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Intelligent Street Light Control Management Using GSM

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Abstract: ***Efficient use of electricity is very important. This paper focuses an idea in which we remotely operate street lights using GSM. This research proved that by using Wireless sensors to operate the street lights less electricity get consumed as compared to keeping street lights continuously ON.***

Introduction;

Sensor

A **sensor** is used to convert any unbiased quantity to be dignified into a signal which is interpreted, displayed, stored or used to govern some other facts. The number of signals formed by the sensor is identical to the quantity to be measured. Sensors are used to calculate a particular characteristic of any object or device.[1] This paper provides the overview about What is sensors, different fields where sensors are used, how sensors are used in day to day life, its advantages and disadvantages and types of sensors.

In our daily life we regularly use various types of sensors in numerous applications such as Infrared (IR) sensor is used for functioning of television remote, Passive Infrared sensor used for automatic gate opening system of showrooms or malls and Light-Dependent Resistor (LDR) sensor used for open-air lighting or road lighting system, and so on.

What is Sensor?

A sensor is a piece of equipment that detects and responds to some type of input from the physical surroundings. The particular input could be sunlight, heat, motion, pressure, moisture etc. The output is a signal that is converted to human readable format at the sensor place or send electronically over a network for further processing.

How Sensors are used?

In Business

In factory, networked vibration sensors warn that a comportment is start to fail. Mechanics plan overnight maintenance to prevent an expensive unplanned shutdown. Inside a refrigerated grocery truck humidity and temperature sensors monitor individual containers, to reduce spoilage in eatable things.

In the Environment

Wireless humidity sensor network watch fire danger in forests which are far away. Nitrate sensors identify industrial and agricultural overflow in rivers, streams and wells. Distributed Seismic Monitors gives before time warning for earthquakes. Meanwhile built-in Stress Sensors report on the structural veracity of bridges, buildings and roadways, and other man-made constructions.

For Safety and Security

Fire fighters spread wireless sensors right through a burning building to identify hot spots and explosion. Concurrently, the sensors provides communications network in urgent situations. Miniature chemical and biological sensors are used raise an alarm at the first sign of any disease.

In the Classroom

Sensor technology also helps teachers in observing experiments of students. Instead of using old devices such as stopwatches, thermometers and barometers, if students uses sensors and powerful software to collect and analyse data during their experiments then it provide more accurate data readings than the old manual methods.

Sensors in Education

Sensor technology can have a vast impact on the techniques used to teach science in the classroom. This technology can bring important improvements in the teaching and learning of subjects like science and mathematics. Anyone can use sensors as they are easy to utilize. Sensor technology provides students with a means of considering, understanding, investigating and

communicating association graphically. The analytical approach helps those students who find science very hard and also help them on collecting and analysing data. Students can do again experiments number of times because data get collected rapidly. As science syllabuses move away from content towards development, the exercise of modern measuring tools should be obvious in every classroom.

Types of Sensor:-

a) Speed Sensor
Speed Sensors are used for detecting speed of an vehicle or an entity. Speedometers, Light Detection and Ranging (LIDAR), Ground speed radar, Wheel speed sensors, Doppler radar, air speed indicators, pitot tubes(to measure air speed) etc. are some examples of Speed sensors. Temperature Sensor provides temperature measurement as an electrical signal which is in the form of electrical voltage and is proportional to the temperature amount.

b)PIR Sensor
PIR sensor or Pyro-electric sensor are electronic sensor used to determine the infrared light radiation produced from things. Objects that has a temperature above zero release heat energy in the form of radiation which is invisible by human eye and detected by PIR motion sensors.

c)Ultrasonic Sensor
The ultrasonic sensors are very much similar to radar technology in which interpretation of echo from radio or sound waves to estimate the attributes of a target by generating the high frequency-sound waves. The transducer used for converting energy into ultrasound or sound waves with ranges above human hearing range is called an ultrasonic transducer.

d) Motion Sensor
Motion sensor is the main device which detects motion of a person who took unauthorized entry in your home. It uses different technologies to detect movement in particular area. When it finds the movement, sensor get tripped and signal is sent to control panel of security systems which is connected to central monitoring centre, alerting both about possible threat in your home. Along with sending an alert to your control panel, motion sensor also sense an burglar. Sensors work when you are not at home. In few sensor systems camera also gets incorporated which helps the system in motion detection. They are able to capture the movement from any room of your house.

