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Study of Smart Street Lights for Smart Cities

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ABSTRACT: Streetlights are among a city's strategic assets providing safe roads, inviting public areas, and enhanced security in homes, businesses, and city centers. However, they are usually very costly to operate and they use an average 40 percent of a city's electricity spending. As the cost of electricity continues to rise and as wasting energy is a growing concern for public and authorities, it's becoming crucial that municipalities, highway companies and other streetlight owners deploy control systems to dim the lights at the right light level at the right time, to automatically identify lamp and electrical failures and enable real time control. This paper describes a new economical solution of street light control systems. We wanted to provide IP address to street lights (IOT) so that base server can control the whole city's street lights using internet. The motive behind implementing this paper is to save energy.

KEYWORDS: Street Lights, Control Systems, IP address, Internet of Things (IOT).

I. INTRODUCTION

India has a road network of over 54,72,144 kilometers as on 31 march 2015, the second largest road network in the world. According to official statistics India has 35 million street lights which generate a total demand of 3,400 MW intensity of light. However, this usage of electricity can be minimized and brought under control and a large amount of electricity can be saved by using certain techniques. The situation of electricity shortage is increasing day by day in India therefore there is a need to take certain steps to overcome these problems. This paper describes a new economical solution of street light control systems. The control system consists of wireless technology. Base server can control the whole city's street lights by just sending a notification using network. The main motive behind implementing this paper is to save energy. Energy wastage: - The main motivation behind implementing this paper to save energy. Manual control of Street Light: - Monitoring and control is an auto- mated system designed to increase the efficiency and accuracy of an industry by automatically timed controlled switching of street lights. Describes a new economical solution of street light control systems.

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II. LITERATURE SURVEY

Sr No.	Title	Publication	Technique Used	Comments
1.	Internet of Things for Smart Cities	IEEE, 2015	Given IP address to each streetlight and manages those IP through Cloud	<ul style="list-style-type: none"> - Very complex design - Huge Infrastructure needed
2.	Remote-Control System of High Efficiency and Intelligent Street Lighting Using a ZigBee Network of Devices and Sensors	IEEE, 2013	- Short range ZigBee technique is used for communication	<ul style="list-style-type: none"> - Range issue - Lot of HW needed for controlling and monitoring
3.	Design and Development of Intelligent Wireless Street Light Control and Monitoring System Along With GUI	IEEE, 2013	- WIRELESS ZIGBEE NETWORK	<ul style="list-style-type: none"> - Range issue - Desktop based application

Sr No.	Title	Publication	Technique Used	Comments
4.	Optimization of Standalone Street Light System with Consideration of Lighting Control	IEEE, 2013	- Considered only Standalone Street Light System	- Can't be used for switching of arrays of streetlights
5.	GSM Based Autonomous Street Illumination System for Efficient Power Management	International Journal of Engineering Trends and Technology, 2013	- Use of GSM (SMS) technique to control streetlights	<ul style="list-style-type: none"> - Network issue - Use of costly GSM modem per streetlight.
6.	E-Street Zone-Automatic Streetlight based on the Movement of Vehicles	Indian Journal of Science and Technology	- Every Street light can be integrated with an IR sensor which detects the movements of vehicles	<ul style="list-style-type: none"> - Costly - Impractical

III. METHODOLOGIES/ALGORITHMS DETAILS

Introduction

System Features This paper 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. Base server can control the whole city's street lights by just sending an SMS to GSM network. The main motive behind implementing this paper to save energy.

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Also, we can automate daily required electrical switching using this paper. We have provided following features into our system:

1. Admin side authentication and client registration.
2. Password Secure database.
3. Database connection polling technique used to efficiently used database connections.
4. Client-side android application to access assignment notice details.
5. REST over HTTP Standard communication technique is used for Client-Server communication.
6. Data is encrypted using standard base64 algorithms.
7. Modular software design approach so that system can be updated easily re software architecture used as coding style.
8. Fault detection.

