GSM Based Smart Street Light Monitoring and Control System

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Abstract— **A Street light, lamppost, street lamp, light standard, or lamp standard 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 includes: prevention of accidents and increase in safety. Studies have shown that darkness results in a large number of crashes and fatalities, especially those involving pedestrians; pedestrian fatalities are 3 to 6.75 times more likely in the dark than in daylight. Street lighting has been found to reduce pedestrian crashes by approximately 50%.A number of street light control systems have been 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 have been developed as well as compatible hardware for most types of lighting**. **The control center will deal with thedata so that it can know the situation of each streetlight. According to the result the control center gives orders to each streetlight to control the switch state and illumination of them [1]-[2]**.

Keywords- Street lights, remote monitoring, GSM technology.

I. INTRODUCTION

GSM based street light monitoring & control system is an automated system designed to increase the efficiency and accuracy of an industry by automatically timed controlled switching of street lights. GSM based street light monitoring & control system consists of an 89C51 microcontroller [1] which on setting of time delays switches ON/OFF the street lights and sends the update through a phone to the specified phone number. This is smart way of managing street lighting systems. There are basically two modules which include the client side and the server side. The client side consists of the GSM modem which is further connected to the microcontroller. 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 [3].

II..IMPLEMENTAION OF THE SYSYTEM

GSM based street light monitoring & control system is an automated system designed to increase the efficiency and accuracy of an industry by automatically timed controlled Switching of street lights. This project describes a new economical solution of street light control systems. The control system consists of a GSM Modem, and control circuitry and the electrical devices. This also includes client server mechanism where user can directly interact with web based application to control the Street light of any place from single position. Base server will running a Java Web Application which will maintain complete street light recode of City/State/Country. When we want to switch ON/OFF any particular street light, server will send a GSM SMS to that street controller to take necessary action. Street light controller will receive that SMS and will decode it and finds the particular street light which needs to put ON/OFF using relay circuit. Here the street controller 89C51 is connected to GSM modem through its UART port (Serial Ports). 89C51 cannot talk to GSM modem directly due to mismatch

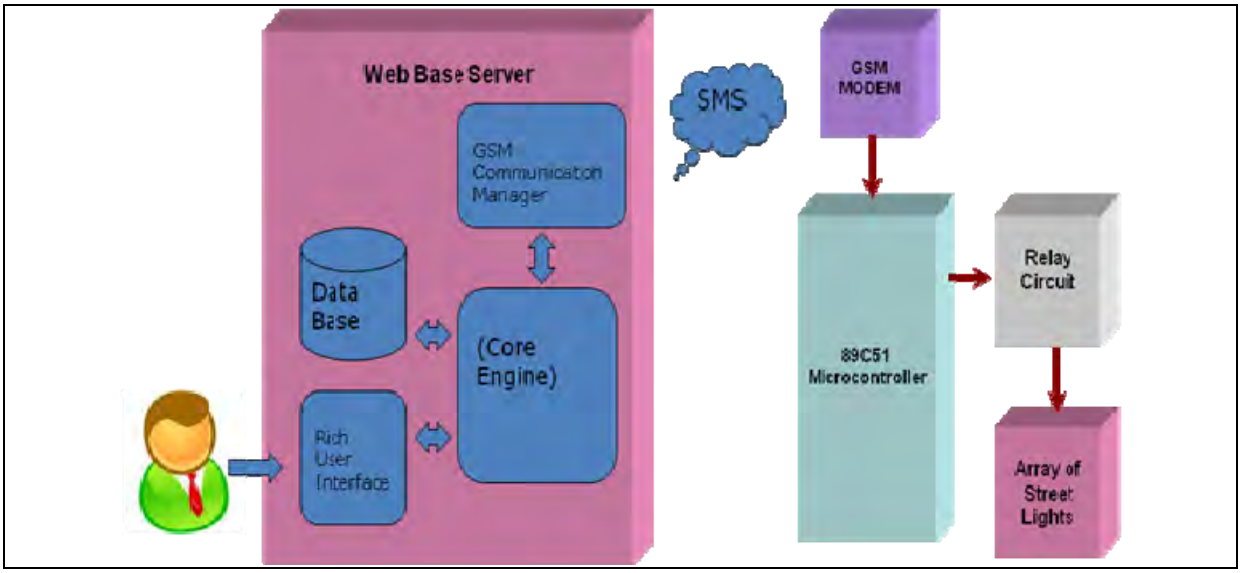

Figure 2.1. System Architecture.

in voltage levels. So GSM modem is connected through voltage level convertor MAX 232. Only 2 lines RX & TX are connected to the MAX 232.The MAX232 is connected to GSM modem via RS 232 cable [1]. An oscillator circuit of 4 MHz is connected to the 89C51. One of the port of 89C51 is connected to relay driver circuit which will help 89C51 to switch power ON/OFF of the street lights.89C51 will continuously reading the serial port after every second for new SMS. Ones the SMS came it will try to fetch that SMS from GSM modem using AT commands. It will then decode the will decode it and finds the particular street light which needs to put ON/OFF using relay circuit. The entire street light lamps are connected to relay driver circuit. Base server will running a Java application which will maintain complete street lighting details of the city. When we want to switch ON/OFF any particular street light, server will send a GSM SMS to that street controller to take necessary action. Further, with the rapid development of mobile communication technology, mobile phone not only can be used to call or send short messages, but also as a smart tool, through which one can browse the web pages, send and receive e-mails, can view notifications and alerts via android applications and connectivity facilities. This system provides its users a very flexible and portable facility of viewing the notifications with the help of their android devices having basic connectivity feature [5, 6].