Wireless Sensor Networks and their Applications

Wireless Sensor Networks (WSNs)
When wireless network of devices communicate to gather information from monitored field then it called as Wireless Sensor Network. Wireless Ethernet is used to connect and send data to different networks. It consists of base stations and number of wireless sensors i.e. nodes which are used to observe physical or environmental conditions like sound, pressure, temperature and co-operatively transfer data through the set of connections to a main location.

Types of WSNs

Depending on the situation, the types of networks are decided so that those can be installing anywhere for ex. underground, underwater, on land, and so on. Different types of WSNs include:
1. Terrestrial WSNs
2. Underground WSNs
3. Underwater WSNs
4. Multimedia WSNs
5. Mobile WSNs

1. Terrestrial WSNs
Terrestrial WSNs are deployed in structured or unstructured manner and consists of about hundreds to thousands of Wireless sensors that are competent in communication with base stations. In an unstructured manner, the sensor nodes are indiscriminately spread within the target area. The pre-planned or structured manner considers finest placement, grid placement, and 2D & 3D placements. In this WSN, the battery power is inadequate; however, the battery is designed with solar cells as a secondary power supply. Use of low duty cycle operations, minimum delays and optimal routing achieves the energy management of these WSNs.

2. Underground WSNs

The underground wireless sensor networks requires more operational, maintenance, and equipment cost and alert planning, hence they are further costly than terrestrial WSNs. Underground conditions are monitored by number of nodes which are hidden in the ground. Above the ground some additional sink sensors are placed to transmit information captured by the sensor to the base station. Recharging of Underground WSNs are very difficult. The underground environment attenuates sensor signals that generates communication problem.

3.Under Water WSNs

Under water WSNs consist of number of sensors deployed under water. For gathering of data from sensor nodes self-governing vehicles are used. As we keep sensors in water sensor failure is a big problem. Beside this Under Water WSNs have to face problems like bandwidth and propagation delay etc. Sensors cannot be recharged in these networks.

4. Multimedia WSNs

To track and monitor events in multimedia format such as audio, video, images, Multimedia WSNs are used. These sensors are interconnected with each other using wireless connection and capable for data retrieval, data compression etc. In this network microphone sensors and cameras are used High bandwidth demand, compression techniques, information processing are some challenges with these type of networks. In addition to this, for rapid multimedia data ransmission high bandwidth is required.

