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Smart City- Automation system of Electricity Supply

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Abstract **— This project of "Smart City- Automation system of Electricity Supply" is developed with keeping in mind the idea of a smart city which is made for making energy consumption smart and efficient. A smart city is the one in which people consume energy resources made available to them in a wise way thereby avoiding unnecessary wastage. Much of this wastage takes place in the consumption of electricity within a city which can be prevented by making use of the concept of automation. In this project we aim at presenting a way of automating energy supply to the city by using the technology of "PLC (Programmable Logic Controller) & SCADA (Supervisory Control and Data Acquisition)". By the means of PLC and SCADA we not only can control and monitor the electricity supply but can also create database and record real time data of the power being consumed. This proves to be an efficient way of keeping the use of energy under the smart borders. Not only this, but the project also aims at calculating the differences between distribution losses that take place within a smart city area so that it could be controlled and monitored for errors and malfunctioning.**

Keywords— Automation, Distribution losses, Electricity supply, PLC and SCADA, Smart city, Traffic control monitoring system.

I. INTRODUCTION

A smart city makes use of digital or information technologies to enhance and upgrade production of built-up services, to decrease Expenses and energy resources consumption [1]. Sections of the society adapting smart technologies include government organizations, transportation services and traffic control and management, power management, health care services and water supply services. Smart city applications and services responses to challenges. A smart city may therefore provide better ways of energy consumption and lead to the efficient use of exhaustible resources such as electricity.

II. PLC AND SCADA

A programmable logic controller (PLC) is a digital electronic device used for automation purposes such as command over machines in industrial equipments, amusement park rides that work completely on automation, or light fixtures in public utilities etc. Unlike traditional computers, the PLCs control and monitor multiple inputs and outputs and are tolerant to extreme temperature ranges and their impacts. Programs that control machine operation are stored in battery-driven or non-transient memory [2].

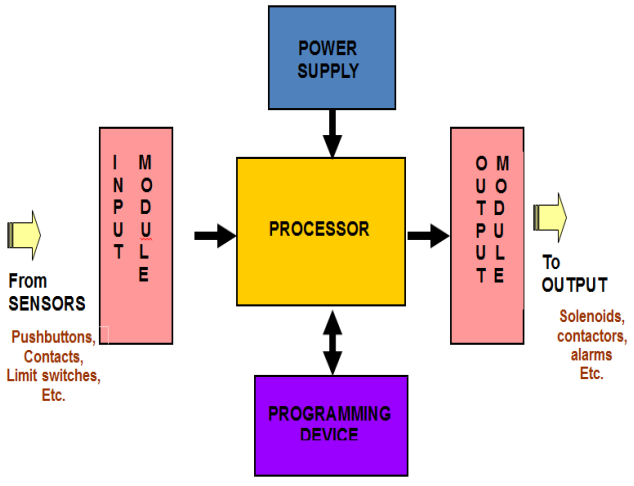


Fig.2.1: PLC system

A PLC Contains:

- Programmable Controllers
- Ladder Logic

- CPU or processor
- Input and Output Systems
- Programmable and detachable Devices.

SCADA stands for Supervisory Control And Data Acquisition. [2] According to its name, it is not a pure standalone software however needs to be used along with PLC as it is a supervisory control software application package. It works above the hardware with which it is interfaced. This hardware generally tends to be PLCs in most cases or other commercial hardware equipments such as RTUs.

