PUSL 2021 COMPUTING GROUP PROJECT

Street Light Monitoring System

Project Report

GROUP 03

IN PARTNERSHIP WITH PLYMOUTH UNIVERSITY

Module Code: PUSL 2021	Module Name: Computing group project
Coursework Title:	
Deadline Date:24th of April 2023	Member of staff responsible for coursework: Mr.Pramudya Thilakarathne.
Programme: BSc (Hons) Software Engineering.	

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Abdul Ahamad,
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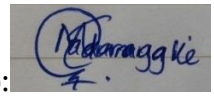
Signed on behalf of the group: 

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Acknowledgement.

As a group of researchers we would like to express our deepest appreciation to all those who provided us the possibility to complete this project. A special gratitude give to our project supervisor Mr.Pramudya Thilakarathne, who's contribution in simulating suggestions, encouragement and coordinate this project invested full effort in guiding the team in achieving the goal.

Table of content.

Chapter 01

Main body of the report.

1.1 Introduction.

Number of cities that the streetlight is one of a huge expense. The cost of streetlight can spend another useful thing of the nation. Currently manual system is used to make manually switched On/off. The lights should be switch on the evening and should switch off the next day morning. Hence, there is a huge wastage of energy between on/off. This is the major problem that we are facing and because of that reason we are shifting to the automatic system, since there is less wastage of power and saving a lot monetarily expenses.

1.2 Background objectives and derivable.

In this street light monitoring system project mainly developed with IOT technology, which would allow collecting the data from sensors and send it to central server to analysis. And sensors used to monitor intensity of lights. The data analytics tools are using to collected data by sensors. Street lights need to be turned on and off based on past usage patterns.

A street light monitoring system can solve above issues by providing real-time information on the energy consumption, brightness level, and maintenance needs of street lights. By analysing 3 data from sensors installed on each light, the system can automatically adjust the lighting levels according to the surrounding environment and reduce energy consumption. It can also detect when street lights are malfunctioning or have been damaged and alert maintenance crews to make repairs. Overall, a street light monitoring system can improve the efficiency and effectiveness of urban street lighting while reducing costs and improving safety for pedestrians and drivers.

There are some hardware such as light sensor, communication devices like ESP 32 and batteries to provide power to the system.

Software components like firebase infrastructure for storing data to store data, and analysing it.

Here are some features of the system .The system is sensor based and it is equipped with sensors to monitor the status of a street light. Sensors can detect the level of the brightness and motion the lights on and off accordingly. This system allows operating to manage the lights from central lights from a central location and without need to physically access for each individual light.

This system have energy management features to optimize the power usage and reduce energy consumptions .And also can able to collect and analyse data on energy usage.

1.3 Literature review.

A Comprehensive Survey on Smart Street Lighting Systems: This paper provides a comprehensive survey of smart street lighting systems. It discusses the various technologies used in these systems, such as sensors, communication technologies, and control systems. The study also highlights the advantages of using these systems, such as energy conservation and improved safety.

Intelligent Street Lighting Control System Based on Raspberry Pi: This research proposes an intelligent street lighting control system that is based on the Raspberry Pi platform. The system is designed to automatically adjust the brightness of streetlights based on the ambient light conditions. The study demonstrates the feasibility of using Raspberry Pi in street light monitoring systems.

Wireless Sensor Network-based Smart Street Lighting System: This research proposes a wireless sensor network-based smart street lighting system. The system uses a network of sensors to monitor the ambient light conditions and adjust the brightness of the streetlights accordingly. The study demonstrates the feasibility of using wireless sensor networks in street light monitoring systems.

An IoT-Based Smart Street Lighting System: This research proposes an IoT-based smart street lighting system. The system is designed to monitor the energy consumption of streetlights and optimize their usage to reduce energy consumption. The study demonstrates the feasibility of using IoT in street light monitoring systems.

Development of a Wireless Sensor Network for Smart Street Lighting: This study proposes the development of a wireless sensor network for smart street lighting. The system uses a network of sensors to monitor the ambient light conditions and adjust the brightness of the streetlights accordingly. The study demonstrates the feasibility of using wireless sensor networks in street light monitoring systems.

1.4 Method of approach.

Street light monitoring system the general approaches are follow,

This system needs to monitor the status of street light and the energy consumptions of a system per day. The project basically used IOT technology ,wireless network and firebase .In this project developed the high level architecture as an example need to store data, data analysis and visualization.

In this system build the hardware components such as sensors, power supplies etc. Validate the real world environment to ensure that the system work efficiently and effectively.

As a group basically used platformio in visual studio code software to developed the arduino code for esp. 32 and used mongodb non relational database to get real time updates of power consumption details .