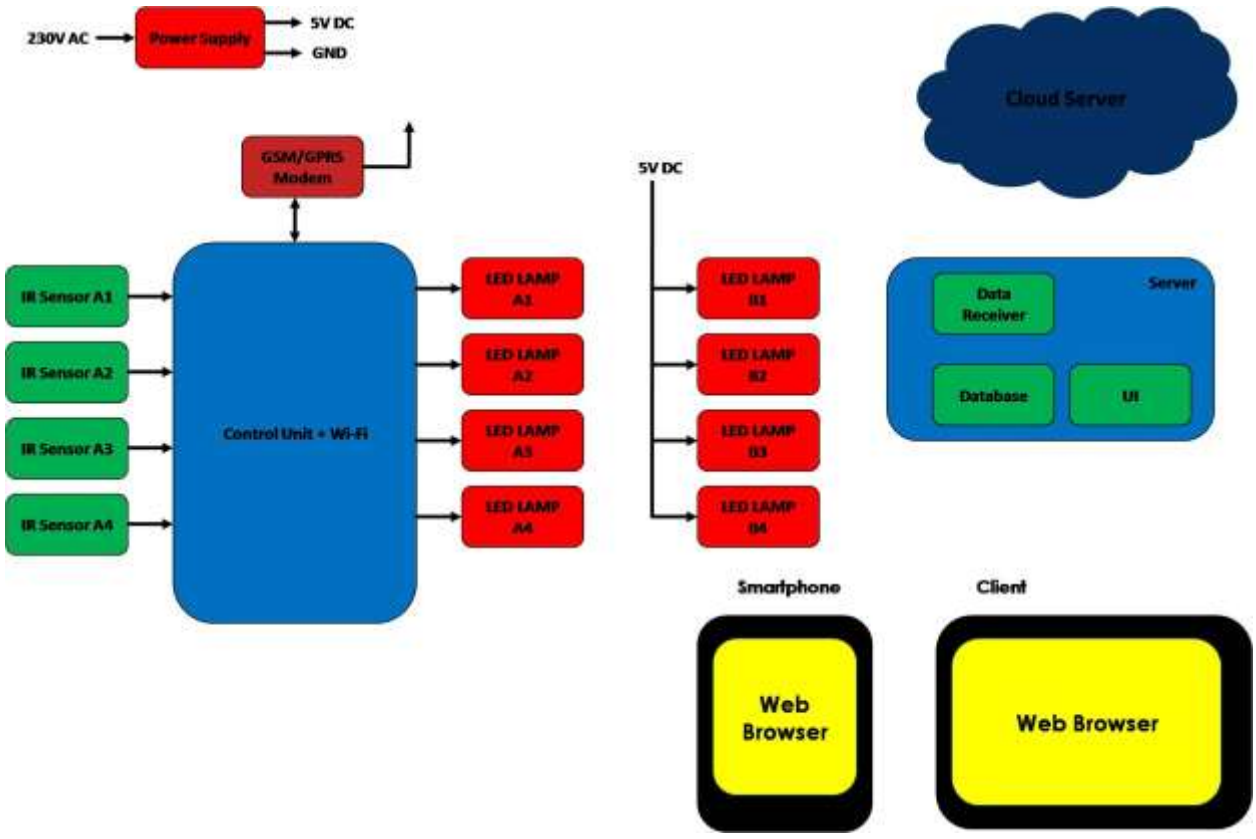
5. Mobile WSNs

When group of sensors can be moved on their own and do communication with physical environment, then it is called as Mobile WSNs. These sensors have the capacity to communicate and calculate sense. The mobile WSNs are much more flexible than the static sensor networks. Enhanced and better coverage, higher channel capacity, better energy efficiency, and so on are the advantages of Mobile WSNs.

Implementation of WSN for Remote Street Light Management

Block Diagram of System Model:-

Following diagram shows the block diagram used in implementation of the project.



Description of the Work:

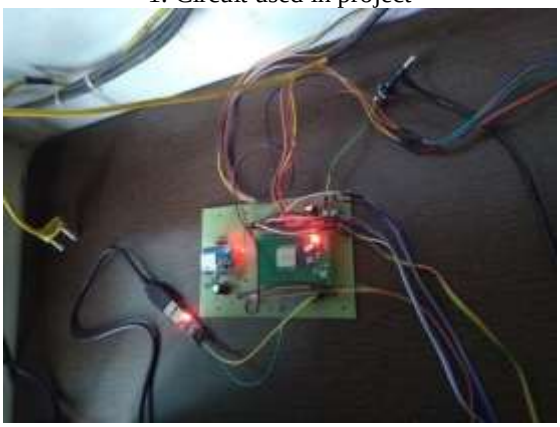
Control Unit:
System B: All lamps are continuously ON
System A: Lamps are controlled based on whether vehicle is present on lamp or not.
Manual Mode: Lamp ON OFF can be controlled through browser on smart phone over Wi-Fi network.
Auto Mode: Lamps are controlled based on whether vehicle is present on lamp or not.

