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IOT based Streetlight Automation System

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***Abstract*: A Street light, lamppost, street lamp is a raised source of light on the edge of a road or walkway, which is turned on or lit at a certain time every night. Major advantages of street lighting include: prevention of accidents and increase in safety. Studies have shown that darkness results in many crashes and fatalities, especially those involving pedestrians; pedestrian fatalities are near to 7 times more likely in the dark than in daylight. Street lighting has been found to reduce pedestrian crashes by approximately 50%. A street light control system is to be developed to control and reduce energy consumption of a town's public lighting system. These range from controlling a circuit of street lights and/or individual lights with specific ballasts and network operating protocols. These may include sending and receiving instructions via separate data networks, at high frequency over the top of the low voltage supply or wireless. Various protocols are to be developed as well as compatible hardware for most types of lighting. The control centre will deal with the data so that it can know the situation of each streetlight. As per the result the control centre gives orders to each streetlight to control the switch state and illumination of them.**

Keywords- Street lights, remote monitoring, Wi-ART technology.

INTRODUCTION

The idea of designing a new system for the streetlights that do not consume huge amount of electricity and illuminate large areas with the highest intensity of light is concerning each engineer working in this field. Providing street lighting is one of the most important and expensive responsibilities of a city. Lighting can account for 10–38% of the total energy bill in typically cities worldwide. Street lighting is a particularly critical concern for public authorities in developing countries because of its strategic importance for economic and social stability. Inefficient lighting wastes significant financial resources every year, and poor lighting creates unsafe conditions. Energy efficient technologies and design mechanism can reduce cost of the street lighting drastically.

Manual control is prone to errors and leads to energy wastages and manually controlling during mid night is impracticable. Also, dynamically tracking the light is manually impracticable. The current trend is the introduction of automation and remote management solutions to control street lighting.

GSM based street light monitoring & control system is an automated system designed to increase the efficiency and accuracy by automatically controlled switching of street lights. It consists of an ATmega32 microcontroller which on setting of time delays switches ON/OFF the street lights and sends the update through a server to the control centre. This is a smart way of managing street lighting systems. There are basically two modules which include the DCU and the server side. The DCU consists of the microcontroller which communicates with RF modules and is further connected to the GSM module. The server side consists of the JAVA based web server; it has a core engine which interacts with the user, database and the GSM communication manager.

Key benefits:

- Control street lights at feeder level or individual level.
- No additional cost of wiring.
- Find faulty lights.
- Schedule feature for ON / OFF.
- ON / OFF control for
    - Single lighting panels
    - Multiple fixture panels
- Centralized monitoring and control of lights.
- Integration with existing system.
- Single data concentrator shall support up to 300 lighting poles.
- Supports mesh network and hopping of data for large coverage of 100s of KMs.
- Electricity saving modes,
    - Time based scheduling and ON / OFF control with day light harvesting.
    - Override support to ON / OFF individual lights as required.
    - Light sensors input based control.
- Easy to install, plug-n-play retrofit solution.
- Secure cloud based graphical user interface for collecting real time data.
- Support to smart phone for monitor and control and alerts.
- Fault detection alarms and events using email / SMS.

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Specifications of the System

1. Functionality provided by the system:

It is an automated GSM based street light monitoring & control system designed to increase the efficiency and accuracy by automatically controlled switching of street lights. It consists of an ATmega32 microcontroller which on setting of time delays switches ON/OFF the street lights and sends the update through a server to the control centre. This is a smart way of managing street lighting systems. There are basically two modules which include the DCU and the server side. The DCU consists of microcontroller which communicates with RF modules and is further connected to GSM module. The server side consists of the JAVA based web server; it has a core engine which interacts with the user, database and the GSM communication manager.

2. System interfaces, inputs, and outputs:

- STREETLIGHT

Fig1

- DCU

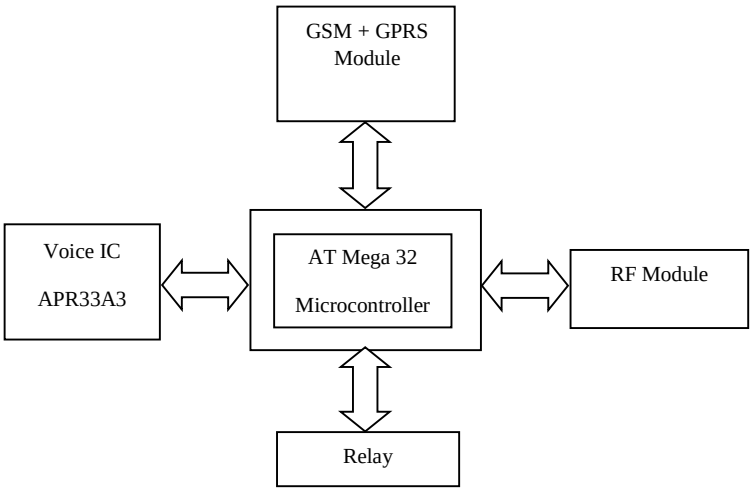

Fig2

3. EXPECTED OUTCOMES:

- To put discipline in the execution of the street lighting operation which will essentially introduce a saving in the power consumption of the utility.
- Scheduling for ON / OFF.
- Identification of faulty lights.
- Generation of various Reports

