Application of Real Time Clock (RTC Timer) integrated with GPRS in the Streetlight Management

Swanand D. Sant (*)

CEO, SRJ Systems, Mumbai

Suraj Sant

BE SY (Electronic & Telecommunication) Student, Atharva College of Engineering, Mumbai

---

Abstract: *The primary focus of this paper is on the application of RTC Timer considering industry 4 generation technology (IoT) in managing day to day functions of the streetlights, monitor the loses of energy and further planning of conservation of energy by using remote web applications. Today management is inclined toward the adoption of contactless systems which allow minimum manual intervention and achieve maximum precession in the work environment which attend minimum contact to avoid the spreading of COVID 19.*

This paper endures the proposed architecture of the implementation of the Streetlight management using the RTC micro controller tightly integrated with the IoT system and will be operated through the centralized web application from the central control room.

Keywords: GPRS, IoT, RTC, Real Time Tracking, Streetlight Management, GIS

1. INTRODUCTION

The complete application concept gives the monetary idea about Almanac Real-Time Clock microcontroller using I2C protocol which works in master-slave configuration developed using C language. A real time clock is basically just like a watch - it works on a battery and keeps date and time even when there is no power supply. Using a Real-Time Clock (RTC), it is possible to keep track of long timelines, even if microcontroller is reprogrammed or disconnected from serial bus or a power plug.

The RTC chip is a specialized chip that just keeps track of time. It can count leap-years and knows how many days are in a month, but it doesn't take care of Daylight Savings Time. With the application of Real time Clock (RTC) and Internet of Things (IoT) we can develop the Streetlight management system to benefit to society.

2. LITERATURE REVIEW

2.1. Internet of Things (IoT):

The Internet of Things describes the network of physical things that are rooted with GPRS, sensors, software, and some other technologies for the purpose of connecting and switching data with each and systems over the internet to operate distantly.

There are four generations of the technologies adopted by the industry in different technical eras. Industry four represents to the 4th industrialised rebellion, while it is concerned with areas that are not usually categorised as business applications such as smart cities.

- Generation 1:
  First generation revolution came in existence computerization or mechanization in Power sector and water sector
- Generation 2:
  Second generation revolution came in for mass production with assembly line by using electrical power
- Generation3:
  Third generation revolution came in with I formation technology with automation, which was a big platform for the evolution of generation four
- Generation 4
  This industry is the current growing industry in the full automation of the manufacturing and service industry both includes (Private and Government Sector), Following are the example of the industry four generation The internet of

things (IoT), The industrial internet of things (IIoT), Cyber-physical systems (CPS), Smart manufacture, Smart factories, Cloud computing, Cognitive computing, Artificial intelligence Machine Learning, Robotics

2.2. Real time Clock

The purpose of an RTC or a real time clock is to provide precise time and date. A real-time clock is an integrated circuit that contains a timer generated by a crystal oscillator that supplies the time of day and often with the date. RTC has a small memory on-chip that stores time and date description values. The time and date values are the years, month, date, hours, minutes, and seconds. In this modern era, an electronic device becomes smaller. The smaller size becomes a concern of electronic technology. Can be used for various applications. RTC is an electronic device in the form of an Integrated Chip (IC) available in various packaging options. It is powered by an internal lithium battery. As a result of which even if the power of the system is turned off, the RTC clock keeps running. It plays a very important role in the real time systems like digital clock, attendance system, digital camera etc. In applications where time stamp is needed, RTC is a good option.

Advantages of RTC:

- Errors in the RTC are negligible.
- Memory usage of RTC is low.
- The CPU usage is very low
- Efficiency of the System is high
- Low power consumption
- Frees the main system for time-critical tasks.
- More accurate
- Arrangement of battery backup which keeps the clock running even if there is power failure

One of the best examples where we can use RTC with the help of IoT are Street lights managements.