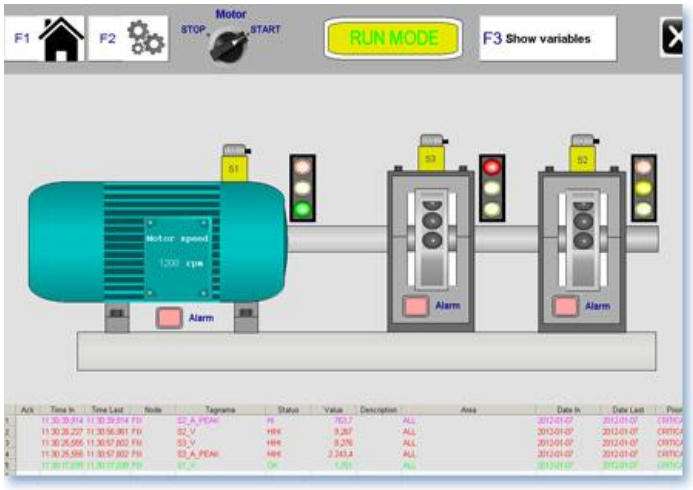


Fig.2.2: Example SCADA System

III. RELATED WORK

The intelligrid project in North America has invented a term called "Advanced Distribution Automation" abbreviated as ADA. [3] It is to elaborate the extended version of controlling the electric distribution grid to the distribution level and further. Its aim is to involve automation in distribution of electricity which is possible via the idea of a smart grid. The electric distribution grid is separated logically into two parts- transmitting systems and distributing systems. Transmitting system function above 110Kv while the distributing systems need lower voltages to operate. The real-time assessment capabilities of such grids help in overcoming a wide spectrum of problems. Automation plays a major part in the development of smart grids. These intelligent grids are able to function with minimal human intervention as they can themselves detect faults and errors in the distribution network and accordingly take corrective measures. However, smaller establishments such as societies and households are not possible to be controlled by these.

IV. BENEFITS OF USING AUTOMATION

Efficiency of operation: By including the central equipment in SCADA, it can be guaranteed that the entire network is being used efficiently and effectively. This ensures real-time monitoring of the output devices and eases control over them.

Promoting green environment: The remote controlling and monitoring of the entire network reduces the carbon dioxide emissions from vehicles as it abolishes the need to travel.

Short time for payback of investments: Investments made in the power distribution have a major impact on the smart grid systems and the savings that are done using them, which is due to lesser distribution obstacles along with more methodical grid functionality. As a result there is managerial improvement due to the usage of device state analysis functions.

Adapting the ever changing requirements: A smart city needs to adapt with the ever-changing demands of the citizens it comprises of, offering a long-term solution. A smart grid for power transmission can be developed step-by-step and aimed at those elements that are most influential upon its citizens. [1]

V. PROPOSED SYSTEM

This project is developed keeping in mind the concept of smart city focuses on smart consumption of electricity by the means of automation. This automation can be provided by making use of PLC (Programmable Logic Controller) and SCADA (Supervisory Control And Data Acquisition).By making use of PLC and SCADA mechanism, we have demonstrated automated control of electricity to public lights and traffic signal controlling. Not only this but we have also maintained databases to record the turning on and turning off time of the street lights and traffic signals in-order to track any kind of anomalies. We can also monitor and control systems remotely via SCADA interfacing. Other than this we have also made use of meters to show the difference of current drop over the distribution of electricity in households on 230v AC to track distribution losses in power supply.

As shown in the figure, a PLC system is the pivot of this entire system. Here the PLC is responsible for monitoring and controlling the street lights and traffic signals. Also, it takes input from the meters in order to calculate the power losses being encountered during distribution of electricity in the households.

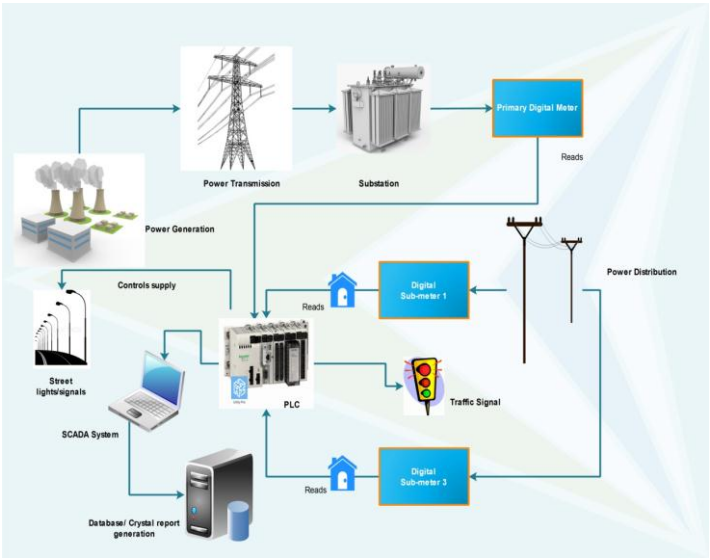


Fig.5.1: System Architecture

The streetlights and signals can not only be controlled through the PLC via the PLC panel but for ease and convenience, remotely operating the entire power distribution can be possible via the SCADA graphical user interface wherein the operator can monitor the public electricity distribution remotely via a personal computer or even a laptop that maybe connected through a Wi-Fi network as well.

