Smart Street Light System using IoT

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Abstract - *The Word Smart is an acronym for the 5 elements of specific, measurable, achievable, relevant, and time-based. IOT describes the large and growing set of digital devices as now numbering in the billions which operate across networks of potentially global scale. As the world is growing a bit faster people are being attracted to this word smart. India is one of the fastest growing economies in the world taking this as a factor we are implementing a switch to smart technique - Namely Smart street light system. The manual streetlight system lights powered from sunset to sunrise with maximum intensity even when power is available. The Saved energy can be utilized in various purposes like residential, commercial etc. This is done by using the LDR sensor. Considering the intensity of light, we can turn a light on/off. The power supply to the system is the main supply and converting them using a Relay. Every city need to have street light system which is essential. In order to save the energy, we are using the project through an IOT module. As there is a tremendous change in the world everything is changing into automation. This is a smart control and intelligent decision making devices based on accurate real time field data.*

Key Words: Automation, Arduino UNO, Energy Efficiency, ESP8266 Wifi Module, IoT, LDR, Monitoring, Relay

1. INTRODUCTION

The Internet of Things (IoT) is an assortment of interrelated preparing devices, mechanical or virtual machines, articles, animals and individuals that have fascinating identifiers (UIDs) and the ability to move information over a framework without expecting of human-to-human.

In light of the joining of various progressions, real time assessment, AI, thing sensors, and installed frameworks with systems, the possibility of the Internet of Things has progressed. Regular fields of introduced structures, remote sensor frameworks, control systems, automation (tallying home and building computerization) and others all add to the Internet of Things.

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IoT uses various progressions and shows to speak with devices subject to the necessities. The huge advancements and shows are remote, Wi-Fi-direct, RFID, NFC, radio shows and Wi-Fi-Direct.

IoT applications are flourishing in general adventures and markets. The IoT has countless improvement over various organizations.

The daily lighting system has limited to only two ON and OFF options, and is not effective, this type of operation results in power loss due to continued peak voltage. The diversion of electricity from street lights is therefore one of the obvious power losses, but with the use of automation, this results in many new energy and money savings methods. LDR is used as a sensor in this module. The aim is to provide an efficient & energy-saving lighting system by determining the present lighting condition and changing the lights accordingly. The circuit consists of an sensing component known as LDR, followed by Relay, The input is given from the direct supply and the relay convert them to a required voltage and then the switching on the lights takes place. Street lightening is an essential infrastructure for cities in order to assure the security of citizens and goods. This infrastructure has however a high economic and ecological cost. Thus, municipalities are looking for innovative solutions to master the costs of their streetlights, which represent up to 60% of their electricity expenditure.

2. Literature Survey

A gathering of researcher from establishment Sir M. Visvesvaraya[4] had created keen road light GPS beacon utilizing Xbee remote module. They will likely screen the wellbeing of Street lights and ahead checked outcome to the oversee station. Inside the light module, it incorporates light ward resistors (LDR) module, microcontroller module and Transmission module. The light module will speak with the oversee Center through wi-fi the utilization of Xbee.

Various methods have been proposed by various scholars one such technique that came recently is the use of the DHT11 sensor [3]. As the name recommends the DHT 11 is a temperature and humidness sensor with an extraordinary exact stickiness and temperature alignment. It is

incorporated with a 8bit small scale controller guarantees the unwavering quality and long haul dependability. Has a quick reaction and quality and superior. The single-wired sequential interface framework has been incorporated to turn out to be speedy and very simple. Little size, low power, signal transmission go up to 20 meters, empowering a wide assortment of uses even in the most requesting locales or territories. Another such kind of a method recently utilized was with the assistance of a Light sensor, Smoke Sensor, Carbon outflow sensor, Noise Sensor. [4]

First the Chips would be made to be placed in on the lights. These chips can contain a small scale controller together with shifted gadgets like ozone depleting substance sensor, haze sensor, quality gadget, clamor gadget and GSM modules for remote information transmission and gathering among concentrator and PC. the data from the chips would be gotten on an outside concentrator (PC) and consequently the PC would likewise transmit the predominant activity to the chip. in accordance with the overview of variety inside the force of daylight in the field space, prudent programming would be done to affirm least utilization of vitality. The discharges inside the climates would be distinguished together with the utilization of vitality and any stealing of power.

3. Methodology

3.1 Theoretical Analysis

The client is at the board Station for example the Master Node, that will be that the overseeing gadget of remote gadget organize. The client ought to recall of working remote gadget organize essentially based application. Client should offer right system arrangement parameters for IOT essentially based application.