Hardware:	**Wi-Fi Credentials:**	**Server Details:**	**Power Calculations:**
Controller: ESP32 GSM Modem: A6 Sensors: IR Sensor	SSID: Street Lights Password: PassworD IP: 192.168.4.1	IP: 104.237.152.18 Port: 3500 URL: http://104.237.152.18:3500/ Database: mysql Server: HTTP (node js) Sending data to server Method: GET API: /streetlight/<system A power>/<system B power>	Power consumed for following duty cycle per second 0% = 0 mW 30% = 8 mW 60% = 17 mW 100% = 28 mW

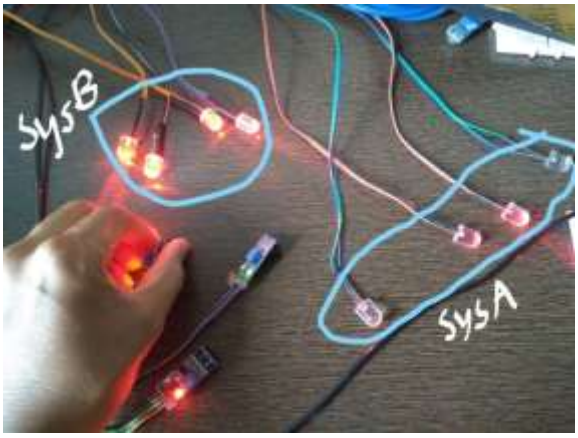
In this module we have designed a system which shows that electricity consumption of current light system is more than intelligent street light system. In our system we are able to handle street lights either manually or in auto mode.

Following diagrams shows actual work done for the same.