VI. COMPARISION OF EXISTING AND PROPOSED SYSTEM

Sr. No.	PARAMETER	ANALYTICAL ANALYSIS	COMPUTATIONAL ANALYSIS
1	Automation of electricity supply	Absent	Present
2	Controlling of traffic signals	Mechanically or using microcontrollers	Through PLCs
3	Use of sensors for operating power ONs and OFFs	No sensors used for turning ON and OFF power supply	Photo sensors used for turning OFF lights when sun is up and no lights are needed
4	Remote monitoring via SCADA systems	Not possible in current system	Possible in built system
5	Maintaining real time database of turning on and off lights and signals	Not applicable	Applicable
6	Use of meters to detect current in distribution of electricity	Absent	Present

Table 6.1: Comparing the proposed and existing system

In this table of comparison, we have tried to show the differences between functionality in the current system and our proposed system. These differences are encircled around the concept of automation making use of PLC and SCADA systems for controlling and monitoring the entire distribution system which is not done in the current scenario.

Also currently, the database reports of the overall power consumption is not taken into account due to which unnecessary consumption and wastage of electricity does not come into notice by the board of electricity thereby leading to inefficient usage of the power. In order to be smart, the city's functional bodies, one of them being the electricity board needs to be well acquainted with the city's power consumption and make sure no wastage is done as it is an essential resource that cannot be wasted unnecessarily. These databases bring the cities one step closer to being smart and knowing their consumption levels.

The use of meters for calculating the power being released by the distribution lines and the power being actually utilized after distribution brings into notice the distribution losses that are a major concern for electricity distributors as huge electricity losses appear at the distribution phase of electricity supply that goes unnoticed. The proposed plan eliminates this problem by calculating the differences between the power supplied and the power utilized.

VII. IMPLEMENTATION

In this project we have used ladder logic programming in order to implement PLC functionality for operating our street lights and traffic control model. In order to operate the traffic and street lights remotely, we have made use of SCADA graphical user interface.

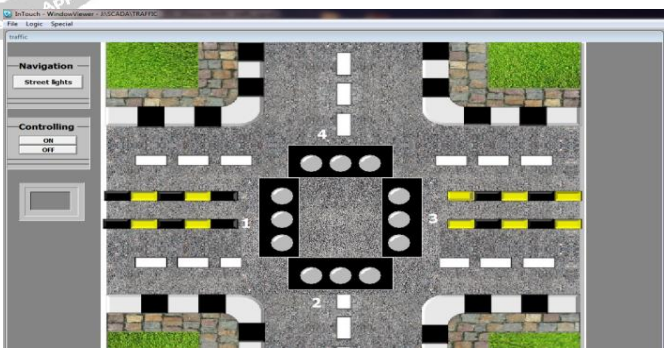


Fig. 7.1: Traffic signal monitoring

Fig. 7.1 is the SCADA GUI for controlling and monitoring the traffic signal lights remotely. Fig. 7.2 is the SCADA GUI for controlling and monitoring the street lights. These are windows forms that are designed using In touch wonder ware window maker version 10.1.