Following code is explained about the on and off according to the brightness level.

```
const int ldrPin = 4;

const int ledPin = 5;

void setup() {

  pinMode(ledPin, OUTPUT);

}

void loop() {

  int ldrValue = analogRead(ldrPin);

  if (ldrValue < 1000) {

    digitalWrite(ledPin, HIGH);

  } else {

    digitalWrite(ledPin, LOW);

  }

  delay(1000);

}
```

And following codes used to create the tables of mongo db.

```
CREATE TABLE street_lights (
```

```
    light_id int(primary key),
    location varchar(50),
    status int,
   wattage decimal,
istallation_date datetime,
last_maintanance_date  datetime
);


create table maintenance(
maintainace_id int(not null primary key),
light id foreign key reference street_lights( light_id),
maintanance_type varchar(100),
maintnance_date datetime,
technician_id foreign key reference technicians
);

create table technician(
technician_id int(primary key),
name varchar(100),
phone_number varchar(10),
email varchar(30)
);

create table Usage_Log(
log_id int(primary key),
light_id int foreign reference Street_Lights(light_id),
usage_date date,
usage_time (in hours),
```

electricity_cost varchar

);

create table Energy_Consumption(

consumption_id int (not null primary key)

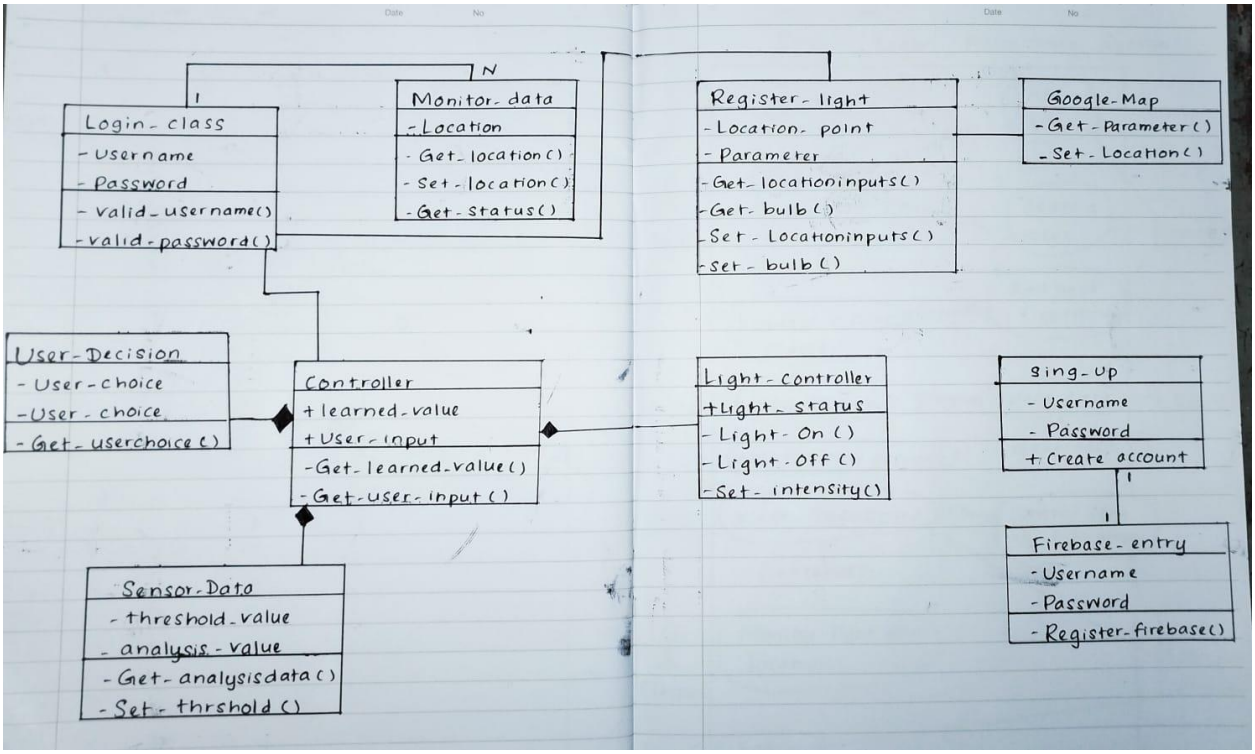
light_id int foreign key reference Street_Lights(light_id),

