Intelligent Street lighting System

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Abstract:
Street lights consumes a major part of a city power. Power consumption can go as high as fifty percent of total power usages. For reducing consumption and making street lights self-sufficient, an intelligent system of street lights can be developed. The system will work on the principle of proximity. The system can detect both sunlight and vehicles along with pedestrians to provide an efficient lighting solution. It will be powered by solar energy, which is considered as one of the cleanest source of energy. The system will be incorporated with a solar tracking unit for inlying the solar panel with sun for optimal charging of the battery.

INTRODUCTION:

In cities, life don't stop at night. It is just as important as day time. This makes illumination of streets an important factor. But in doing so, city's huge amount of power is expensed. Sustainable development being more important these days, a system is required which should be intelligent enough to be operated on its own and can regulate its power use. In the project developed keeping in mind all of these and with all necessary addition to work done till date.

LITERATURE REVIEW:

New streetlight system which consume less energy and covers a large area with the intensity of light being maximum. Street lightning accounts for a 35-45% of municipality's utilitybill [1]. An intelligent lightning control system will bring down the municipal street lightning cost by 70% [2]. Currently, streetlights uses HID (high intensity discharge) lamps as a light source. But they are known for consuming more power and atmospheric CO_2 being emitted by large power consumed is global concern. Hence LED array illumination have gain attention worldwide as an energy reducing light source. LED illumination requires only one-third of power consumed by the HIDs. The LED can be used for three time longer than HID making the Controlling a system manually has its own limitations.

It is prone to errors and energy wastage. Also manually dimming a light or increasing intensity at midnight is very impractical. Use of automatic system is and remote management system is feasible [4]. There are various other ways for controling the system such as design and implementation of CPLD based solar power saving system for street lights and automatic traffic controller [1],Intelligent Street Lighting System Using GSM [5], design and fabrication of automatic street light control system [6], automatic street light intensity control and road safety module using embedded system [7], energy consumption saving solutions based on intelligent street lighting control system [8].
The comparison of the different wireless technologies that can be used for monitoring the proposed street light system isshown in Table 1.

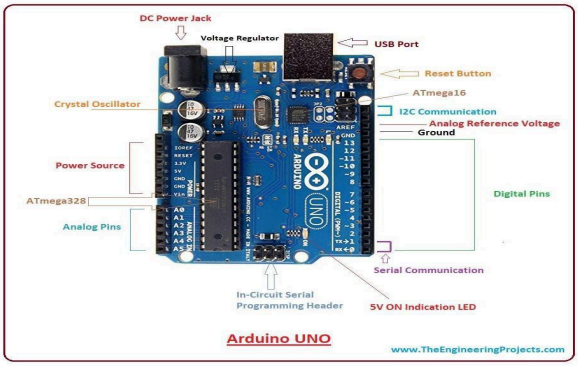
Table 1

Parameters	**PLC**	**ZigBee**	**433 MHz module**
Data Rate(kbps)	0.625-50	250	10
Power consumption	More	Less	Less
Installation cost	Expensive	Expensive	Low
Maintenance cost	Good	Very good	Low
Frequency	-	0.9-2.4 GHz	433MHz
Range	-	10m-1.6k m	10-110m

I. LIST OF COMPONENT AND THEIR DESCRIPTION

1. Arduino Uno:

Arduino consists of both of a physical programmable circuit board (often referred to as a micro controller) and a piece of software of IDE (integrated development environment) that runs on your computer used to write and upload computer code on the physical board probably known as printed circuit board (PCB).



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Specifications:-

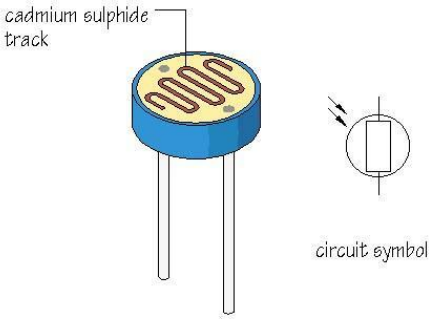
1) Micro controller: Atmega328
2) Operating voltage: 5Volt
3) Input voltage (recommended):7-12 V
4) Input Voltage (Limits):6-20 V
5) Digital Input Pins: 14(among them 6 pins are provided with **PWM output**)
6) Analog Pins: 6

2 .Servo motor:

A servo motor is an electrical device which can push or rotate an object with great precision. If you want to rotate and object at some specific angles or distance, then you use servo motor. It is just made up of simple motor which run through servo mechanism. If motor is used is DC powered then it is called DC servo motor, and if it is AC powered motor then it is called AC servo motor. We can get a very high torque servo motor in a small and light weight packages.

