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FUTURE READY TALENT

IOT BASED WEATHER ADAPTIVE STREET LIGHTNING SYSTEMS

MICROSOFT INTENSHIP

PROJECT REPORT

Submitted By

SANTHIYA C

LEKHA SHREE SB

DHARSHINI T

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CHAPTER - 1

INTRODUCTION

1.1 PROJECT OVERVIEW

The IoT-based Weather-Adaptive Street Lighting System aims to optimize energy usage and improve the efficiency of street lighting by integrating weather data with smart lighting controls. By using real-time weather information, the system adjusts the intensity and timing of street lights, ensuring appropriate lighting levels while minimizing energy consumption and operational costs. Traditional street lighting systems often operate on fixed schedules or light sensors, which may not be optimal for changing weather conditions. By integrating IoT capabilities, such as sensors, connectivity, and data analytics, the street lighting system becomes adaptive and responsive to environmental factors, particularly weather conditions. By dynamically adjusting lighting levels based on weather conditions, the system reduces energy consumption and lowers operational costs. Optimal lighting during adverse weather conditions improves visibility for drivers, cyclists, and pedestrians, thereby enhancing road safety. By promoting energy efficiency and reducing carbon emissions, the system contributes to sustainability goals and environmental conservation. The sensor data is collected and transmitted to a central control system or cloud-based platform using wireless communication protocols like Wi-Fi or cellular networks. The system then analyzes the data to determine the appropriate lighting levels based on the prevailing weather conditions

Objectives:

- Optimize energy efficiency: Reduce energy consumption by dynamically adjusting street lighting levels based on weather conditions.
- Environmental sustainability: Contribute to environmental sustainability by reducing energy waste and carbon

  emissions
- Enhance safety and visibility: Provide adequate illumination on streets to improve visibility for pedestrians and drivers, promoting safety.
- Cost reduction: Reduce operational costs by optimizing energy usage and minimizing maintenance requirements.

1.2 PURPOSE

The purpose of a weather adaptive street lighting system is to optimize the operation of street lights by dynamically adjusting their intensity and timing based on real-time weather conditions. This system aims to achieve several objectives. First, it enhances energy efficiency by intelligently controlling the street lights to minimize energy consumption. By lowering the lighting intensity during periods of low ambient light, such as cloudy or rainy weather, the system conserves energy. Conversely, it increases the lighting intensity during periods of low natural light, such as foggy or dark nights, to ensure safety and visibility. Second, the system reduces operational costs associated with street lighting by optimizing energy usage and eliminating the need for manual adjustments. Third, it enhances

safety by ensuring appropriate lighting levels based on weather conditions, improving visibility for pedestrians, cyclists, and drivers. Fourth, the weather adaptive system contributes to environmental sustainability by minimizing energy consumption and reducing the carbon footprint associated with street lighting. Lastly, it enables maintenance optimization by providing valuable insights and data on energy consumption, lighting patterns, and performance, facilitating proactive maintenance planning and efficient resource allocation. Overall, the purpose of a weather adaptive street lighting system is to create a smarter, energy-efficient, and safer urban environment by leveraging real-time weather data to optimize street lighting operations.

CHAPTER – 2

LITERATURE SURVEY

2.1 EXISTING SYSTEM

Latest solar powered technological advancements have paved the way for **automatic street light systems** to take the front seat. These automatic solar street lights are raised outdoor light sources powered by photovoltaic panels. These photovoltaic panels are either connected in the pole or mounted on the lighting structure. There is a rechargeable battery in the automatic street light system which provides the requisite power to the LED lamp during the entire night. These solar street lights are able to automatically sense outdoor light with the help of a sensor. They can this way smartly save power & give light on successive nights even when sunlight is unavailable for a couple of days. This is the reason many users nowadays are switching over to solar street lights.

Average Road Luminance in Cd/m

Brightness (Road Luminance) depends on the light distribution of the luminaire, the lumen output of the luminaire, the installation design of the street lighting, and the reflective properties of the road surface. The higher the brightness level, the better the lighting effect.

2.2 REFERENCES

2.2.1. Inadequate Sensor Accuracy:

Adaptive street lighting systems rely on sensors to detect various environmental factors such as ambient light, movement, and traffic patterns. However, the accuracy of these sensors can be a challenge. Inaccurate readings can result in inappropriate lighting adjustments, leading to either excessive energy consumption or insufficient lighting. Sensors used in adaptive street lighting systems are responsible for detecting environmental factors such as ambient light levels, motion, and traffic flow. However, sensors may suffer from calibration issues, leading to inaccurate readings. Improper calibration can result in incorrect lighting adjustments, leading to either excessive energy consumption or insufficient illumination. The placement and coverage of sensors play a critical role in accurately capturing environmental data. If sensors are improperly positioned or their coverage areas are limited, they may not capture the complete picture of the surroundings. This can result in inadequate lighting adjustments, as the system may not have a comprehensive understanding of the actual conditions. Regular calibration and maintenance of sensors to ensure accurate readings. Optimal sensor placement and coverage to capture comprehensive environmental data. Implementing self-cleaning mechanisms or protective covers to minimize environmental interference. Continuous monitoring and testing of sensor performance to identify and replace faulty or degraded sensors promptly. Improving data processing and analysis algorithms to enhance the system's ability to make accurate lighting adjustments based on sensor inputs. However, sensors may suffer from calibration issues, leading to inaccurate readings. Regular calibration and maintenance of sensors to ensure accurate readings .It can be result in inappropriate lighting adjustments, leading to either excessive energy consumption or insufficient lighting. The placement and coverage of sensors play a critical role in accurately capturing environmental**.**