2.3. Streetlight Management

Street Light Management System (SSLMS) is very unique product in its kind to regulate the switching of public area lighting system automatically. It has facility to measure the electricity consumption, identify the Tampers & other Electrical conditions for optimum usage of Street lighting. A purpose of automated streetlight managing system using IoT will save the energy by reducing the electricity consumption as well as to reduce the manpower by precession work management. Streetlights are an essential part of any city since it facilitates better night visions, provided security on the roads, and exposure to public areas but it consumes a quite large proportion of electricity. In the manual streetlight system lights, it's powered from sunset to sunrise with maximum intensity even when there is sufficient light available. It ensures high reliability and excellent long-term stability. This work is implemented using a programmed. The work has achieved a better performance compared to the existing system.

Real Time Clock used timer (RTC based system) system) for Automatic On / Off operations based on variation in illumination levels needed during time period between sun set and sun rise next day. The manual mode of operation was eliminated as it was creating energy wastage due to human limitations and difficulty in timely on / off operations which needed movement of wireman over large distances causing time delays. So to avoid this delays we can use IOT system which can be operated from the centralized control room and mobile devices want this will help to identify and rectify the problems and conserve the energy and provide the better services efficiently. The most common RTC used is DS1307

2.4. Components of Entire System

- Smart Controller (RTC Timer)
- Integration Component
- Communication System
- Mobile App
- Web Application

3. OBJECTIV OF THE STUDY

The elementary objective of the paper is to comprehend that how RTC Controllers are utilized in the streetlight management and integrated with IoT for the purpose of energy conservation

4. METHODOLOGY OF STUDY

Secondary data collected from the various websites and real-time information from the M/s Mango's Enterprise and M/s Hertz Transelectro

5. RESULT AND ANALYSIS

5.1. Smart Controller:

Single chip ARM32bit controller-based design. Smart Controller is an industrial product exclusively designed to control the Real Time events based on the User requirements. The heart of the Smart Controller is a Real Time Clock which is controlled by a microcontroller. The RTC used is a precision clock with an accuracy of ±4 minutes per year. Four controlled outputs are provided which can be programmed to Activate or deactivate a process based on the ON/OFF timings. The user interface is provided through the 16x2 LCD Matrix Display and four Feather Touch Keys. Smart Controllers made user friendly and providing easy to use and easy to understand menu and is provided with some preprogramed Timings as per the user requirements. The Almanac Time for Switch ON and Switch OFF of lamps for the entire year has been programmed in to the controller. In case of the complete AUTO operation of the controller, the Switching ON and OFF of the outputs will be decided comparing the current time with the ON/OFF Almanac Time. Please refer Appendix 'A' for complete ON/OFF Almanac Time Table. The Smart Controller is GPRS enabled device which can get connected to internet through a GPRS / GSM Modem. All the AT commands required to initialize and establish a GPRS data connection as well as GSM connectivity through SMS are incorporated in the software of Smart Controller. The Smart Controller also can be interfaced to an industrial three phase power meter through RS-485 interface. The complete MODBUS protocol is implemented inside the controller for interfacing with industrial control and monitoring device. Dedicated RS232 and RS485 Ports in automatic and manual mode in case of failure and at command interface for GPRS modem

5.2. Parts of Smart Panel

- RTC Master Controller
- Modem-for IP address
- SMPS-for power supply
- Contactor
- MCB-to trip the overload
- Connectors-
- Meter-to control power factor
- CT- Current transformer
- GPRS-to locate the device
- Embedded Software

RTC Timer is the most important component of the entire system and works like a brain of the system it always checks the time in the clock given to him and also keeps the date information in the calendar given to him.

According to the chat provided in Almanac chart it automates to switch on and off to control the street lights according the sunset and sunrise which will star to save the energy

Using the mobile device and fitted model the provided power supply device collects the various information of current, voltage, wattage etc... In real-time to the centralized managed application

Following all parameters will be sent by the device in real-time

Table 1: Device in Real Time

Sr No	Parameters	Sr No	Parameters
1	Power On Time (HH:MM:SS)	16	Total switching panels
2	Power Off Time (HH:MM:SS)	17	Total switching panels with GPRS
3	Voltage at the selected time	18	Sunrise time - Date wise
4	Current at the selected time	19	Sunset time - Date wise
5	Wattage at the selected time	20	Power reset - Date and Time
6	Power Factor	21	Offset Time set "Date and Time"