3. LDR Sensor:

A servo motor is an electrical device which can push or rotate an object with great precision. If you want to rotate and object at some specific angles or distance, then you use servo motor. It is just made up of simple motor which run through servo mechanism. If motor is used is DC powered then it is called DC servo motor, and if it is AC powered motor then it is called AC servo motor. We can get a very high torque servo motor in a small and light weight packages. These devices depend on the light, when light falls on the LDR then the resistance decreases, and increases in the dark.When a LDR is kept in the dark place, its resistance is high and, when the LDR is kept in the light its resistance will decrease



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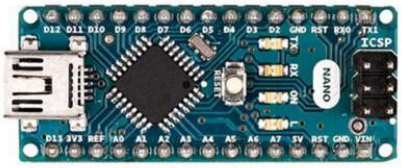
4. Solar Panel :

A solar cell is an electronic device that catches sunlight and turns it directly into electricity. It's about the size of an adult's palm, octagonal in shape, and colored bluish black. Solar cells are often bundled together to make larger units called solar modules, themselves coupled into even bigger units known as solar panels (the black- or blue-tinted slabs you see on people's homes—typically with several hundred individual solar cells per roof) or chopped into chips (to provide power for small gadgets like pocket calculators and digital watches).

5. Arduino nano:

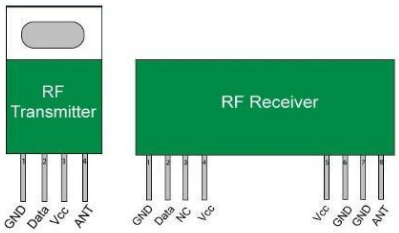
The Arduino Nano is a small, complete, and breadboard-friendly board based on the ATmega328P (Arduino Nano 3.x). It has more or less the same functionality of the Arduino Duemilanove, but in a

different package. It lacks only a DC power jack, and works with a Mini-B USB cable instead of a standard one. The Arduino Nano can be powered via the Mini-B USB connection, 6-20V unregulated external power supply (pin 30), or 5V regulated external power supply (pin 27). The power source is automatically selected to the highest voltage source.



6. RF Module – Transmitter &Receiver:

we use RF modules for transmit and receive the data because it has high volume of applications than IR. RF signals travel in the transmitter and receiver even when there is an obstruction. It operates at a specific frequency of 433MHz. RF transmitter receives serial data and transmits to the receiver through an antenna which is connected to the 4th pin of the transmitter. When logic 0 applied to transmitter then there is no power supply in transmitter. When logic 1 is applied to transmitter then transmitter is ON and there is a high power supply in the range of 4.5mA with 3V voltage supply.



7.Relay:

The relay module is an electrically operated switch that allows you to turn on or
off a circuit using voltage and/or current much higher than a microcontroller could
handle. There is no connection between the low voltage circuit operated by the
microcontroller and the high power circuit. The relay protects each circuit from each
other.
The each channel in the module has three connections named NC, COM, and
NO. Depending on the input signal trigger mode, the jumper cap can be placed at high
level effective mode which ‘closes’ the normally open (NO) switch at high level input and
at low level effective mode which operates the same but at low level input.

This is a 5V 4-channel relay interface board, and each channel needs a 15-20mA driver current. It can be used to control various appliances and equipment with large current. It is equiped with high-current relays that work under AC250V 10A or DC30V 10A. It has a standard interface that can be controlled directly by microcontroller.