Database of the traffic signal and street lights has been created using SQL server 2008. The ON time and OFF time of the traffic signal as well as street lights are recorded through SCADA systems in the form of database tables in figures 7.3-7.6:

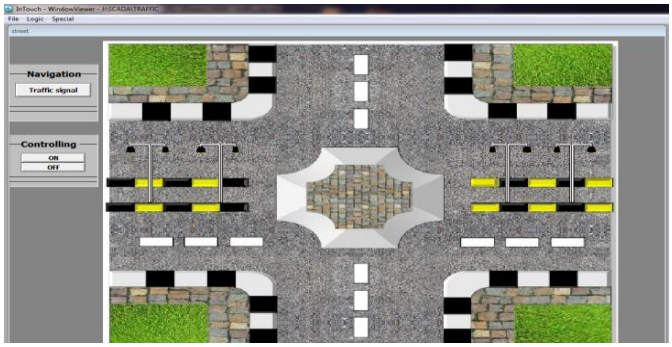
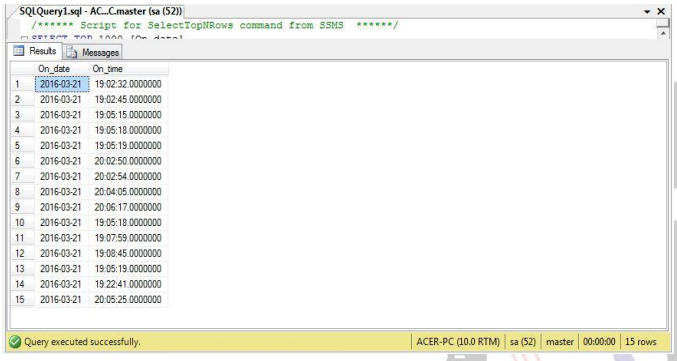
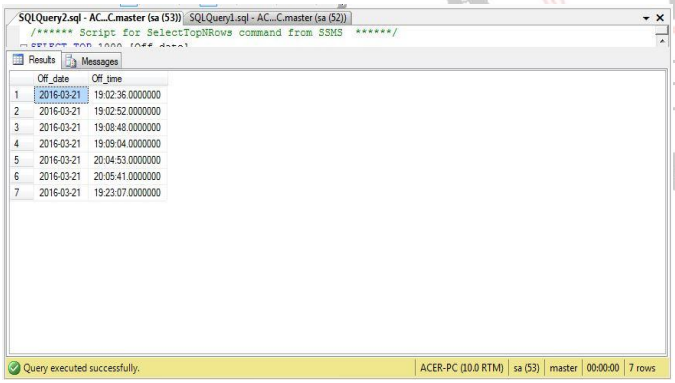


Fig 7.2: Street light monitoring



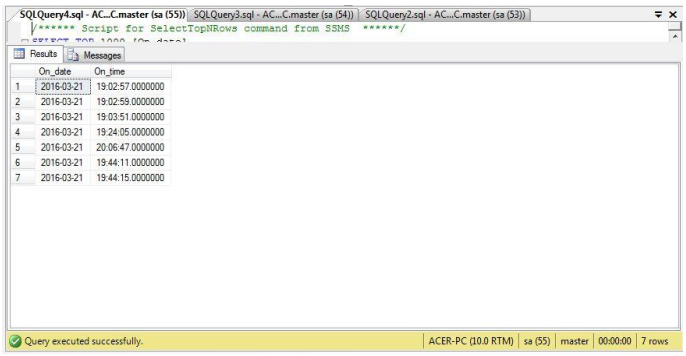
	On_date	On_time
1	2016-03-21	19:02:32.0000000
2	2016-03-21	19:02:45.0000000
3	2016-03-21	19:05:15.0000000
4	2016-03-21	19:05:18.0000000
5	2016-03-21	19:05:19.0000000
6	2016-03-21	20:02:50.0000000
7	2016-03-21	20:02:54.0000000
8	2016-03-21	20:04:05.0000000
9	2016-03-21	20:06:17.0000000
10	2016-03-21	19:05:18.0000000
11	2016-03-21	19:07:59.0000000
12	2016-03-21	19:08:45.0000000
13	2016-03-21	19:05:19.0000000
14	2016-03-21	19:22:41.0000000
15	2016-03-21	20:05:25.0000000