consumption_date time,

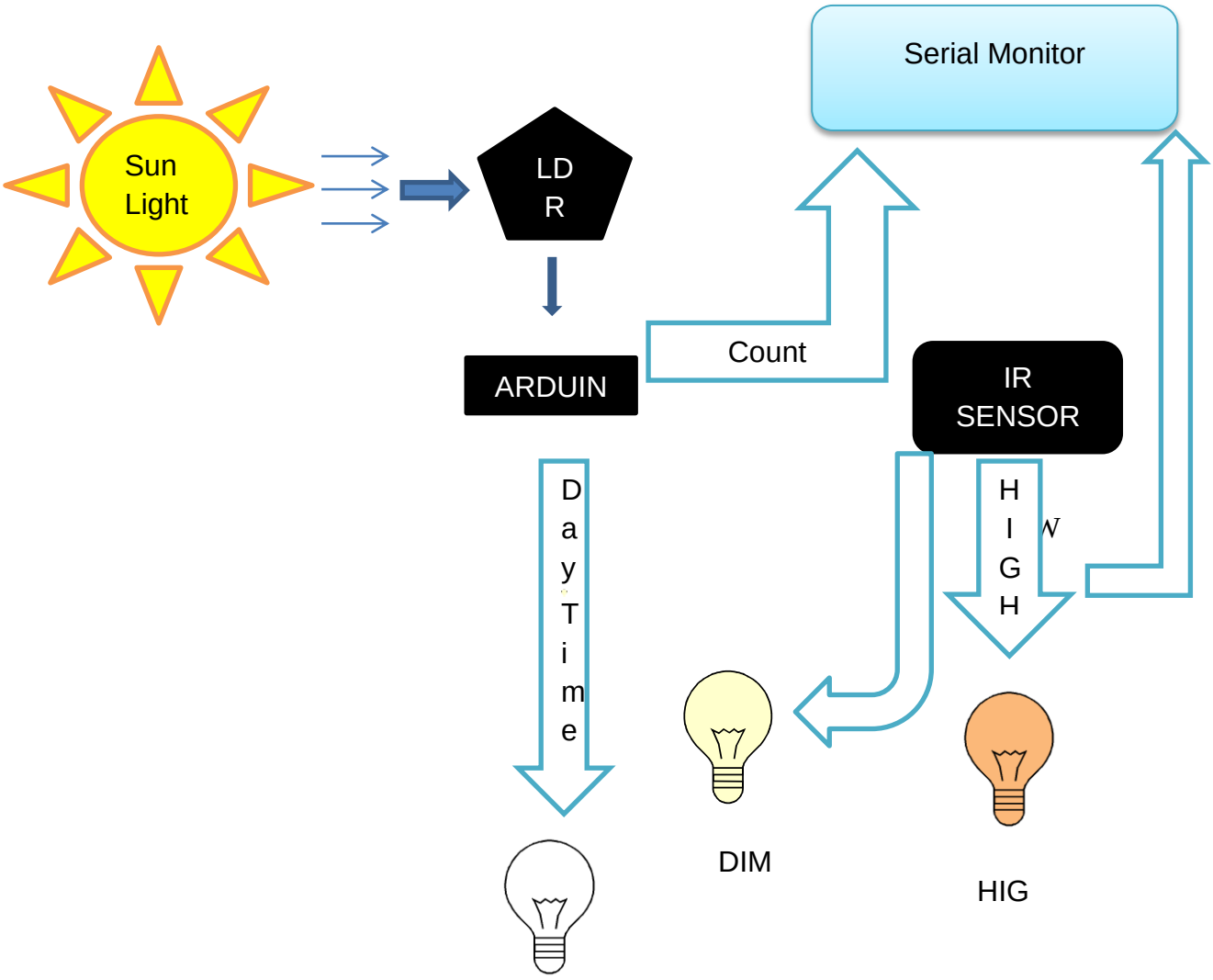
electricity_consumption varchar(40)

);