Alternatives:-

Passive infrared sensor (PIR)
A passive infrared sensor (PIR sensor) is an electronic sensor that measures infrared (IR) light radiating from objects in its field of view. They are most often used in PIR-based motion detectors. PIR sensors are commonly used in security alarms and automatic lighting applications. PIR sensors detect general movement, but do not give information on who or what moved. For that purpose, an active IR sensor is required.

Working Methodology:

Intelligent street lighting system consists of two parts. First is controlling system consists of transmitting and receiving section and Second is solar power system consists of solar tracking and power saving section.

1. Control system:

To decide whether to turn the LED ON or OFF controlling part is carried out using wireless transmitters and receiver that is RF H433 Mhz Tx and Rx. Transmitters (Tx) and receiver (Rx) which communicate using RF signal and using amplitude shift system (ASk) RF 433 has the range upto 100m but can be

manipulated by adjusting antenna height . Therefore for communication RF Tx (Transmitters) need to come in range of 50m of RF Rx (receiver)to communicate to ardino nano to process the signal . RF TX will continue to send signal but RF Rx will not receive until it is in range of 50m of RF Rx. When RF Tx enters the 50m range then Rx will receive the signal and arduino nano will make LEDs turn ON. LEDs which are connected in rows to that of first LED. when RF Tx will go out of range all the LEDs will slowly Turn OFF.

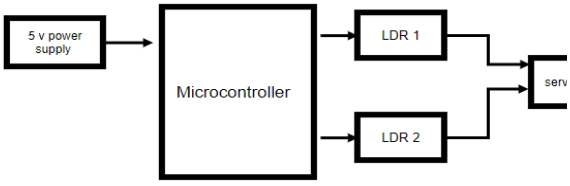
2. Power and Storage Section:

This System consist of LDR, solar panel, servomotor and microcontroller (Arduino uno). LDR (Light Dependent Resistor) is also known as photo resistor is the light sensitive device. Its resistance decrease when the light falls on it and that's why it is frequently used in Dark or Light Detector Circuit.

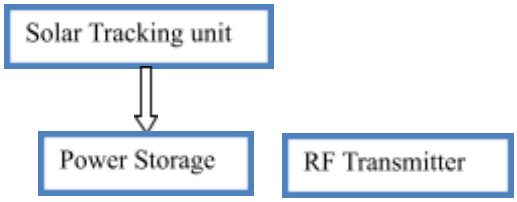
The two LDR's are placed at the two sides of solar panel and the Servo Motor is used to rotate the solar panel. The servo will move the solar panel towards the LDR whose resistance will be low, mean towards the LDR on which light is falling, that way it will keep following the light. And if there is same amount of light falling on both the LDR, then servo will not rotate. The servo will try to move the solar panel in the position where both LDR's will have the same resistance means where same amount of light will fall on both the resistors and if resistance of one of the LDR will change then it rotates towards lower resistance LDR.