Fig. 7.3: Street_on database table



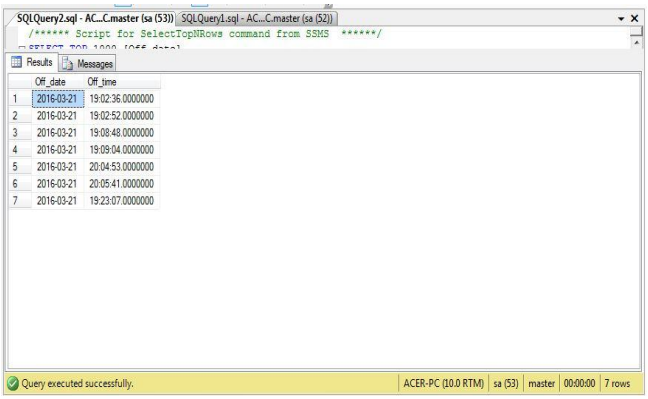
	Off_date	Off_time
1	2016-03-21	19:02:36.0000000
2	2016-03-21	19:02:52.0000000
3	2016-03-21	19:08:48.0000000
4	2016-03-21	19:09:04.0000000
5	2016-03-21	20:04:53.0000000
6	2016-03-21	20:05:41.0000000
7	2016-03-21	19:23:07.0000000

Fig. 7.4: Street_off database table



	On_date	On_time
1	2016-03-21	19:02:57.0000000
2	2016-03-21	19:02:59.0000000
3	2016-03-21	19:03:51.0000000
4	2016-03-21	19:24:05.0000000
5	2016-03-21	20:06:47.0000000
6	2016-03-21	19:44:11.0000000
7	2016-03-21	19:44:15.0000000

Fig. 7.5: Traffic_on database table



	Off_date	Off_time
1	2016-03-21	19:02:36.0000000
2	2016-03-21	19:02:52.0000000
3	2016-03-21	19:08:48.0000000
4	2016-03-21	19:09:04.0000000
5	2016-03-21	20:04:53.0000000
6	2016-03-21	20:05:41.0000000
7	2016-03-21	19:23:07.0000000

Fig. 7.6: Traffic_off database table

The information in these tables gets automatically inserted when the signals and street lights are turned on via the SCADA interface.

VIII. CONCLUSION

A smart city makes use of digital or information technologies to enhance and upgrade production of built-up services, to decrease Expenses and energy resources consumption. This project implements the idea of a smart city using automation. Automation makes it easier to measure inputs from the external devices such as digital meters, monitor and control the output devices such as streetlights and traffic signals. This project also enables to detect power losses in the distribution phase of electricity supply. We can also monitor the electricity consumption based on the database and crystal reports generated by the system.Keeping this application in mind, we can safely conclude, that this is a successful implementation of the electricity supply automation system using PLC and SCADA.

IX. FUTURE SCOPE

In future we can implement traffic signal based on proximity sensor and operate the traffic signal according to the traffic condition. We can limit electricity supply to a particular area, if the limit exceeds there will be a current cut off due to which the citizens shall consume electricity in limits where they will not waste the electricity. Bill will be mailed and sms will be sent about the mail. This will help citizens to remain updated about their bills and schedule their bill payments accordingly. As manual billing will be replaced by automatic bills, physical work will be reduced leading to less consumption of fuel and in turn lead to a greener and friendlier environment.

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REFERENCES

[1] ABB Medium Voltage Products: "Smart Distribution Solutions for Urban Networks| Smart City Distribution Solutions" Smart_City_Power_Distr_broch_758009_LRENa_without_pocket _for_web.pdf.

[2] P.Thamarai, R.Amudhevalli "Energy-monitoring-systems-using-PLCs-SCADA" www.neelb.org.uk/_resources/assets/attachment/full/0/6995.pdf.

[3] Paul Hasse: "Intelligrid project in North America"mydocs.epri.com/docs/CorporateDocuments/EPRI_Journal/2005-Fall/1012885_IntelliGrid.pdf

[4] Martin Liska, Dominik Viglas, Frantisek Janicek, Anton Belan, "Excellence Laboratory of Smart Grids"wseas.us/e-library/conferences/2015/Dubai/ABIC/ABIC-20.pdf.