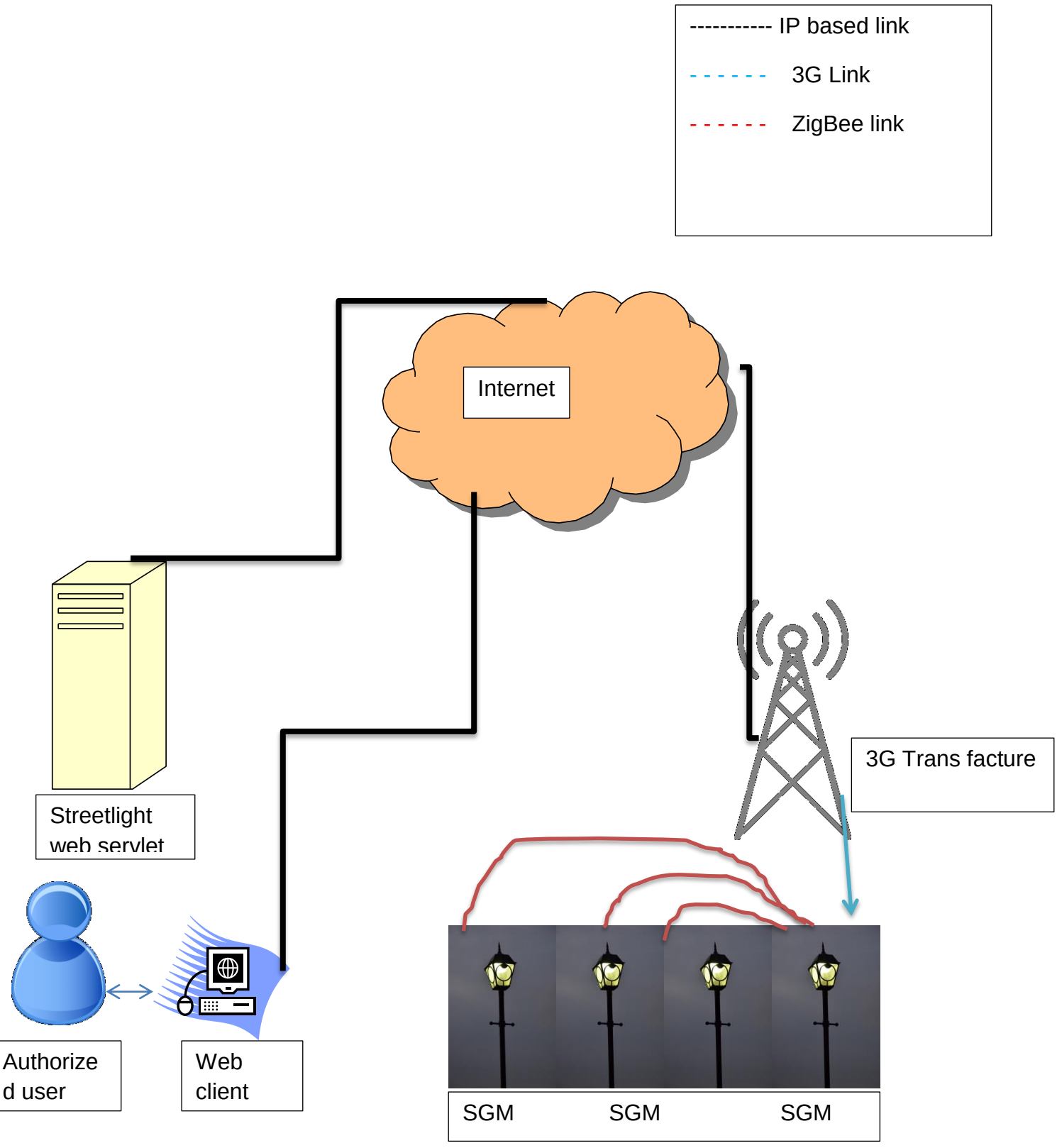
Class diagram



High level architecture diagram.



Network diagram.



1.5 Requirements.

The system will be able to monitor the status of street lights. On/off status of a light, energy consumption etc… The system equipped with sensors to monitor the ambient light levels, other parameter can affect the performance of system. Communication capability of a system with a mongo dB to store the data and used mongo dB atlas to graphically illustrate the data. Used Wi-Fi networks to communicate with wireless technologies.

Power management of the system designed and to ensure the reliability of minimizing the power consumption over extends period of time. This project used efficient power management of the system.

To avoid unauthorized access or tampering the data security and privacy involving encryption and other privacy measures to protect the data. System maintained and serviced with the clear user guidance to provide to user. Technical support should also available for address any issue or a problem faced by the user.

In this project we used mandatory technologies such as sensors requires to detect the status of a each street light and integrated to a lightning fixture. Wirelessly sensor data should be transmitted to central purpose unit for analysis purpose. For this requires using wireless communication such as Wi-Fi.

The system included data analytic tool mongo dB atlas for analyse for sensor data. And used machine learning algorithm to detect patterns .Mongo dB data storing technology process to store large amount of data and it can provide flexibility, scalability and cost efficient benefits.

As a power management source the project used solar power energy source to renew the energy source. The system designed with security to prevent unauthorized access to ensure the data privacy. To that used access control mechanism.

To maintenance and support of the system for support in continued operations such as regular software updates, technical support and also the training for users.

There are some common user groups including maintenance personal such as group of technicians and engineers responsible for repairing and maintaining the system and detects faults and failures ,status of the lights and plan maintenance tasks.

City officials group includes city planners, administrators and policy makers to monitor the performance of street lights for the street light infrastructure, energy consumption analysing and data driven decisions about lightning policies.

Citizen’s group includes pedestrians, residents and commuters who use the system to report

faults and failures ,request repairs or replacements and to provide the feedback of the lightning conditions.

Environmentalists group includes researchers, environmental activists and policy makers who use to monitor the system, impact of a street lightning to the environment, analyse energy consumptions and purpose solution for reducing carbon emissions.

The group includes utility companies of this system use to optimize lightning configuration, monitor energy consumptions and manage the energy demand to reduce cost and to improve the sustainability.

Emergency responders group includes fire fighters ,emergency medical technicians and other first responders who use the system to navigate and the locate that whose using the system for emergency areas in poorly lit areas.

1.6 End project report.

This street light system project aimed to improve the management and the efficiency of a street light system in urban areas. This system is designed to control and designed remotely monitor, providing real time status and the energy consumptions.

Street light monitoring systems architecture can divide into two major components it is hardware and software. The hardware consist of sensors, communication modules like esp. 32 and the software like visual studio code and data analytic modules like mongo dB, mongo dB atlas.

Mainly system designed is based on internet of things (IOT) technology that enable to collect and process the data from multiple sources. This system combine of sensors to detect determine the status of street lights, sensors to detect the light intensity, motion. The data is collecting by the system and transmitted to mongo dB server through the communication module.

This system was implemented by using light intensity sensors, solar charger, solar panel, esp. 32 Wi-Fi module etc.. The esp. 32 was programmed by using arduino, and the data was transmitted to database server through the communication module.

The system was implemented by using various sensors such as light intensity sensor. The esp 32 was programmed by using arduino language and data was transmitted by using a simple socket-based request-response style protocol .The mongo dB atlas is using to status of the street lights ,control their operations and also reports of energy consumptions.