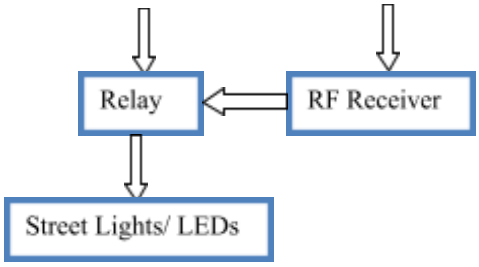
Block diagram

For solar tracking



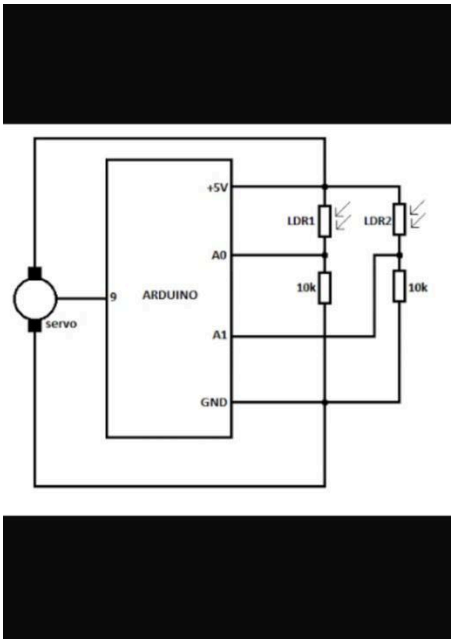
For Automatic light control



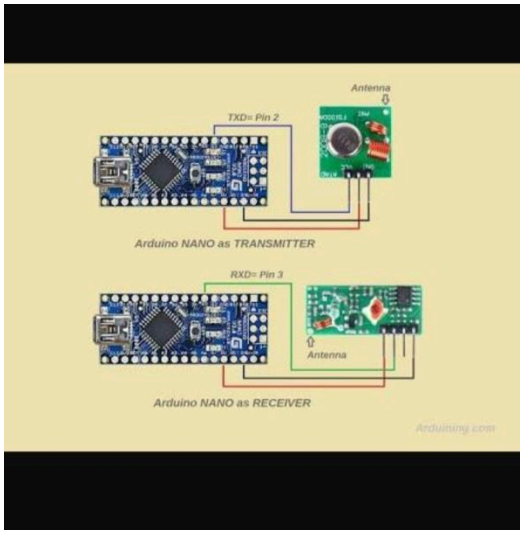


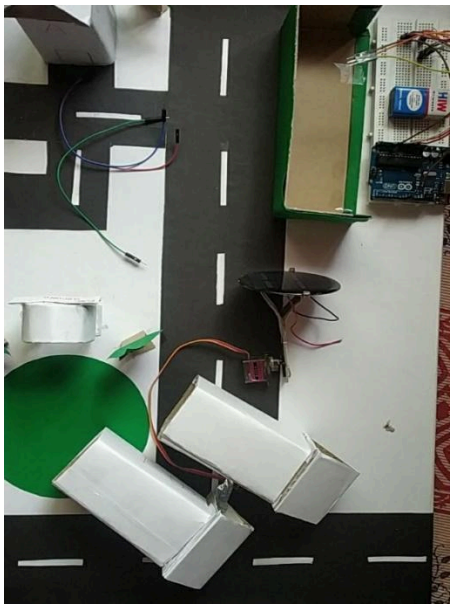
Circuit Diagram:

1.Solar circuit:



2. RF Module – Transmitter &Receiver Circuit:





Results and Discussions:

In the proposed intelligent street light system, during the day time, the solar tracking unit tracks the path and movement of the sun. This aligns the solar panel in accordance to sun for efficient battery charging. Cleaner source of energy, solar will is being used here to reduce the dependence on non-conventional source of energy. The street lights will be turned on only during night time. The lights will be turned on only when a pedestrian will pass through it by sensing his presence with Proximity sensor. Also, when a vehicle carrying a transmitter comes in the range of the receiver, lights will be turned on in accordance to movement of vehicle. This system will efficiently save power by using lights only when it is required.

Limitations:

- Trackers are a more complex system than fixed racking. This means that typically more site preparation is needed, including additional trenching for wiring and some additional grading.
- Solar trackers are generally designed for climates with little to no snow making them a more viable solution in warmer climates. Fixed racking accommodates harsher environmental conditions more easily than tracking systems.
- Fixed tracking systems offer more field adjustability than single-axis tracking systems. Fixed systems can generally accommodate up to 20% slopes in the E/W direction while tracking systems typically offer less of a slope accommodation usually around 10% in the N/S direction.

Future scope:

- Various other IOT systems can be connected for complete smart city project.
- Keeping track of power consumption.
- By connecting the solar panels in an array more energy can be extracted.

CONCLUSION:

Simply installing the solar panels will not be very efficient in charging the battery. Hence we devised a way to to track the sun in the day to achieve max possible sunlight. solar tracking system is more efficient than any other ordinary panel. established model of automatic tracking system to keep vertical contact between solar panel and sunlight this project of Automatic street lights is cost effective, practical ecofriendly and the safest way to save energy. it clearly takles the two problems that world is facing today , saving the total power consumption by sustainable development. according to static data we can save more that 40% of electrical enerdy that is now consumed by the highways. Intial cost and maintenance can be the draw backs of this project. the leds have long life,emit cool light, donor have any toxic material and can be used for fast switching

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