Modules

1. Web based GUI: Server will be web based application and this module will be responsible to take inputs from admin. The gui is developed in HTML and Java-script Our server input will be taken through this GUI where proper validations are supported. This includes new student registration, new assignment upload, etc.
2. Database Manager: This module will help to handle all database related activity. All the SQL queries will be taken care in this module. A database connection polling system will be present to avoid repeatedly opening and closing database connection. The JDBC driver manager ensures that the correct driver is used to access each data source. The driver manager is capable of supporting multiple concurrent drivers connected to multiple heterogeneous databases.
3. Communication Manager: Communication Manager will handle the client server communication part. We have used REST over HTTP Standard communication technique for communication. REST stands for Representational State Transfer. (It is sometimes spelled "ReST".) It relies on a stateless, client-server, cacheable communications protocol – and in virtually all cases, the HTTP protocol is used. REST is an architecture style for designing networked applications. The idea is that, rather than using complex mechanisms such as CORBA, RPC or SOAP to connect between machines, simple HTTP is used to make calls between machines.
4. Assignment Notice Logic: This module handles all assignment and notice related logic. It also uniquely maintains each transaction sessions so that it can differentiate each system user. It takes help of database manager to complete all its transaction related database commits. It fetches records from database as per student's class and type of request.
5. System Configuration: The configuration manager which will be holding IP address of the entire client will be singleton in nature. The singleton pattern is a design pattern that restricts the instantiation of a class to one object. This is useful when exactly one object is needed to coordinate actions across the system.
6. Encryption/Decryption Module: Base64 encryption/decryption technique has been implemented in system. This module will handle all encryption and decryption logic of all types. This encryption is applied on database where each user's password is stored

Algorithms in Details

Steps of Algorithm

- 1. Login system admin
- 2. Add, remove operational admin
- 3. Login for operational admin
- 4. Read latitude and longitude
- 5. Add Location
- 6. Add junction
- 7. Apply scheduling pattern
- 8. LDR will detect faulty streetlights
- 9. Dynamic control

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We are using some standard algorithm.

1. Base 64
2. NDEF
3. Encryption/Decryption
4. AES (Advance Encryption Standard Algorithm)

1. Base 64 Algorithm: • Is a group of similar binary-to-text encoding schemes that represent binary data in an ASCII string format • By translating it into a radix-64 representation.

2. • The general strategy is to choose 64 characters that are both members of a subset common to most encodings, and also printable

3. • The particular set of 64 characters chosen to represent the 64 place-values for the base varies between implementations.

4. • The ratio of output bytes to input bytes is 4:3 (33 • We used this algorithm to encrypt user's password which is saved present in server database

2. NDEF Algorithm (NFC Data Exchange Format)

• The NFC Data Exchange Format (NDEF) specification defines a message encapsulation format to exchange information, e.g. between an NFC Forum Device and NFC Forum Tag

• NDEF is strictly a message format, which provides no concept of a connection or of a logical circuit, nor does it address head-of-line problems.

• The NDEF specification defines only the data structure format to exchange application or service specific data in an interoperable way, and it does not define any record types in detail record types are defined in separate specifications.

• When an NFC Forum Device is in proximity of an NFC Forum Tag, an NDEF message is retrieved from the NFC Forum Tag by means of the NFC Forum Tag protocols. The data format of the NDEF message is the same in these two cases so that an NFC Forum Device may process the NDEF information independent of the type of device or tag with which it is communicating.

3. AES (Advanced Encryption Algorithm)

4. SHA256(Hashing)

IV. EXPERIMENTS

Software Testing

Testing process to be followed: The testing process highlights the broad-level phases to be executed. Each of these phases has series of steps to be executed. The various broad-level phases have been described below:

1. Identify the requirements to be tested. All test cases are derived using the current Design Specification.
2. Identify the expected results for each test.
3. Identify the testing-related equipment's and reference document that are required to execute the testing process.

Setup the test environment.

4. Test Design.
5. Test Execution

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V. RESULTS

Test Cases and Test Results

Test Case ID	1
Test Case Description	Verify that system provide system admin user to create Operational admin logins
Steps	1.Install Application. 2. Start Application. 3.Navigate to Home Page. 4.Navigate to Login page. 5. Do Login

Use Case Table 1

Expected Results	System provides system user to create operational admin logins.
Action Results	System provides system user to create operational admin logins.
Status	Pass.

Use Case Table 2

Test Case ID	2
Test Case Description	Verify that proper error messages get displayed in error scenario
Steps	1. Install Application. 2. Start Application. 3. Navigate to Homepage. 4. Navigate to Login. 5. Do Login.