This street light monitoring system was evaluated in real world scenario in a urban areas. The system be found in monitoring and controlling the street lights and providing real time updates and information of their status and energy consumptions. This system is also user friendly and providing the clear intuitive way of accessing data.

The street light monitoring system is an effective solution for monitoring and managing street light system in urban ares and provides real time information about the status of a street lights and enables the efficient consumptions of energy management .And the system is user friendly for users .Overall, the system has an overall potential to improve the efficiency of street lightning system and reduced energy consumption of urban areas.

As a group of researches we collected some feedbacks from real clients by conducting interviews with stakeholders of Hanwalle area. Some of them are as follows,

“This street light monitoring system is really effective to the pedestrians because as a pedestrian we had a trouble to walk in a road hence we really bothered if street lights are turned on and off manually some days person who switched the street light will get forget and it may cause some pedestrian accidents. Because of this reason we really appreciate this street light monitoring system.” – Pedestrian.

“Street light monitoring system is very effective for drivers like us because it is very helpful to drive the vehicle carefully in night time. The system avoids accidents on night time.” – Vehicle driver.

“As an environmentalist I want to tell you that this system is energy conservation and reduce green gas emission and better solution for light pollution” – Environmentalist.

Profitability mainly focuses on the achieved the goals of this system to make success of company mission for relying outside investors.

By monitoring and controlling the street light monitoring system controlling real time and business can reduce energy consumptions and also lower their carbon footprint. Cost reduction can help businesses to save the money by reducing the maintenance and manual inspection.

By ensuring public safety street lights are functioning properly then business can help to create safe environment for public. From this can deter criminal activities and make pedestrians and drivers feels more secure.

Enhanced data insights can provide valuable data insights some of them are energy usage patterns, traffic patterns and maintenance needs and these information can used to optimized operations and make more about business decisions.

To improved customer satisfaction a well- lit and well maintained street can enhance overall customer experience for business in surrounding areas.

Overall this system can help to achieve the variety of objectives such as cost reduction, energy conservation, data insights, public safety and customer satisfaction by investing in technology because of that reason business can improved operations and also can contribute to a safe and more sustainable community.

During street light monitoring system project our group made some several changes ,

Earlier we planned to develop the project using arduino ide but the middle of the developing part got an issue that old version arduino ide were not support to work with windows 11 version. Because of that reason as a team got a decision to code to esp 32 by using visual studio code platformoi.

And faced an issue to connect with real time update software firebase then changed the plan and got the decision to connect the database using mongo dB and visualized the data using mongo dB atlas.

1.7 The post-mortem

- Were the project objectives the right ones to adopt?

  Yes

- Was the product properly specified (in relation to the business objectives)?

  Yes

- The relationship between the project and the client.
  At the beginning of the project, the project team worked closely to define the project requirements , objectives and the scope. Our group conducted several meetings and discussed the stakeholders needs were fully understood and incorporate with project plan.

  Throughout regular communication during the project supported to informed client about the project progress. This would have included project reports, scope, timeline, budget, meetings and the updates and changes.

  At the project progressed client was able to provide its own feedback about usability, functionality and the project design.

  The final stage of this project the project team would have worked closely with client to conduct testing and to ensure street light monitoring system met the requirement speciation. For this as a team we used user acceptance testing method.

- Was the chosen development process the right one?

  Yes

- Were the chosen technologies the right ones?

  Yes those chosen technologies were right.

- Your own performance (try to be specific).
  Stay focused in main goal

  Stay in touch with group more often.

  Discuss lessons learned in the middle of the project.

- Wider reflections on Client feedback.
  Generally as a group majority of clients feedbacks were positive feedbacks.

- Generally, what lessons are to be learnt for the future.
  The team identified that team could not be able to finished the final product by the given deadline. The results were due by month.

  Diligent task should be appropriately and enforce realistic deadlines. Foster an environment that encourages collaboration.

1.8 Conclusion

The street light monitoring system is a better project that can reduce maintenance cost and the energy consumption in municipalities and urban areas. Through the automated technology the system can adjust the brightening levels based on the real time conditions. This can help ensure that reducing energy waste and lowering cost. By implementing this system located areas can improved their sustainability, reduce their carbon footprint and save money in the process.

Chapter 02.

2.1 Reference list.

Chapter 03.

3.1 Appendices

User guide

Setup –At the beginning you should need to setup the hardware component of the system. This system includes the iot devices such as arduino, sensors, led lights etc.. You should connect these devices to the internet using Wi-Fi connectivity.