7	VA	22	Panel's current host IP
8	Power loss per day	23	Panel's previous host IP
9	Power loss rate per day	24	Panel's current port no.
10	Lights On for extra duration	25	Panel's previous port no.
11	Lights Of for extra duration	26	Panel's current RTC ID
12	Power loss duration per day	27	Panel's previous RTC ID
13	Annual Energy Loss	28	Pole information
14	Annual Consumption (Actual kwh)	29	Pole material
15	Annual Cost of Energy Consumption	30	Pole replacement date

Centralized application will generate the statistical reports on the above parameters received in real time from the Microcontroller device fitted on the electric poles day to day and desired time basis

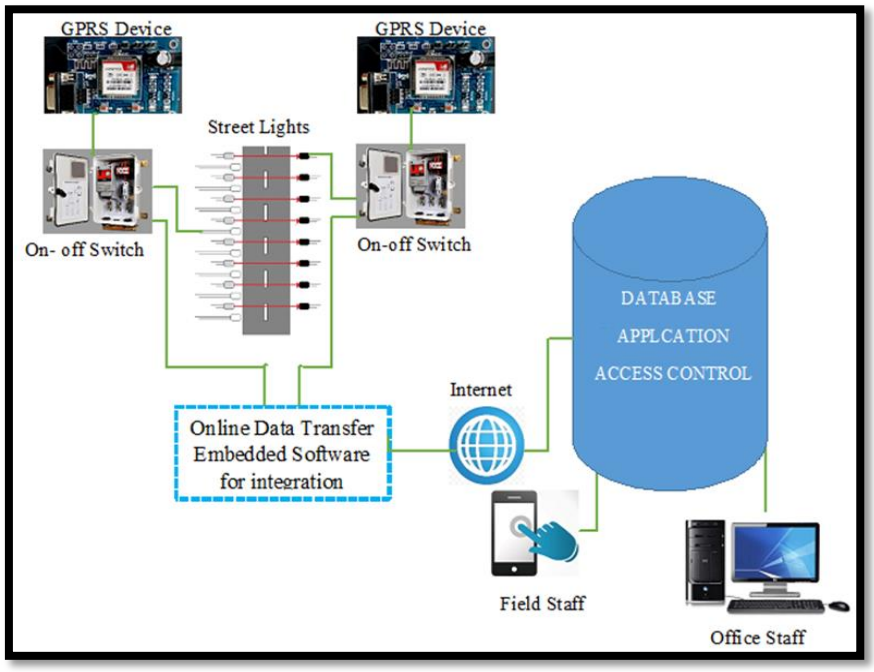

Figure 1: Proposed Conceptual Diagram

6. FACTS AND FIGURES

Sr No	Total street lights	14,000 SVL
1	No. of days during which power loss takes place (due to changeover of timer settings)	10
2	Power Loss duration per day	1.5 Hrs
3	Lamp rating	180 W (150 W + 30 W Ballast)
4	Annual Energy Loss @ Rs.3.70/kwh	14000 (Lamps) x 10 (days) x 1.5 (Hrs./Day) x 180 W _____ 1000 = 37800 kwh
5	Annual Cost of Energy Loss @3.70 / kwh Per Festival	**Rs.1,39,860/-**
6	Annual Cost of Energy Loss for 4 Festivals	**Rs. 5,59,440/-**

Table 2: Source: M/s Heartz Transelectro Vithalwadi, Ulhasnagar, 30.09.2020, "Streetlight Proposal"

1. Annual Consumption (Actual) = 90,48,624 kwh
2. Annual Cost of Energy Consumption @ Rs.3.70 /kwh = Rs. 3,34,79,910/-
3. Estimated 10% savings by way of Voltage Dimming = Rs. 33,47,991/-
4. Spare Consumption (approx.) = Rs. 1,00,00,000
5. Reduction of Spares Consumption by way of Voltage Controlling (@ 25%) = Rs. 25,00,000