Expected Results	proper error messages get displayed in error scenario
Action Results	proper error messages get displayed in error scenario

Use Case Table 3

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Test Case ID	3
Test Case Description	Verify that system should sent SMS on operational admins phone number for his login details
Steps	<ol style="list-style-type: none"> 1. Install Application. 2. Start Application. 3. Navigate to Homepage. 4. Navigate to Login. 5. Do Login.
Expected Results	Systems send SMS to admins phone number.
Action Results	Systems send SMS to admins phone number.
Status	Pass

Use Case Table 4

Test Case ID	4
Test Case Description	Verify that system should provide both login on homepage.
Steps	<ol style="list-style-type: none"> 1. Install Application. 2. Start Application. 3. Navigate to Homepage. 4. Navigate to Login. 5. Do Login.
Expected Results	system should provide both login on homepage.
Action Results	system should provide both login on homepage.
Status	Pass

Use Case Table 5

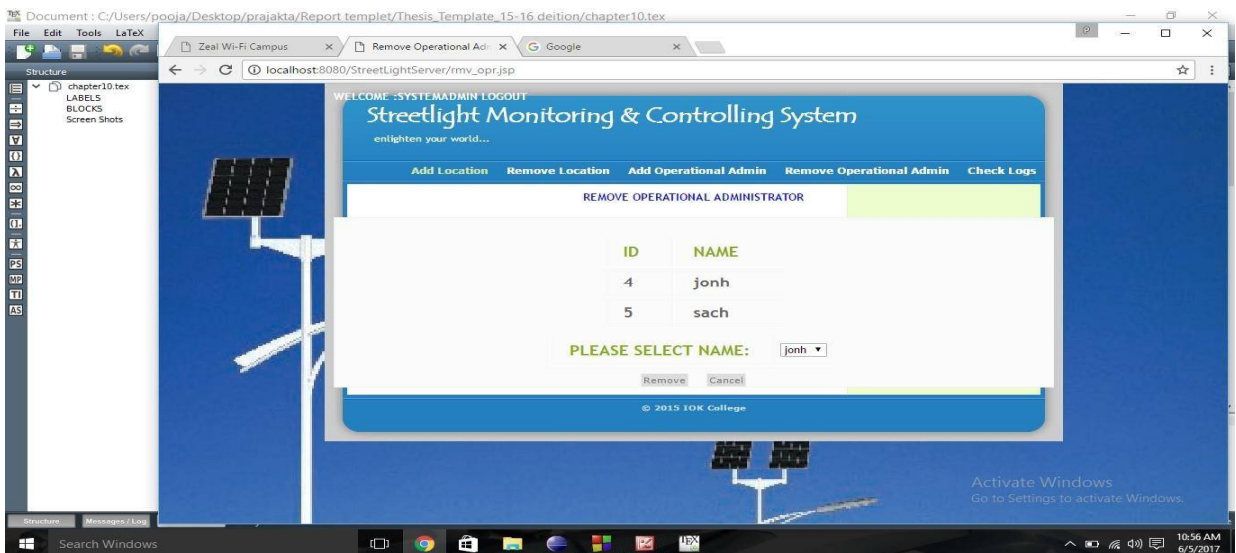
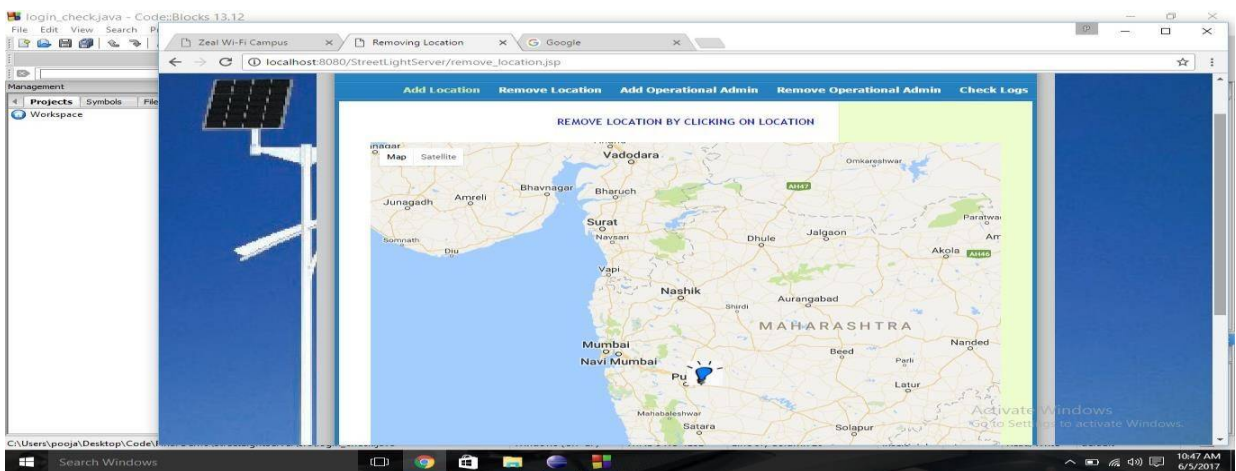
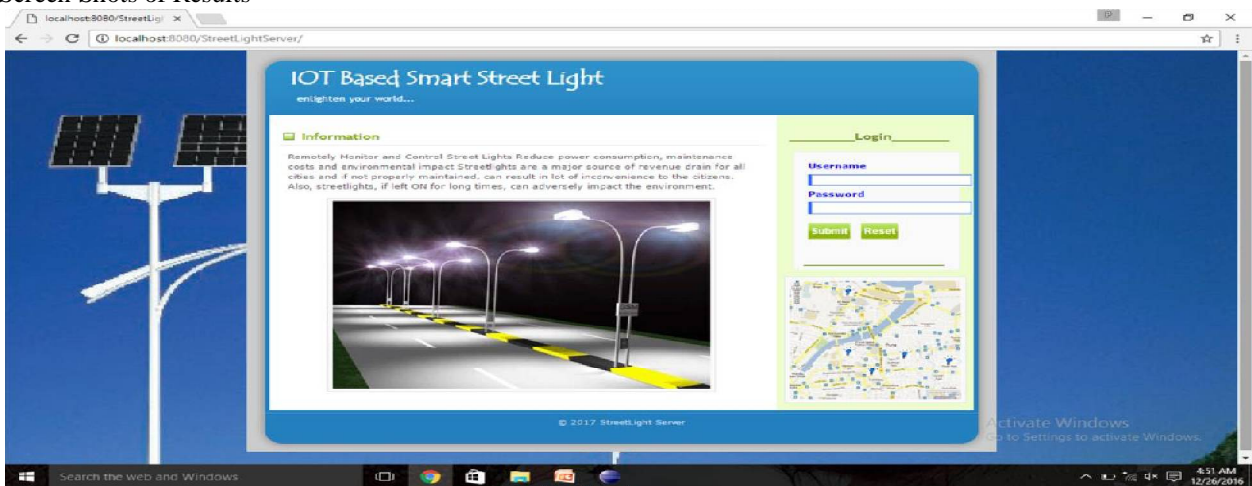
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Screen Shots of Results

