IMPLEMENTATION OF IOT BASED STREET LIGHT MONITORING CONTROLLING SYSTEM USING DYNAMIC TRAFFIC STATISTICS

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*Abstract:*Generally, large amount of power is consumed for lightening of streets in countries. But when we compared the street light with vehicle, vehicle takes less amount period in lightening. In present days, the outdoor street lights will have high cost, safety, maintenance and environmental issues. In this paper we are going to study about the advanced street lightening system which consumes less energy. In this system, it consists of autonomous fault detection system and monitoring capabilities. This system is very beneficial to all players include municipalities and distribution companies. Depending upon the amount of traffic moved on the road and outdoor light, the intensity of light changes. As there is change in intensity then the power is consumed and this entire process is observed from the proposed system. Depending upon the proposed optimization subroutine, the server of the system sends the scheduling, switching and dimming level to each traffic signal pole. By using power line communication (PLC), the controller set points are transmitted to the local pole controller. The power line communication block consists of both transmitter and receiver part, the both transmitter and receiver are used to transfer the instructions from server to various traffic signals in the locality of the server.

***Index Terms*–Power Line Communication (PLC), Raspberry PI, Arduino, IR Sensor**

I. INTRODUCTION

Here street lights are nothing but ubiquities considering on every road and high way which is illuminated by lamps in night. The most important civilization index in present days is development of transportation network and which consists of streets, roads and high ways. In streets, roads and highways sufficient visibility is provided to decrease the accident rate and as well as to increase the flow of vehicles and safety. But huge amount of electric power is needed to Light all the streets and roads. Mostly, the every country requires maximum 30% to light the streets and roads. It consumes huge amount of energy and the spending cost for energy is too high as well as environmental pollution emits CO_2 in large amount. We know that for some roads vehicle gives very small rate in specific period of time.

Let us discuss this with an example, if we divide the roads into small parts, with each part has a length of 500 meters then from this we can find that in many roads only a very small number of these parts have vehicles that pass through them and the rest of the parts have no vehicles, but still consuming electrical power. This type of problem is known as dynamic problem, where any part of the road can be free and then shortly be occupied then free again.

Power Line Communication (PLC) technology is used in street lightening system to optimize the control of street lightening. There is no need to run additional wires in PLC to control the devices. PLC can be worked in some areas where the wireless transmission data is poor. So PLC is used all over the world with wireless platform in smart grid projects and smart cities.

Coming to smart cities, the entire system of street light depends up on the networksystems. Basically, network street light system improves the efficiency of energy of city lightening system and reduces the operational and maintenance cost. This system is the backbone of networking. The main advantage of smart lightening system is that it consists of smart sensors and actuators and as well as set of capabilities and interfaces are incorporated. From past we can observe that the wireless sensor network which monitors and controls the indoor and outdoor lighting systems. So the entire street lightening system is controlled by the wireless communication system. This wireless communication system consists of GSM, GPRS and wireless sensor network.

Depending upon the contextual information which is extracted from the sensory data, street lamps are generated from dimming commands in intelligent street lightening system. Here to adopt the environmental and presence variations in outdoor lightening system different number of multi-purpose sensors and actuators are used. Now the system will interacts with operators and supervisors. To provide safety and comfort for outdoor lightening systems sensor-based operation, dimming, fault detection, and subgroup selection operations are used. At last the design of outdoor lightening system is very complex.

II. PROPOSED SYTEM

The below figure (1) shows the block diagram of proposed system. The block diagram is divided into two parts mainly one is server block diagram which is shown in figure 1(a) and another one is traffic light block diagram which is shown in figure 1(b).