Source: M/s Heartz Transelectro Vithalwadi, Ulhasnagar, 30.09.2020, "Streetlight Proposal"

Estimated Savings

1. Estimated Savings by elimination of 1 & ½ hrs. Extra time for 10 days = Rs. 5,59,440/-
2. Estimated Savings by elimination of 3 hrs. Extra time for 1/10th lights = Rs. 3,72,988//-
3. Estimated Savings by Voltage Dimming in Energy Consumption = Rs. 33, 47,991/-
4. Reduction in Spare Consumption by Voltage Dimming = Rs. 25, 00,000/-

7. BENEFITS OF THE SYSTEM

- Find faulty lights and faulty lines
- Program feature for switch ON and switch OFF of streetlights
- Switch ON and switch OFF mechanism for Single lighting panel's multiple fitting panels
- Centralized & distant monitoring and controlling of lights
- Amalgamation with current system of any of the technology platform
- Single data controller shall support up to "N" lighting poles.
- Power saving modes, Time based scheduling and switch ON and switch OFF control with day light harvesting. Override support to switch ON and switch OFF individual lights as required. Light sensors input based control.
- Cloud based or data centre implementation services
- Support to any smart phone both iOS and Android
- Failure recognition alarms and events

8. CONCLUSIONS

The project will deliver a wireless working system for street light management which will increase its efficiency of work with very minimal errors as in many states of India there is still power generation issues so we need to do the conservation of power. Only citizen is not responsible to save the energy but the administration has to take an initiative to implementation of such schemes which will support the conservation of energy and simultaneously will save the cost incurred over utilization of electric power by monitoring the various technical parameters such as voltage, wattages, current, leakages etc...

Further COVID 19 situation is demanding the contactless system and minimum manpower movement is in demand and hence will change in the direction for implementation of Location based IoT systems in India.

Using the RC Timer, IOT system are integrated with the Communication operated with the centralized control room this concept will bring the revolution in the streetlight management in the smart e-governance and smart city concepts.

9. REFERENCES

1. Konstantin Prodanović, May 17, 2019 **"The public sector will bring the IoT into the mainstream"**
2. Kiran Rawat, Kanika Sahni, Sujata Pandey, Jyoti Rawat and SudhanshuTripathi, "**Implementation of AMBA APB bridge with efficient deployment of system resources**", 2015 International Conference on Computer, Communication and Control (IC4), 10-12 Sept. 2015, Indore, India
3. https://www.twi-global.com/what-we-do/research-and technology /technologies / industry-4-0
4. M.N.A.M. Alias, S.N. Mohyar, M.N. Isa, A. Harun, A.B. Jambek, S.A.Z. Murad, **"Design and analysis of dedicated Real-time clock for customized microcontroller unit**". Indonesian Journal of Electrical Engineering and Computer, Science Vol. 14, No. 2, May 2019, pp. 796~801
5. M/s Mango's Enterprise, November 2020, Proposal on **IoT Based GIS Enabled Streetlight Management System99**
6. M/s Heartz Transelectro Vithalwadi, Ulhasnagar, 30.09.2020, **"Streetlight Proposal"**

7. M/s EL Measure Bangalore 02.12.2017, **"The Streetlight Management"**

8. Mohd Alias, M.N.A., Mohyar, S.N. "Architectural design proposal for a real-time clock for wireless microcontroller unit" (2017) EPJ Web of Conferences, 162, art. no. 01072

9. Songyan Xu, Ratnesh Kumar, **"Real-Time Control of DenseTime Systems Using Digital-Clocks",** IEEE Transactions on Automatic Control, Vol. 55, No. 9, **September 2010**

10. NajibGhatte, Vinit Pereira, MadurDattaprasad, TusharSurwadkar, Real-Time Clock Implementation Using I2C Protocol Check, International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, Vol. 3, Issue 1, January 2014

11. Ulrika H. Westergren, Katrin Jonsson, Ott Velsberg March 2019 UMEA University "**Internet of Things in the Public Sector Perspectives from Northern Europe"**