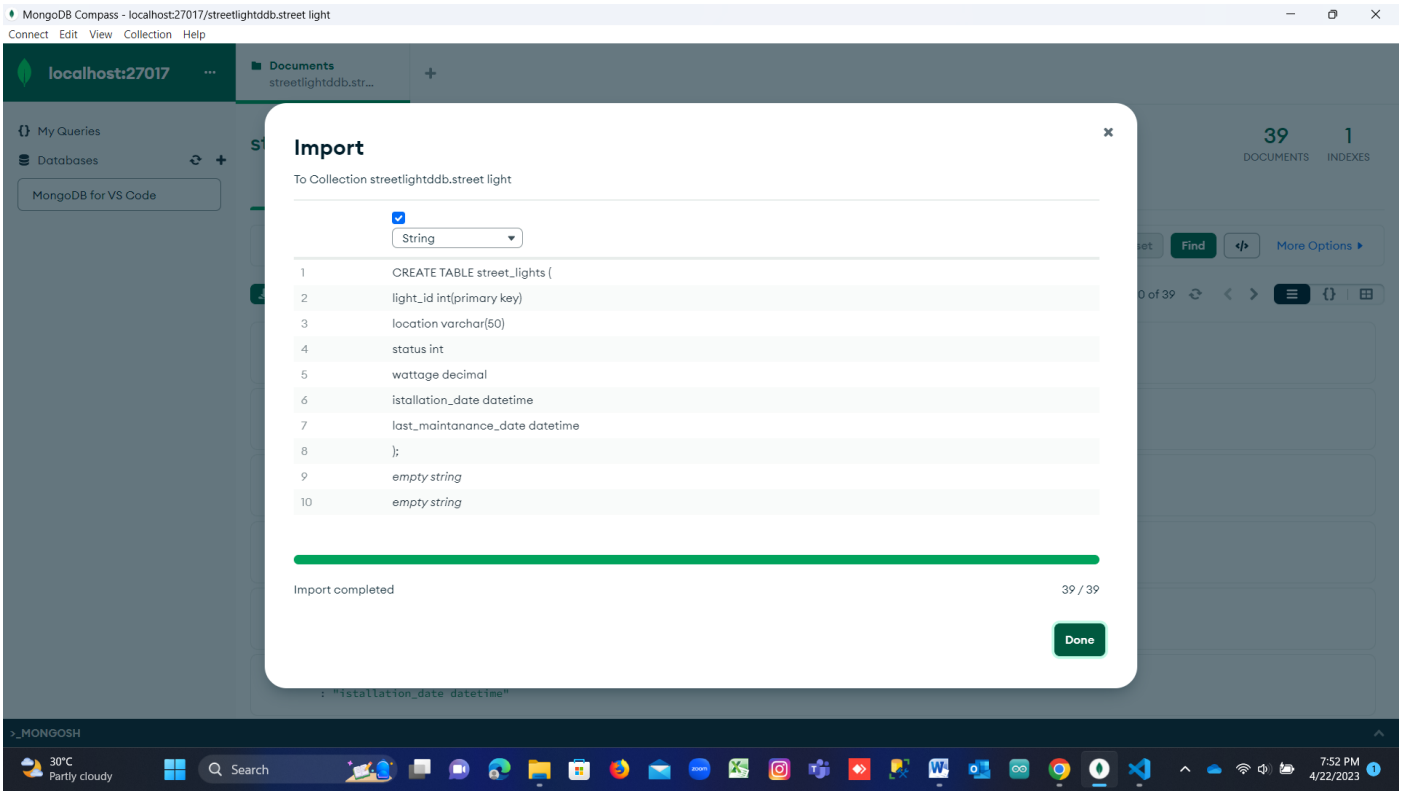
Data analysis – Mongo dB atlas provides data analysis tools help to track the power consumptions.