3.1.1 Current System

Street lights are on from 6:30 to 7am and is not often the time mentioned, on a regular basis the current system is not effective and wastage of energy is quite often.
The analysis part looks like this :
Bulb used=150W
Number of nodes =36,
Number of working hours per day->=12hours
Power consumed per day=20*13*0.150=39kwhr
ie 39*30=1170kwhr/month
ie 39*365=14235kwhr/year
Bill generated =1170*3=3150 Rs per month.

3.1.2 Expected current system

3.1.2.1 Vitality usage:

Works on profile premise. All road lights are ON from 6:30pm to 6:30 am, in various words, road lights are working absolutely for twelve hours every day. Assumptive twenty hubs to work control devoured by them will be given as,

Bulb utilized =150 W=0.150 Kw,
Number of hubs = 20 hubs,
Number of working hours out of every day = 12 hours
Power Consumed every day = 20 * 12 * 0.150 = 36 kwhr
for example 36 * 30 = 1080 kwhr/month
Month to month Bill for 20 hubs (Rs 3/kwhr) = 1080 * 3 = 3240 Rs for every month.

3.1.3 Smart system

Expected power sparing in different manners.

• 0% utilization state from 7am to 7pm.
• 97% sparing at the hour of nightfall state from 7pm to8pm.
• 7% vitality sparing in light of voltage revision state from 8pm to 11pm .
• 55% utilization on account of diminishing method utilized state from 11pm to 1am.
• 34% utilization in light of darkening just as stunning strategy state from 1am to 2am.
• 55% utilization as a result of diminishing procedure utilized state from 2am to 6am.
• 96% sparing at the hour of nightfall state from 6am to 7am.

The above smart system is unique and by using any of the technique mentioned below the energy preservation is done and that can be utilized in various ways for other resources. The effective utilization of the resource is done to various ways and when the consumption power is less and providing better feature than the existing one the energy can be transformed into other sectors for better development of the city.
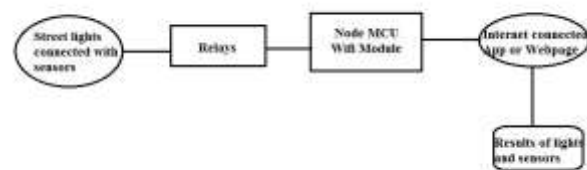

Fig. 1: The above flow chart represents flow sequence of the system.

3.2. Equipment Used

- Relay
- LDR
- ESP8266
- Thingspeak

3.2.1. Relay

A relay is an electromagnetic switch which is used to switch High Voltage/Current using Low power circuits. Relay isolates low power circuits from high power circuits. Voltage source: 230 V. Current: 10 A. Relay acts like a Switch.

Latching relays require simplest a single pulse with a manipulate strength to perform the switch consistently. Some other pulse implemented to a 2nd set of manage terminals, or a pulse with contrary polarization, rearranges the transfer, whilst recursive pulses of the same kind need no consequences. Magnetic relays are useful in packages when breaking of sequence electricity must no longer change the circuits that the relay is regulating.

3.2.2. LDR

Also called as photo resistor. Light controlled variable resistor. The check of a photoresistor decreases with extending scene lightweight significance, in a couple of words, it reveals electrical conduction. A photoresistor could similarly be maintained in photosensitive locator circuits, and smooth impelled and darkish-started move circuits. A photoresistor is fabricating plant created utilizing a high check semiconductor. Inside the diminish, a photoresistor can have a restriction as ridiculous as various megaohms (Mω), while at breaks the sunshine, a photoresistor will have a deterrent as beside no a similar number of hundred ohms. If scene touchy on a photoresistor outperforms a particular repeat, photons devoured by suggests that of the semiconductor give sure electrons enough essentialness to hop into the conductivity band.
Applications of LDR: Night lights, Street Lamps, Light meters.

3.2.3. ESP8266

Leading platform for Internet of Things, Low-cost. Dual Functionality, Type:32-bit Microcontroller.

3.2.4. Thingspeak

ThingSpeak is an open wellspring of web of things (IoT) utility and API to purchase and recover records from issues abuse the hypertext move convention and MQTT convention over internet or through a near to space organize. ThingSpeak licenses the presentation of detecting component work programs, area following bundles, and an informal community of things with standing updates

3.3. Proposed Method

The various proposed methods has some challenges and thus how much amount of power it is preserving going into vain when in an situation in the morning once the climate changes to a cool state the bulb switches on it is an worst scenario and the preserved energy is being utilized in this case and the system is in a neutral state where there is no common exchange of the power as the sensor depends purely on the surrounding area or the region. Hence in order to overcome such sort of problems we have deigned the smart streetlight system only by using an ldr and make connected with a direct supply.