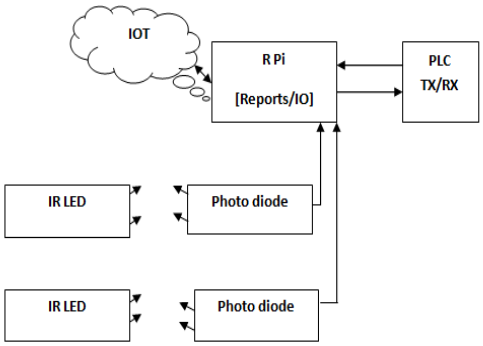

Fig. 1. a) Block scheme of server

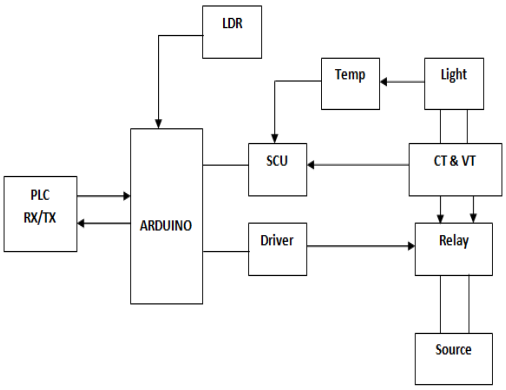

Fig. 1. b) Block scheme of Traffic light

2.1 RASPBERRY PI

Raspberry PI is nothing but a credit card sized which is plugging into a computer monitor or TV. Generally, it is used as key board and mouse. The cost of Raspberry PI is very low. To explore computing, it enables the people of all ages and as well as it gives complete read out of how to write a program in languages like scratch and python. To get connected with internet, Raspberry PI is equipped with an Ethernet chip that is ENC28J60. The below figure (2) shows the Raspberry PI chip.

Fig. 2. Raspberry PI

2.2 GPIO PINS

GPIO pins are nothing but General Purpose Input Output pins. It is placed on an integrated circuit to run the specified operation. But it is mainly controlled by the user at run time. Generally, it means a group of pins that can switch as a group to either input or output. Here each pin can be set up to accept or source different logic voltages, with configurable drive strengths. Some of the GPIOs have 5 V tolerant inputs and as well as the device can accept 5 V without damage.

2.3 POWER SUPPLY

The main requirement of our project is power supply. Now to obtain DC power supply, the AC main voltage will be stepped down by the transformer, rectified by filtered by capacitor. This DC power supply is given to base unit and recharge unit from the mains line. A center tapped secondary transformer is used which consists of 0-12v, from this transformer we get 5V power supply.

2.4 SD CARD

SD card is a non-volatile memory card which is developed from SD card association. It is developed to improve the multimedia standard. The thickness of SD card is about 1.4mm. In this we used 8GB card to store the data while operations are performed.

2.5 PHOTO DIODE

It is a semiconductor device which converts light into electric current. When photons are observed in photodiode then current is generated. Generally, photodiode consists of optical filters, built in lenses and large and small surface areas. In photo diode, if

surface area is increased then the response time becomes very slow. At last in large area photo diode, a traditional solar cell is used to generate solar power.

2.6 IR LED

An IR LED is a special type LED which emits infrared rays ranging from 700 nm to 1 mm wavelength. By using different IR LEDs different wavelengths are obtained because different LEDs produce different colors. Sensors are used by complementing the IR receivers.

2.7 POWER LINE COMMUNICATION

Power line communication transmit data on conductors for AC electric power transmission consumers. Power line communication is also known as power-line carrier, power-line digital subscriber line (PDSL), mains communication, power-line telecommunications. From different applications ranging from home automation to internet access we need different types of power line communication technologies. This technologies limit up to one type of wires but they can cress between two levels. To form very large networks, transformer propagates signal through various technologies.

2.8 ARDUINO

The below figure (3) shows the arduino board. It is a microcontroller board which is based on the ATMEGA 328. It consists of 14 digital input/output pins, 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It is simply connected to a computer with a USB cableor power it with an AC-to-DC adapter or battery to get started. Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter.The Uno board has a resistor pulling the 8U2 HWB line to ground to make into DFU mode.

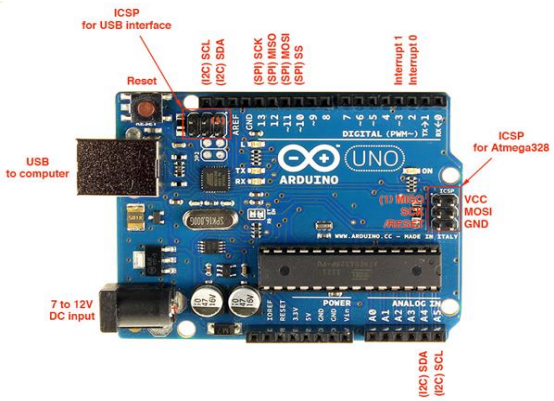

Fig. 3. Arduino board

2.9 LDR (Light Dependent Resistor)

LDR is nothing but light controlled variable resistor. If the intensity of incident light increases then resistance of photo resistor decreases. Photo resistor is applied in light-sensitive detector circuits, and light-activated and dark-activated switching circuits.

2.10 SCU (SIGNAL CONDITIONING UNIT)

Signal condition unit manipulates an analog signal to meet the requirements of next stage. This unit consists of input signal where the signal is divided into broadband AC and low-pass DC signals. Signal inputs accepted by signal conditioners include DC voltage and current, AC voltage and current, frequency and electric charge. At last signals are amplified to AC to DC outputs.

2.11 CT & VT

To measure the high voltages and high currents we use current transformer and voltage transformer. A current transformer is a type of transformer that is used to measure alternating current. Voltage transformers is also called potential transformers (PT), which are connected to parallel type of instrument transformer and it is used for metering and protection in high-voltage circuits.