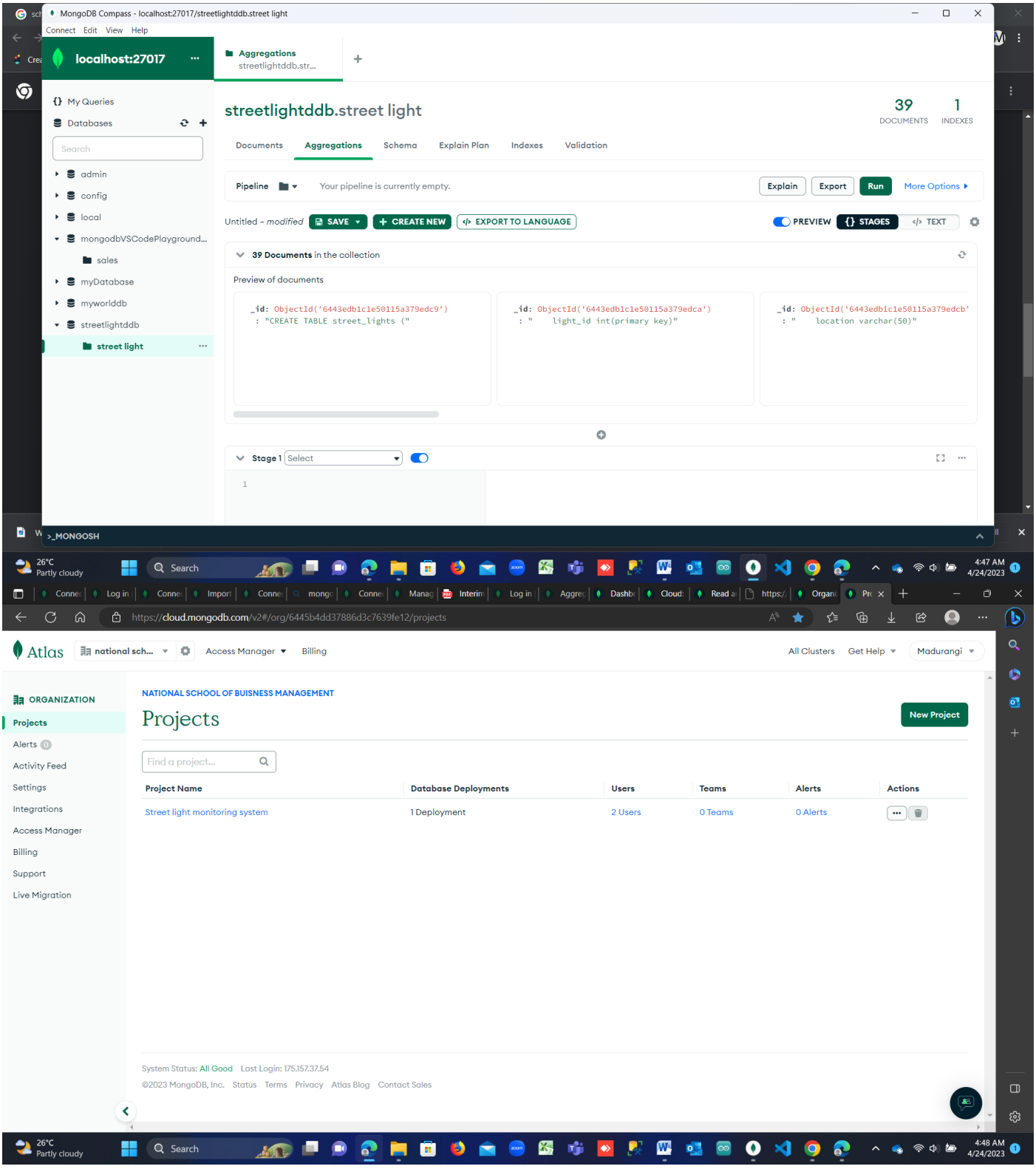
Troubleshooting- If encounter any issue with hardware components you should identify the problem and you may encounter.

