A sensor is a device, module, or subsystem whose purpose is to detect events or changes in its environment and send the information to other electronics, frequently a computer processor. With advances in micro machinery and easy-to-use microcontroller platforms, the uses of sensors have expanded beyond the traditional fields of temperature, pressure or flow measurement, for example into MARG sensors. Moreover, analog sensors such as potentiometers and force-sensing resistors are still widely used.

A sensor's sensitivity indicates how much the sensor's output changes when the input quantity being measured changes. For instance, if the mercury in a thermometer moves 1 cm when the temperature changes by 1 °C, the sensitivity is 1 cm/°C (it is basically the slope Dy/Dx assuming a linear characteristic). Some sensors can also affect what they measure; for instance, a room temperature thermometer inserted into a hot cup of liquid cools the liquid while the liquid heats the thermometer.

4.3. Light Dependent Resistor

A Light Dependent Resistor (LDR) or a photo resistor is a device whose resistivity is a function of the incident electromagnetic radiation. Hence, they are

light sensitive devices. They are also called as photo conductors, photo conductive cells or simply photocells. They are made up of semiconductor materials having high resistance.

A light dependent resistor works on the principle of photo conductivity. Photo conductivity is an optical phenomenon in which the materials conductivity is increased when light is absorbed by the material. When light falls i.e. when the photons fall on the device, the electrons in the valence band of the semiconductor material are excited to the conduction band. These photons in the incident light should have energy greater than the band gap of the semiconductor material to make the electrons jump from the valence band to the conduction band. Hence when light having enough energy strikes on the device, more and more electrons are excited to the conduction band which results in large number of charge carriers. The result of this process is more and more current starts flowing through the device when the circuit is closed and hence it is said that the resistance of the device has been decreased. This is the most common working principle of LDR.

LDR's have low cost and simple structure. They are often used as light sensors. They are used when there is a need to detect absences or presences of light like in a camera light meter. LDR's are used in street lamps, alarm clock, burglar alarm circuits, light intensity meters, for counting the packages moving on a conveyor belt, etc.

4.4. Infrared Sensor

An Infrared light emitting diode (IR LED) is a special purpose LED emitting infrared rays ranging 700 nm to 1 mm wavelength. Different IR LEDs may produce infrared light of differing wavelengths, just like different LEDs produce light of different colours. IR LEDs are usually made of gallium arsenide or aluminium gallium arsenide. The appearance of IR LED is same as a common LED. Since the human eye cannot see the infrared radiations, it is not possible for a person to identify if an IR LED is working. A camera or a cell phone camera solves this problem.
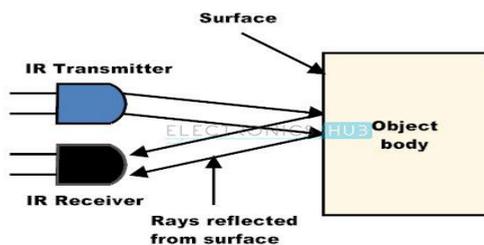

An IR sensor consists of two parts, the emitter circuit and the receiver circuit. This is collectively known as a photo-coupler or an optocoupler. The emitter is an IR LED and the detector is an IR photodiode. The IR photodiode is sensitive to the IR light emitted by an IR LED. The photo-diode's resistance and output voltage change in proportion to the IR light received. This is the underlying working principle of the IR sensor. The type of incidence can be direct incidence or indirect incidence. In direct incidence, the IR LED is placed in front of a photodiode with no obstacle in between. In indirect incidence, both the diodes are placed side by side with an opaque object in front of the sensor.

The light from the IR LED hits the opaque surface and reflects back to the photodiode. Each IR sensor controls LED's. The use of IR sensor in this project is it senses the position of vehicle and gives signal to the arduino board and it will turn ON the LED's.

4.5. PIR Sensor

PIR sensors allow you to sense motion, almost always used to detect whether a human has moved in or out of the sensors range. They are small, inexpensive, low-power, easy to use and don't wear out. For that reason they are commonly found in appliances and gadgets used in homes or businesses. They are often referred to as PIR, "Passive Infrared", "Pyroelectric", or "IR motion" sensors.
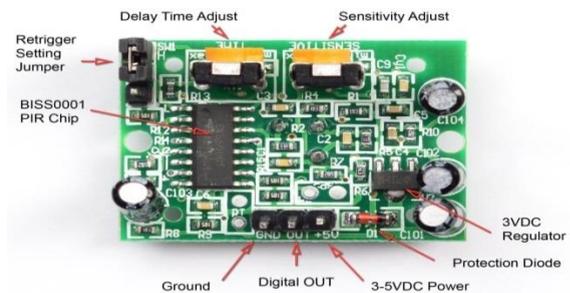
PIR sensors are more complicated than many of the other sensors, because there are multiple variables that affect the sensors input and output. The PIR sensor itself has two slots in it. When the sensor is idle, both slots detect the same amount of IR, the ambient amount radiated from the room or walls or outdoors. When the warm body leaves the sensing area, the reverse happens, whereby the sensor generates a negative differential change. These change pulses are what is detected.