2.12 RELAY

A relay is an electrically operated switch. In relay magnetic field is created when current is flowing through the coil. Relay have two switch positions, one is ON and another one is OFF. Relays are used where it is necessary to control a circuit by a separate low-power signal. Here the relay is used to give an electric shock in case the patient goes unconscious.

2.13 DRIVER

Driver is nothing but a circuit which is used to control the other circuitlike high-power transistor, liquid crystal display (LCD) and others.

2.14PYTHON IDLE

Python is a powerful programming language. It consists of high level data structure which is efficient and for object oriented programme simple and effective approaches are used. It an ideal language for scripting and rapid application development. Python is extended with new functions and data types. This is implemented on C or C++.

2.15 ARDUINO SOFTWARE (IDE)

The arduino software- integrated development environment contains a text editor for writing codes, a message with buttons for common functions. The programs written with arduino software (IDE) are called sketches. These sketches are written in text editor and saved with file extension.ino. The editor has features for cutting/pasting and for searching/replacing. Here the bottom right hand corner of window displaysconfigured board and serial port. The tool bar button allows us to verify and upload programs. For common input and common output procedures The Arduino IDE supplies a software library from the Wiring project. Arduino IDE employs the program to convert the executable code into a text file. In this user written code requires two basic functions and these are compiled and linked with a program. The two functions are discussed below

1. Set up (): This function indicates that when sketch starts after power-up or reset. It is used to initialize variables, input and output pin modes.
2. Loop (): after the process of set up, a loop function is executed repeatedly in main program. As well as it controls the entire board until the power is off.

III. RESULTS

Fig. 4. Hardware kit

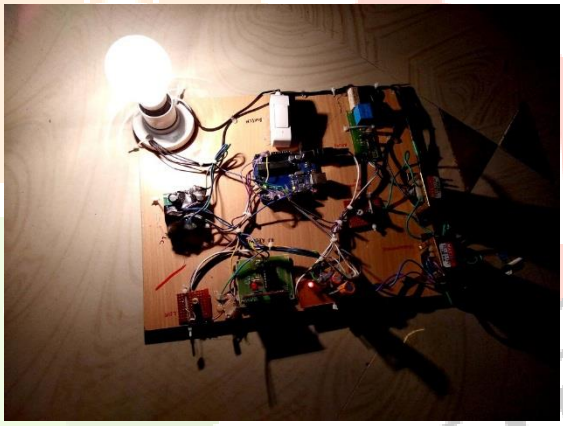

Fig.5. Executed Output

The Luminous and Temperature Values Are Collected from Python 2.7.9 Shell as shown in below figures

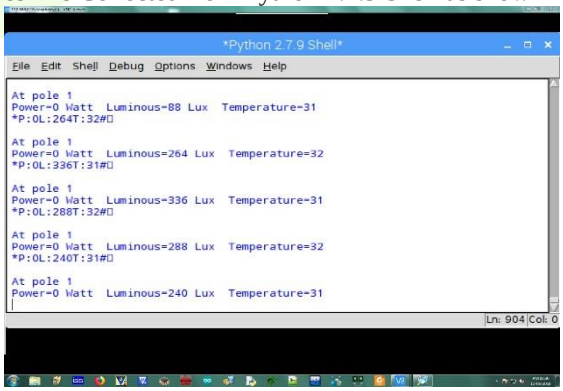

Fig. 6. Data collected from street light-1

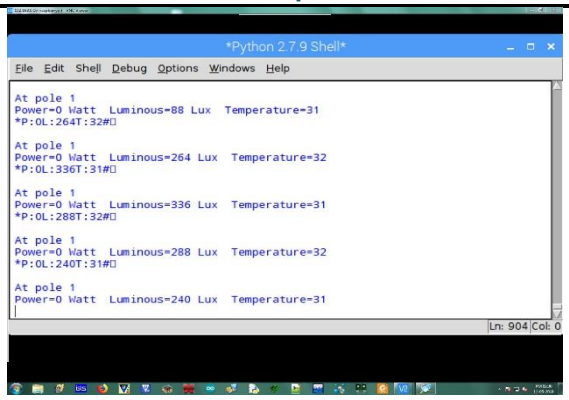

Fig.7. Data collected from street light-2

IV.CONCLUSION

In this paper we studied about the new energy optimization control system for streetlistening. Inthis system we use following devices they are server, a traffic light controller and power line communication transmitters, LDR sensor, Photo diode, IR LED and a signal conditioning unit. From the proposed system we can observe that it reduces power and consumes less energy. This system is flexible and scalable. It can accommodate any type of dimmable lamps.

V. REFERENCES

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