Proposal - Group 03(pusl2021) (2).pdf

Interim report- Interim Report[group_03].pdf

Other materials

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Street light monitoring system
1 Deployment
2 Users
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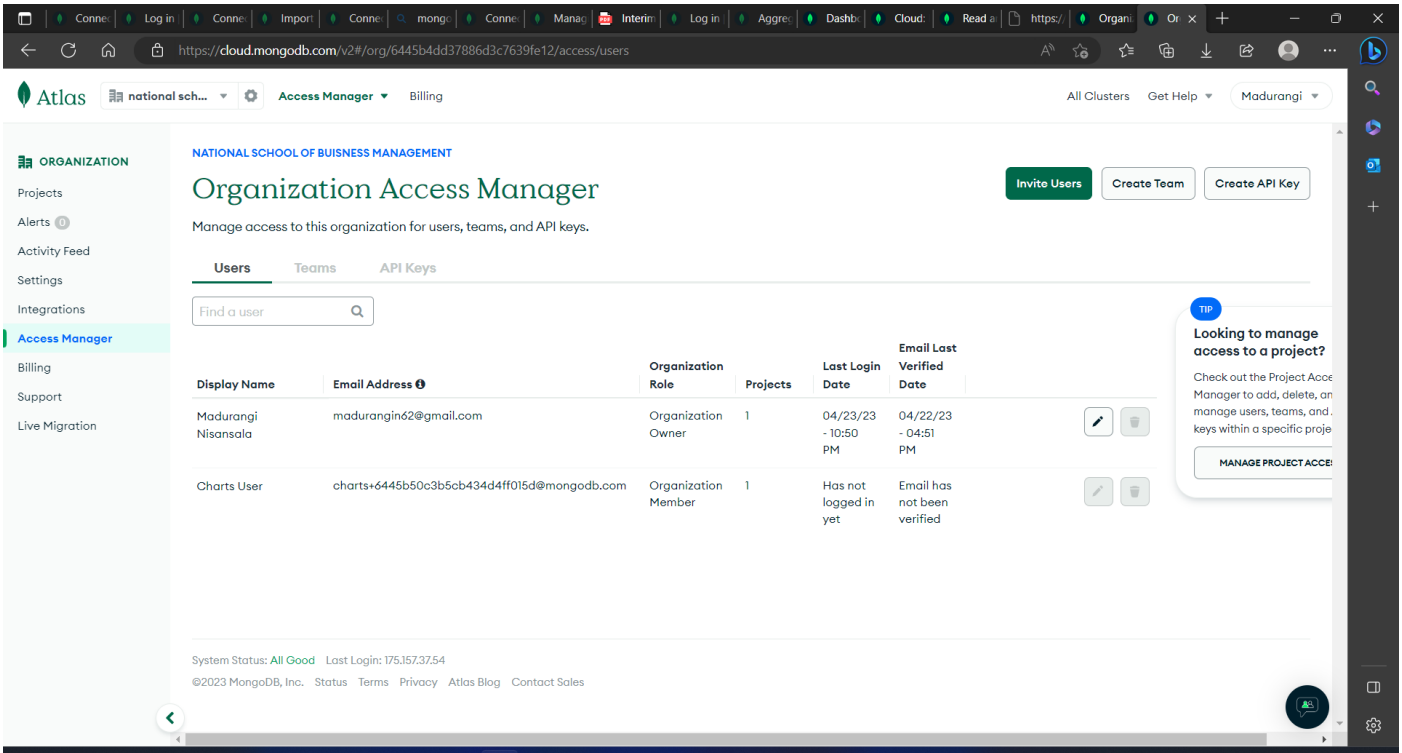
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Manage access to this organization for users, teams, and API keys.
Invite Users
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Display Name
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madurangin62@gmail.com
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Organization Member
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Has not logged in yet
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TIP
Looking to manage access to a project?
Check out the Project Acce
Manager to add, delete, an
manage users, teams, and
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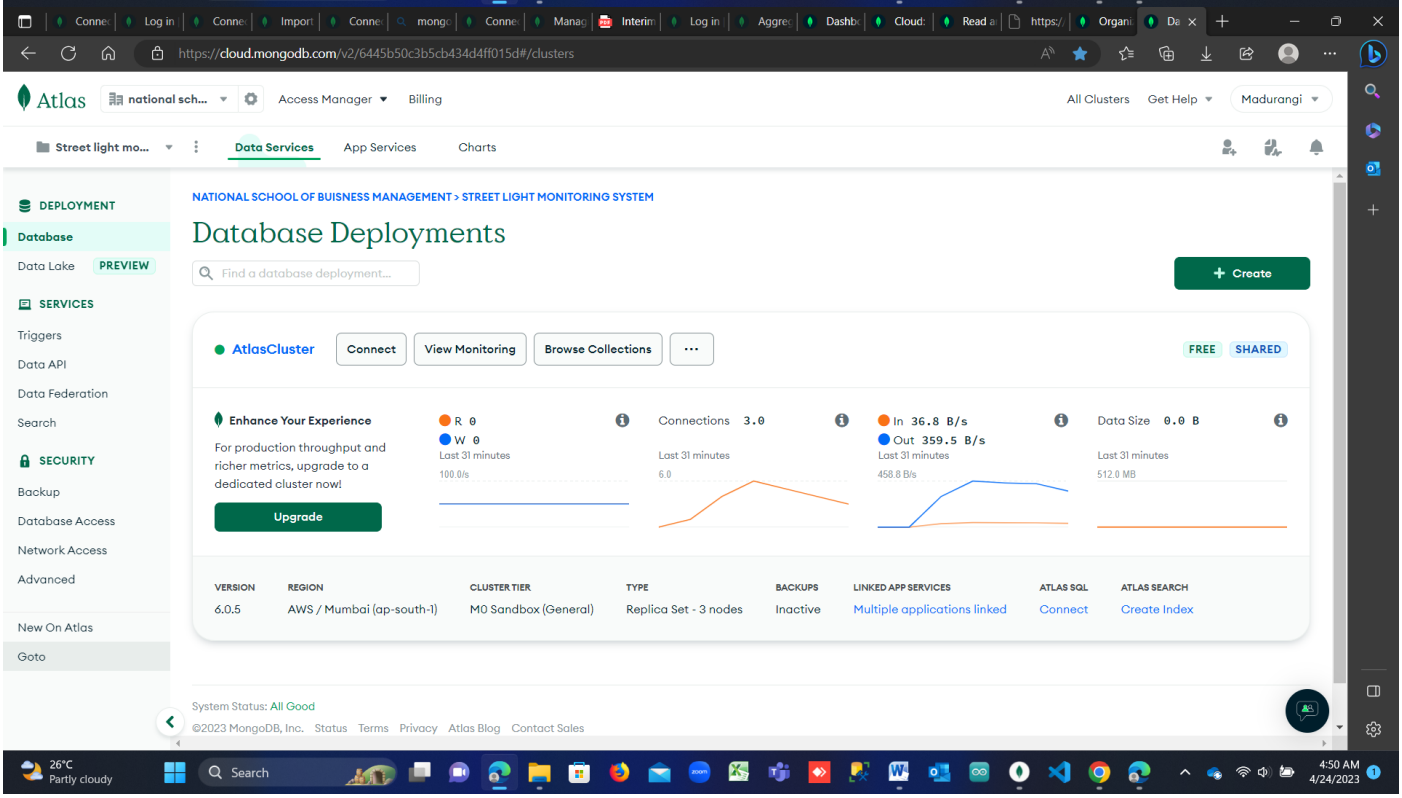
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Backup
Database Access
Network Access
Advanced
New On Atlas
Goto
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Database Deployments
Find a database deployment...
+ Create
AtlasCluster
Connect
View Monitoring
Browse Collections
FREE
SHARED
Enhance Your Experience
For production throughput and richer metrics, upgrade to a dedicated cluster now!
Upgrade
R 0
W 0
Last 31 minutes
100.0/s
Connections 3.0
Last 31 minutes
6.0
In 36.8 B/s
Out 359.5 B/s
Last 31 minutes
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