4. SYSTEM REQUIREMENT:

4.1 Hardware Requirement:

- ATMEGA32 Microcontroller:

  This would be a ATMEGA32 microcontroller with following features

- 10 bit 8 channel ADC
- 2 UART, 1 SPI, 1 I2C
- 8/16 Bit Timer
- 32kBytes Flash memory
- 1024 Bytes EEPROM
- Operating voltage 4.5-5.5V
- Pin out 44

- GSM/GPRS module:

  This would be a Quectel M95 Quad-band GSM/GPRS Module with following features

- Quad-band 850/900/1800/1900MHz
- GPRS Multi-slot Class 12, 1~12 configurable
- GPRS Mobile Station Class B
- Compliant to GSM Phase 2/2+ Class 4 (2W @ 850/ 900MHz) Class 1 (1W @ 1800/1900MHz)
- Supply Voltage Range 3.3~4.6V 4.0V nominal

- RF module:

  This would be wireless module working on radio frequency

  Below are the specifications of the same:

- RF frequency: 865 – 867 MHz (de licensed band in India)
- RF power: 16dBm
- RF standard: IEEE 802.15.4
- Shall support a smart mesh network
- Range: 500meters near line of sight, 80+ meters with one concrete obstacle.

- RF module baseboard:

  This would be a baseboard designed for connecting the RF to the external media. Below are the specifications for the same:

- Serial interface: RS232
- Shall support 2 relay output of 5A @ 230VAC
- Power supply: SMPS 230VAC to 3.3V DC @ 200mA
- GPIO for connecting external modem

- DCU:

This shall be a gateway device designed for making the system IOT enabled. It shall have a front-end of GPRS and back-end with RF. Below are the specifications of the same.

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- RF frequency**:** 865 – 867 MHz (de licensed band in India)
- RF power: 16dBm
- RF standard: IEEE 802.15.4
- Supports a Smart mesh network
- Supports GPRS for cloud connectivity
- SIM slot for GSM connectivity

4.2 Software Specification:

- Automatic time based ON/OFF.
- Supports configuration of lights.
- Supports manual ON/OFF the lights. By overriding the schedule.
- Dashboard to display present status.

SYSTEM ARCHITECTURE

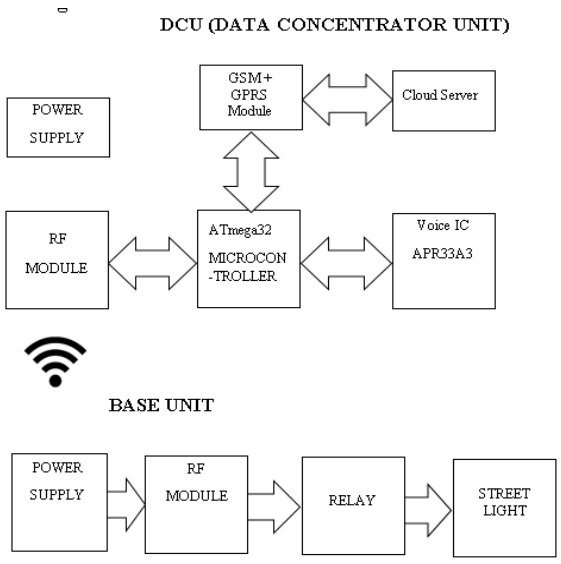

Fig3

Working of Proposed System

The base unit is to be fixed on the streetlight pole consists of a relay, driver circuit, the RF module, and power supply. It sends/receives the status signals to/from the data concentrator unit(DCU) through a radio frequency and performs the required action of on/off the streetlight.

The status signals sent by the base unit are received by the DCU thus these signals are processed by the microcontroller unit and stored in a flash memory. After all the processing task is finished this status data signals are transmitted to a cloud based application through GPRS technology so that the status of all streetlights can be monitored and controlled remotely.

CONCLUSION

Thus, the proposed system is described that integrates new technologies offering ease of maintenance and energy savings and it is appropriate for street lighting in remote as well as urban areas. Wireless networks may present a new solution to bring the installation cost down and to ensure energy efficiency. Over the past 10years many new RF solutions have been developed into our every-day life.

FUTURE SCOPE

- Various reports generation for analysis.
- Addition of CCTV's on poles can reduce crimes and theft.
- Because of this system losses of electrical energy will be reduced, due to this electrical energy demand will be reduced and will match to the generation.
- Fault finding will be very easy and it will be rectified within a stimulated time.

REFERENCES

We thought this project idea of implementing "STREET LIGHT AUTOMATION USING IOT" as all the cities are becoming smarter and smarter and initiative by the government for promoting smart city project.

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