4.6. Camera

As crime rate is increasing day-by-day there are no certain measures taken to prevent them. So, we included a digital camera in our project so that whenever a crime (accidents, harassments e.t.c) going on, on the walkway, this camera takes a snapshot and sends the image immediately to the email.

Logitech International S.A. (commonly referred to as Logitech or Logi; stylized as logitech, previously LOGITECH) is a Swiss provider of personal computer and mobile accessories, with its headquarters in Lausanne, Switzerland and administrative headquarters in Newark, California. The company develops and markets personal peripherals for PC navigation, video communication and collaboration, music and smart homes.

The name Logitech is derived from the French word for software, "logicel". The main advantages of digital camera is It's easy to share the memories by recording a video or taking a photo and sending it to your other ones by using this camera. You can take high-resolution snapshots at up to 5 megapixels. Even if you make a video call in dim or poorly backlit settings, the camera will intelligently adjust to produce the best possible image.

4.7. L298N Module

L298 is known as a dual bidirectional motor driver which is based on dual H-Bridge Motor driver IC. This circuit allows you to control two DC motors independently in either direction. It is a commonly used component for prototypes and hobbyist projects, as it is easy to use and interface the L298 with a Raspberry Pi or an Arduino. Other than its minimal design, it also provides an onboard 5V regulator that you can use to power your 5V circuits very conveniently. We used an L298 breakout board, which makes setup a little easier.
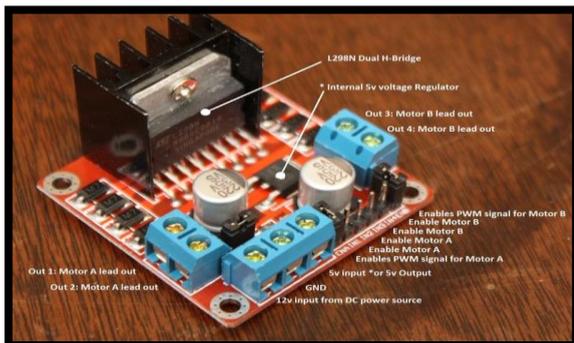

An H-Bridge is a circuit that can drive a current in either polarity and be controlled by *Pulse Width Modulation (PWM). Pulse Width Modulation is a means in controlling the duration of an electronic pulse. In motors try to imagine the brush as a water wheel and electrons as the flowing droplets of water. The voltage would be the water flowing over the wheel at a constant rate, the more water flowing the higher the voltage. Motors are rated at certain voltages and can be damaged if the voltage is applied to heavily or if it is dropped quickly to slow the motor down. Thus PWM take the water wheel analogy and think of the water
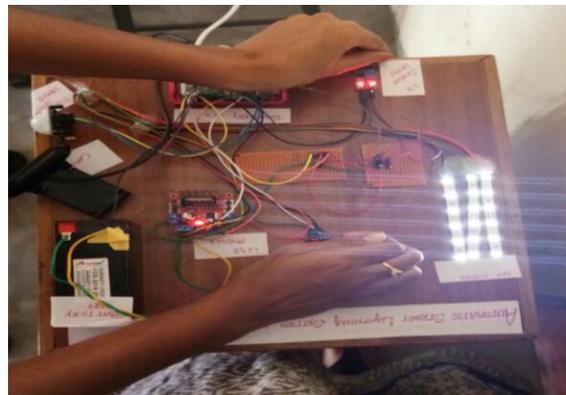
hitting it in pulses but at a constant flow. The longer the pulses the faster the wheel will turn, the shorter the pulses, the slower the water wheel will turn. Motors will last much longer and be more reliable if controlled through PWM.
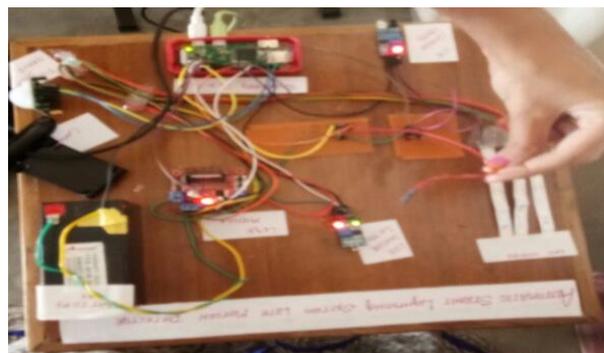
5. RESULTS