The main aim is to preserve the consumption of power that is being used in the normal streetlights and in order to make them effective we proposed a method which preserves the energy by depending on the intensity of the light that is present in the climate. This works by depending on the intensity of the light that falls on the photo resistor and then it generates the required amount of intensity and the bulb switches on/off. Since by the use of the relay in the circuit the monitoring of the bulb takes place. The amount of power that is being supplied there the relay acts as a switch and the bulb glows on. The light switching takes place depending on the beam of incident light falling on the ldr. The moment when the light falls on the ldr the switching of the bulb takes place whether to glow or not. By this the consumption of the energy is being saved and makes the system effective and the cost consumption of the bulb's is less.

Precisely when the LDR perceives force of light its opposition will get diminished, on the off chance that it sees gloom its hindrance will enlarge, along these lines high-power light can be given during the needful conditions.

3.3. Results

The below figures shows the amount of energy consumed in a month and the decay of the system if any of the bulb is malfunctioned. We can observe the daily usage of the power consumed shown in the field 2 chart. As there is a consistency which implies that our system is working effectively. The above results obtained are best suitable to the real world and they further can be utilized foe the energy preservation and the obtained provides the necessity of using the module and how it can be utilized in order to preserve and store energy. This IOT based computerized streetlight framework is financially savvy. The undertaking point is the preservation of vitality. It can likewise wipe out the CO2 outflows and light contamination. The framework doesn't require labor and occasional check rather the framework status is consistently refreshed. It is additionally useful in getting the exact temperature and dampness state of a particular territory.
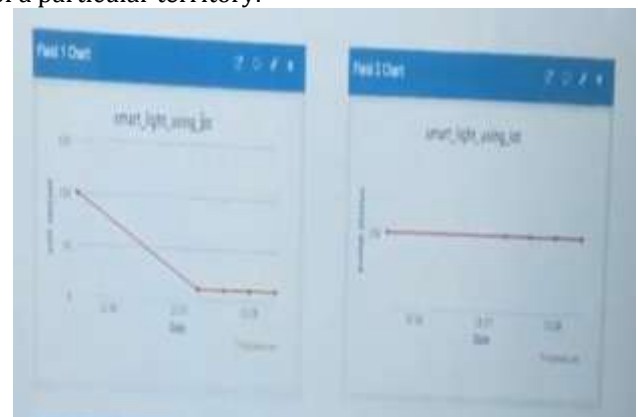

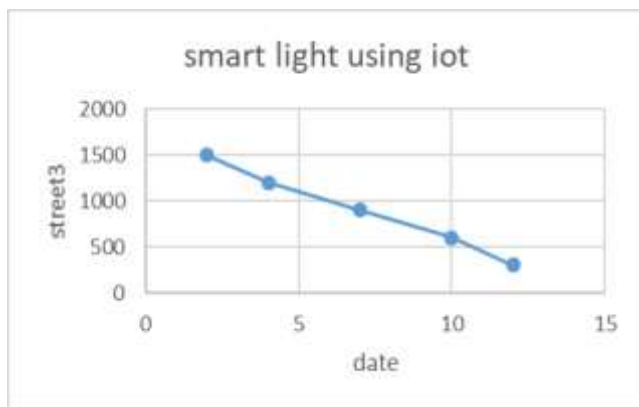**Fig. 2:** The two plots represent the usage of the proposed system.

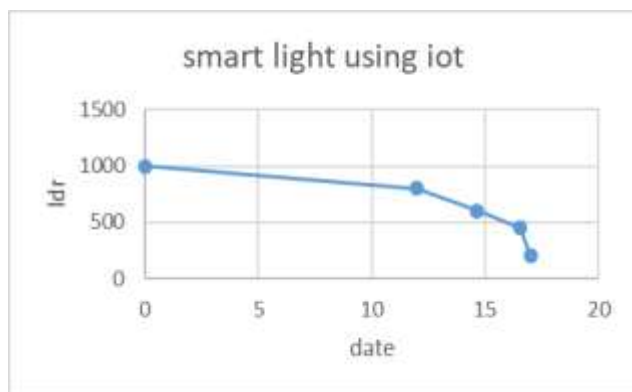**Fig. 3:** Above plot represents Streetlight consumption at a particular area.

Fig4.: Above plot represents the LDR performance statistics.

4. Conclusion

Conserving the energy has been the huge task in our generation by converting the manual process into automation we can save enormous amount of energy. These also reduce manpower and prevent energy wastage. The efficiency of automated systems is more than the manual systems. We can reprogram these devices with respect to our needs. By using the API key, the generated data is stored in Thingspeak database which we can use for future references. Only maintenance is the disadvantage of these systems.

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