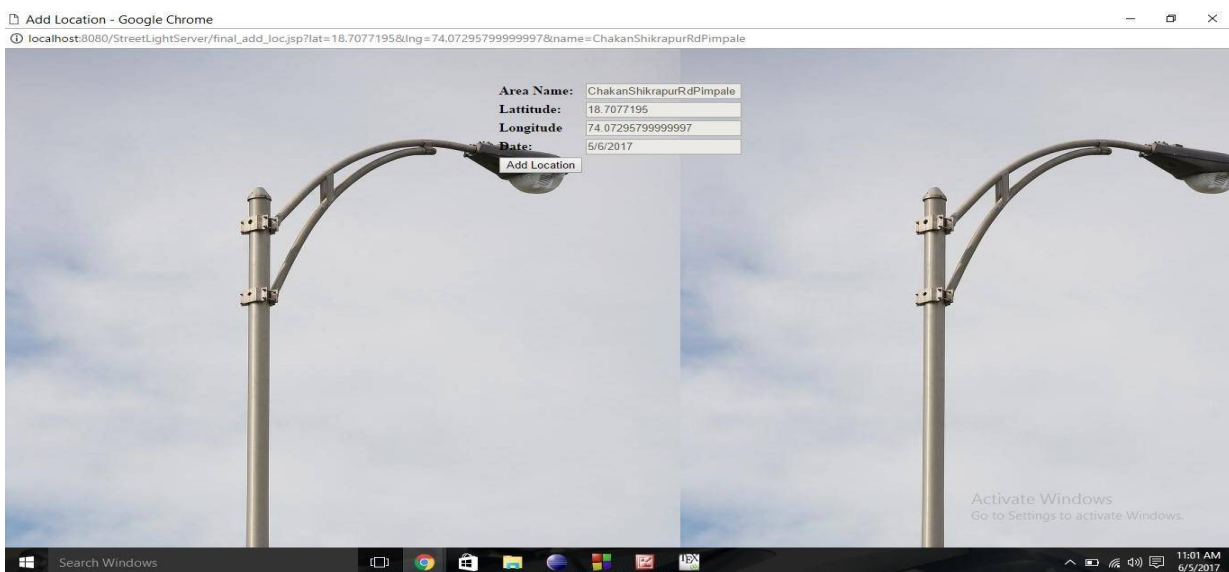
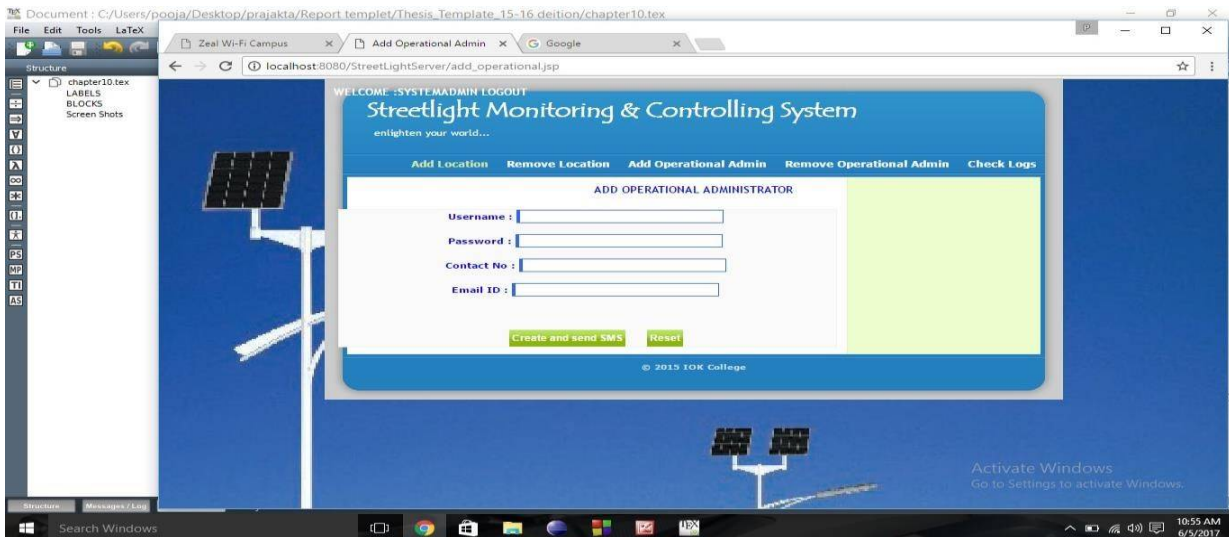


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VI. CONCLUSION AND FUTURE SCOPE

Summary

The system is expected to solve the energy efficiency problem of conventional solar-powered streetlamp system, ensure the traffic safety and prevent crime against night-time walking. It will also help in making our city as Smart City. Transformative lighting business models. Exciting new avenues of energy efficiency beyond illumination. We highlighted the potential of IoT- based lighting-enabled smart city applications using LoD, a real-world lighting control application, which maximizes energy savings as compared to conventional techniques. Going forward, we will further investigate the aforementioned choices, including beyond-lighting value propositions. Additionally, the interplay between the data transmission capacity and the value derived from different types of sensors will be explored. Understanding the trade there in will help municipalities and other local governments strategize as they evolve their smart cities in the years to come.

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VIII. CONCLUSION

The system is expected to solve the energy efficiency problem of conventional solar-powered streetlamp system, ensure the traffic safety and prevent crime against night-time walking. It will also help in making our city as Smart City.

Future Scope

1. To develop an intelligent server application.
2. Client-server type application and they will communicate over internet.
3. Some data need to be read from an NFC tag, and additional jobs will be done by NFC-enabled mobile phone.
4. Less space consumption and more data holding capacity leads to bright future in advertising agencies.
5. Manual, Automatic Schedule Switching.

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