1. Circuit used in project

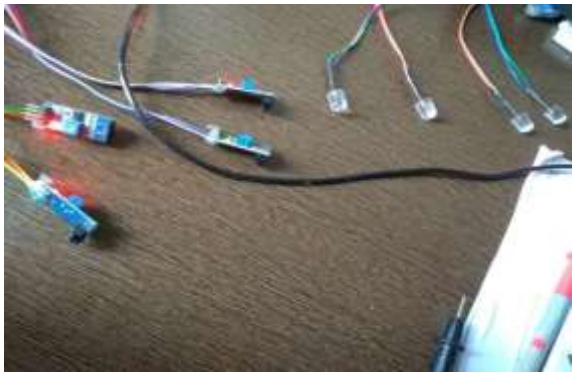


2. System B in which lamps are continuously ON and System A which is initially OFF

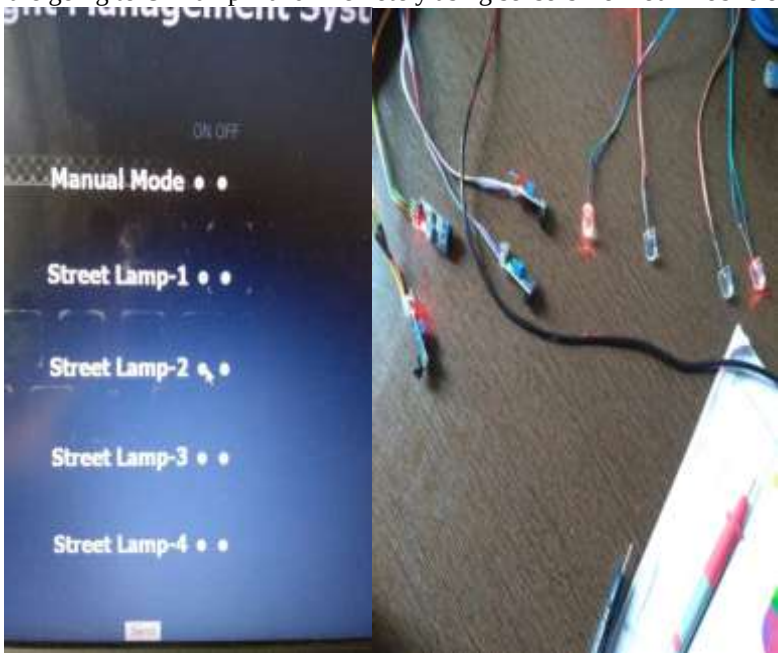


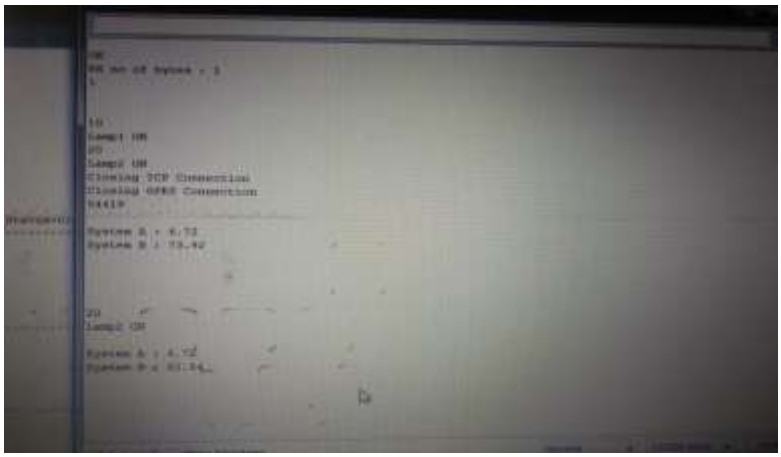
3. ARDUINO Serial Port COM3 is used to check backend working of the project.