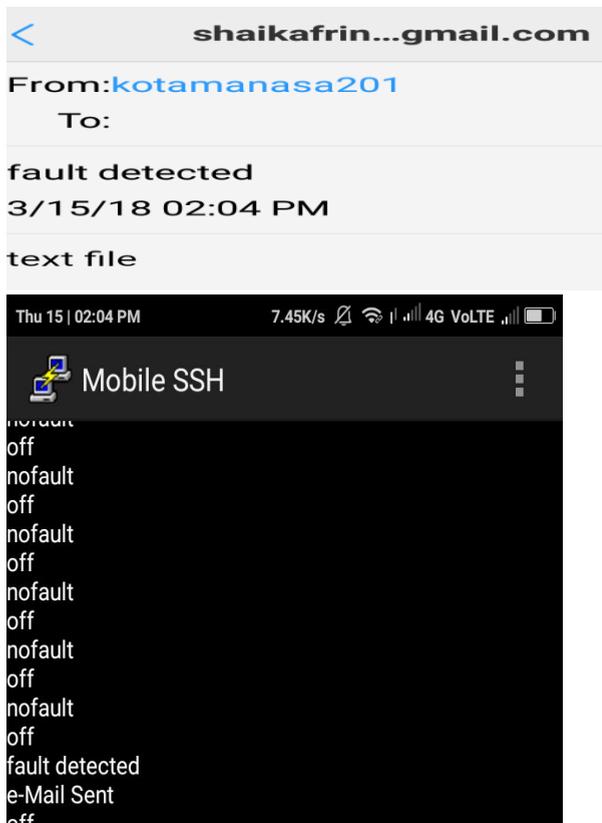**5.1.** When no object detected, the lights glow is dim.
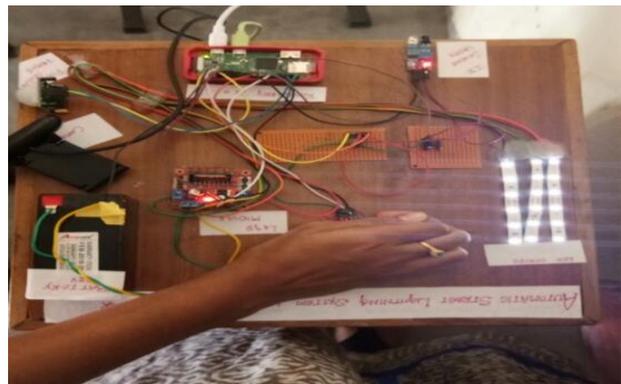
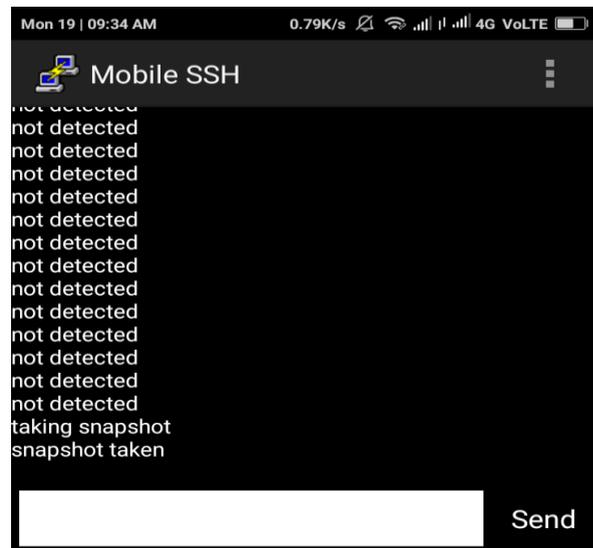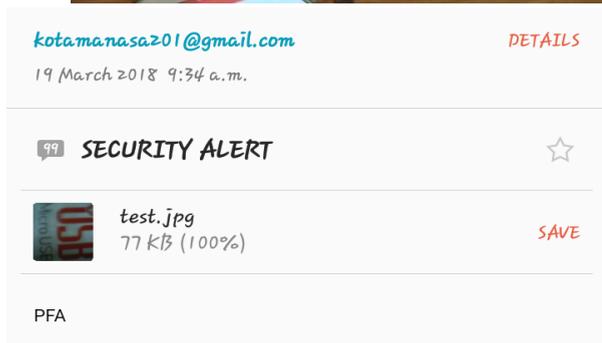**5.2.** When an object is detected, the lights glow is bright.

5.3. During a Fault Detection, an email is sent to the gmail specified as text file.

5.4. Security alert

When a stationary object has been identified, a security alert will be emailed along with the photograph in .jpg format with the help of camera installed.

6. CONCLUSION

The low power consuming, reduced man power automatic street lightning system has been implemented and tested. With PIR sensor reduces the power consumption by dimming the LED'S when the object is not detected and increases the brightness when the object is detected by using IR sensor and the fault is cleared as soon as possible and it reduces the crimes during the late nights by capturing the image using digital cam.

Internet of Things (IOT) and its services are becoming part of our everyday life, ways of working, and business. There is a great deal of research on developing crucial building blocks and models for the next generation.

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