III. WORKING SCENARIO OF PROPOSED SYSTEM

The actual working of the system can be clear by studying following state transitions of the proposed system.

$$S_0 \xrightarrow{\substack{Authentication \\ Successful}} \{Access\ Available\} \quad S_0 \longrightarrow S_1$$

When authentication is successful, access to the system is made available. A transition from S_0 to S_1 is observed. Else if authorization fails system terminates and checks for another valid authorization until success.

$$S_1 \xrightarrow{\substack{Authentication\ Succesful \\ Area\ Selected}} \{Data\ Stored\ in\ D_n\} \quad S_1 \longrightarrow S_2$$

On successful login, i.e. state S_1, The user is supposed to select an area from the Maps .The data is stored in D_n and state transits from S_1 to S_2.

After selecting the Area, the required pattern is chosen and the pattern along with the data is sent to the transfer controller. The transition is observed from S_2 to S_3.

$$S_2 \xrightarrow{\substack{Data\ Fetched \\ And\ Pattern\ Selected}} \{Sent\ to\ Controller\ T_n\} \quad S_2 \longrightarrow S_3$$

The transfer controller stores this data in its database. Then it sends this information in the form of an SMS to the street server. The transition is observed from S_3 to S_4.

$$S_3 \xrightarrow{\substack{Stored \\ In\ The\ Form\ Of\ Message}} \{Message\ received\ \text{at}\ S_n\} \quad S_3 \longrightarrow S_4$$

The data fed to server is implemented by the server and the corresponding street controlling is observed. The state transition is seen as S_4 to SUCCESS state.

$$S_4 \xrightarrow{\substack{Information\ via \\ Message\ (SMS)}} \{S\ U\ C\ C\ E\ S\ S\}\ \mathbf{S}_4 \longrightarrow \mathbf{S}_5$$

The State transition Diagram is as follows:

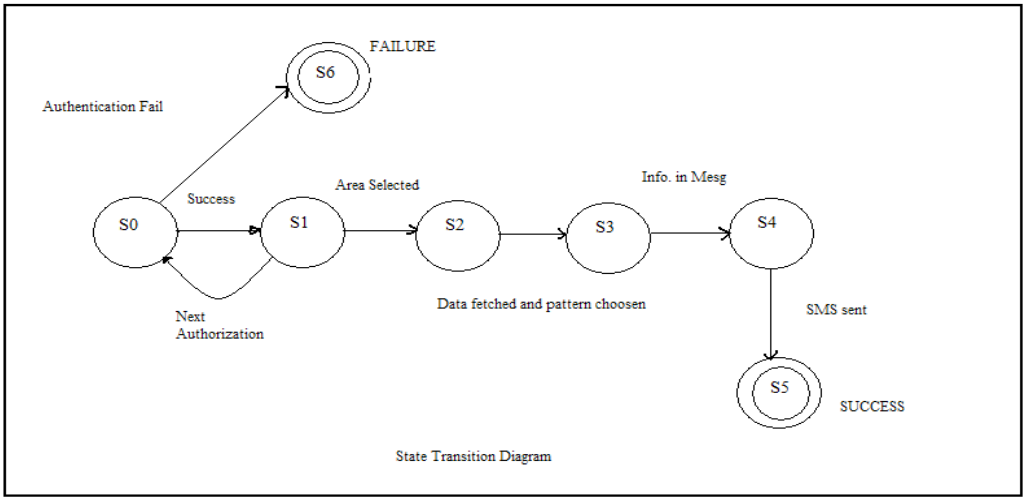

Figure.3.1.State Transition Diagram

IV.MAIN BENEFITS OF THE SYSTEM

Base server can control the whole city's street lights through a single point of control and can control energy consumption. As street lights can be switched ON/OFF according to the requirement, at the specific location, effective use of energy is achieved. It is a reliable and a low cost communication mechanism. It can bring up easy deployment so as to integrate with the current system. Streets lights can be switched on or off in alternate patterns also. Ease of installation is there. There are no hidden engineering costs. It is highly scalable. You can add nodes anywhere in the network and the network software will look after the connections for you. Dimming of lights according to the required intensity is possible [8]-[9].

V.APPLICATION OF SYSTEM

As we have suggested that the system is built to provide Remote access to Street Lights by accessing them just through a server. The system is thus built to save the power consumption of the area under the system. This power can be diverted to different areas under load shedding and attempt to reduce the problem of load shedding can be achieved.

VI.FUTURE SCOPE AND CONCLUSION

For further development, a 2-way communication can be possible i.e. from server to client and from client to server. Android/IOS based applications can be developed for Smart Tabs/Mobile Phones making mobility of control possible. We have put forth a technical solution for implementation of wireless intelligent smart street lighting system. It provides a low cost infrastructure for managing municipal street lighting system. A single point controlling of street lights. Energy consumption can be controlled making it eco-friendly in usage.

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