4. At starting all 4 lamps of System A are OFF

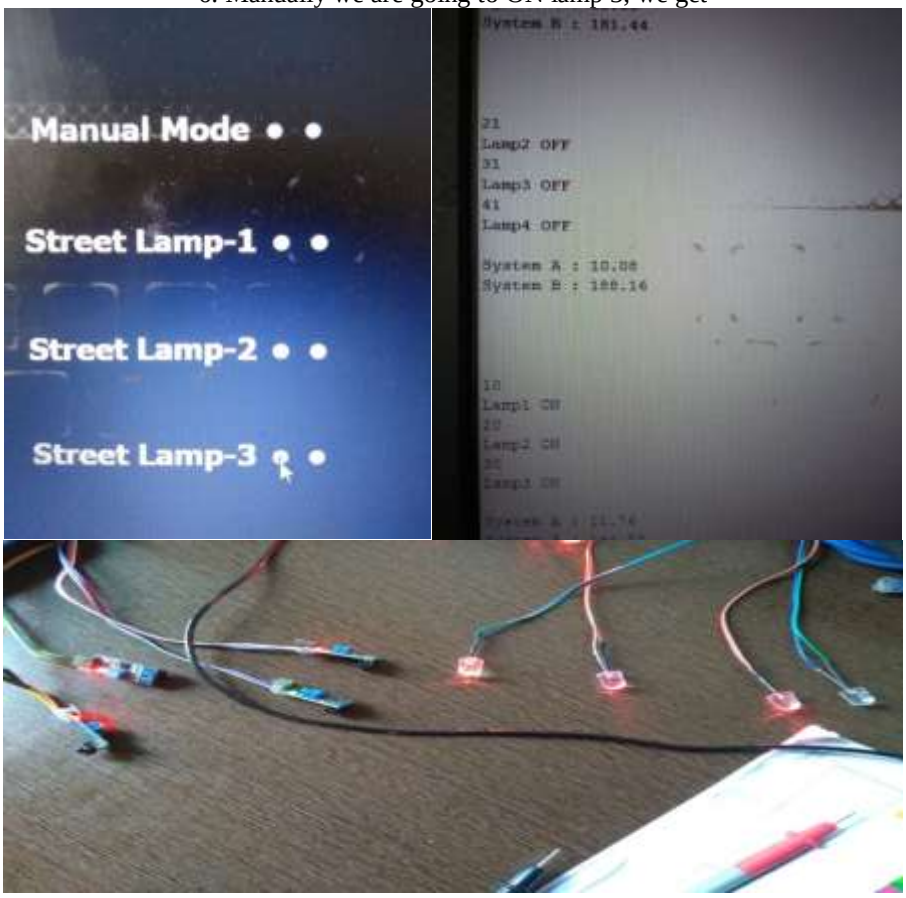


5. Manually we are going to ON lamp 1 and 2 remotely using sensors from our mobile or laptop, we get

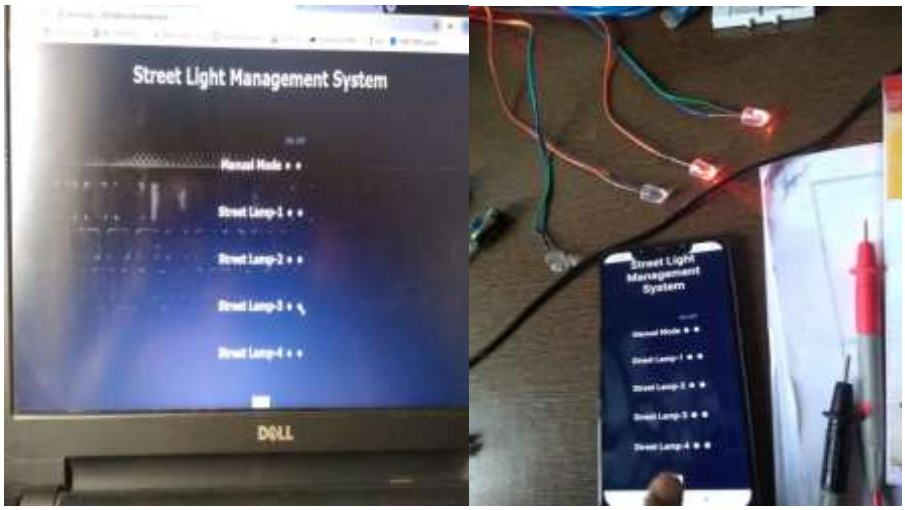




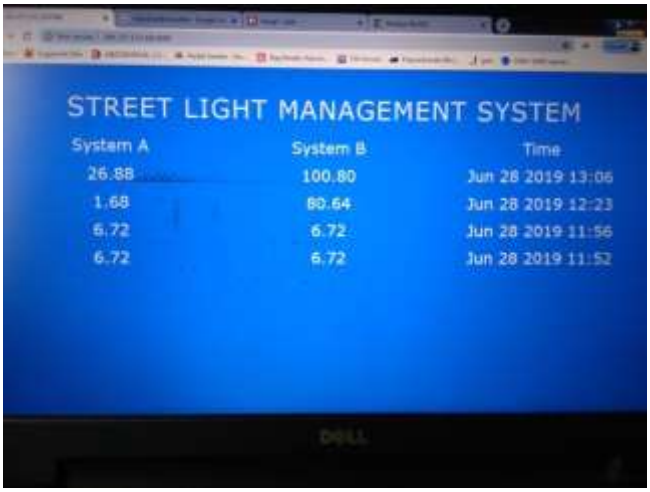
6. Manually we are going to ON lamp 3, we get



7. IP address 192.168.4.1 provides following screen which are used to operate the street lights either in manual mode or auto mode. We can access it using laptop or mobile display.



8. IP address 104.237.152.18 with port number 3500 provides or displays the following screen which shows the electricity consumption of System A and System B. It will send the updates to the system after every 5 minutes. It shows that System A uses less electricity than system B.



Conclusion

Above project shows that use of sensors in handling street lights are beneficial as it helps us in saving the electricity. When we go through the output which is displayed on the last screen, we can easily compare the amount of electricity used by system B(lights continuously on) and system A in which sensors are used. It will also reduce heat generated by street lights in night time.

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