2.2.2 Weather adaptive street lighting system prediction using IOT:

A weather adaptive street lighting system utilizes IoT technology and predictive modeling to enhance its functionality based on weather conditions. By integrating weather data and IoT sensors, this system can intelligently adjust lighting levels in response to changing weather conditions. The IoT sensors installed in streetlight fixtures collect real-time data on various weather parameters such as temperature, humidity, precipitation, and wind speed. This data is transmitted to a central server or cloud platform for processing and analysis. Using advanced predictive modeling techniques, the system leverages historical weather data and real-time inputs to develop a weather prediction model. Machine learning algorithms analyze the data to identify patterns,trends, and correlations between weather conditions and lighting requirements. Once the weather prediction model is established, it continuously evaluates the incoming weather data and makes predictions about the expected lighting needs. For example, during rainy or foggy conditions, the system can anticipate reduced ambient light and increase the brightness of streetlights to ensure proper visibility. Similarly, during clear and sunny conditions, the system can dim the streetlights to conserve energy without compromising safety. The realtime weather predictions are used to dynamically adjust the lighting levels of streetlights, optimizing their operation and energy consumption. By adapting to weather conditions, the system ensures that lighting levels align with the actual needs, enhancing safety for pedestrians and drivers while minimizing energy wastage. Once the weather prediction model is established, it continuously evaluates the incoming weather data and makes predictions about the expected lighting needs. For example, during rainy or foggy conditions, the system can anticipate reduced ambient light and increase the brightness of streetlights to ensure proper visibility. Similarly, during clear and sunny conditions, the system can dim the streetlights to conserve energy without compromising safety.

2.2.3 Development of a Weather Adaptive System Prediction Model Based on Iot

The development of a weather-based street lighting system prediction using IoT involves leveraging IoT technology and weather data to create an intelligent and adaptive lighting solution. By integrating IoT sensors and weather forecasting, this system can accurately predict weather conditions and adjust street lighting accordingly. IoT sensors installed in streetlight fixtures collect real-time data on various weather parameters, including temperature, humidity, precipitation, wind speed, and cloud cover. These sensors continuously gather data and transmit it to a central server or cloud platform for analysis. The collected weather data is combined with historical weather patterns and forecasts obtained from weather services. Using advanced data analytics and machine learning algorithms, the system processes and analyzes this information to create a predictive model . The predictive model takes into account the relationship between weather conditions and the appropriate lighting levels needed for optimal visibility and safety. It learns from historical data and patterns to make accurate predictions about lighting requirements based on anticipated weather conditions. With real-time weather updates and predictions, the system can dynamically adjust street lighting levels. For instance, if heavy rain is forecasted, the system can increase the brightness of streetlights to compensate for reduced visibility. Conversely, during clear and sunny weather, the system can dim the lights to conserve energy. Furthermore, the system can incorporate additional factors such as time of day, traffic patterns, and pedestrian activity to fine-tune its lighting adjustments. By considering these variables along with weather data, the system ensures that street lighting is always appropriate for the specific conditions.

2.2.4 IOT based Street Lighting Control System (IJRASET)]

A large number of street lights present around the world which consume enormous amounts of electrical energy. As it is a huge system, it is very difficult to monitor and control them manually. It is important to develop a smart system that can monitor and control the lights as well as provide communication to the user. This communication is established using IoT. This system monitors the status of every street light (ON/OFF state) by observing the power consumption of light. As the usage of street light is required only during the night, the system automatically turns ON the light at 6 pm and turns it OFF at 6 am. This conserves energy consumption by optimizing the usage period. When a fault occurs in the street light, this system disconnects the street light from the supply and an indication is sent to the User. Using this information, the User can rectify the fault and turn ON the light. This increases the reliability and maintainability of the street light. A portal for real-time monitoring of voltage across light, current through the light, the power consumed by the light and fault status is established using the Thingspeak IoT platform. This real-time information can be accessed from anywhere around the world at any time using the Internet.

2.2.5 IOT based weather adaptive street lighting system(IJCRT)]

As an important part of a smart city, smart street lighting uses wireless IoT sensors, Zigbee, GPRS, Lora, and Bluetooth communication technology to connect the street lamps in the city in series, forming the Internet of things, and realizing the remote centralized control and management of street lamps. According to the traffic flow, time, weather conditions, and other conditions, the scheme can automatically adjust the brightness, and remote control lighting, abnormal will take the initiative to alarm but also can cooperate with other sensors to play the function of anti-theft and remote meter reading.Smart street lighting using IoT can effectively control energy consumption, thus enhancing the level of public lighting management, decreasing the cost of maintenance and management, and using the calculation of sensory information processing and analysis to make intelligent responses and intelligent decision support, making the city road lighting to achieve a “smart” state.

2.2. IOT based weather adaptive street lighting system[(CONIT)]

This street lighting is one of the largest energy expanses of a city. A street lighting system can cut municipal street lighting cost is 50% to 70%. The smart street lighting system is a system that adjusts light output based on the usage and occupancy, i.e., automatic classification of pedestrian versus cyclist, versus automotive. The project is mainly implemented to track the intensity of the light using sensors and it is done using the wireless system to control the energy consumption and uses reduction measures through power conditioning and control. The street light (ON/OFF Status) will be accessed from anytime, anywhere through internet based on the real time system. The street controller should be installed on the pole light which consists of NodeMcu ESP8266. The data from the street light controller can be transfer to base station by using wireless technology to monitor the system. The operation of the system can be conducted using auto mode and manual mode the control system will switch on-off the lights are required timings and can also vary the intensity of the street light according to requirement.

2.3 PROBLEM STATEMENT

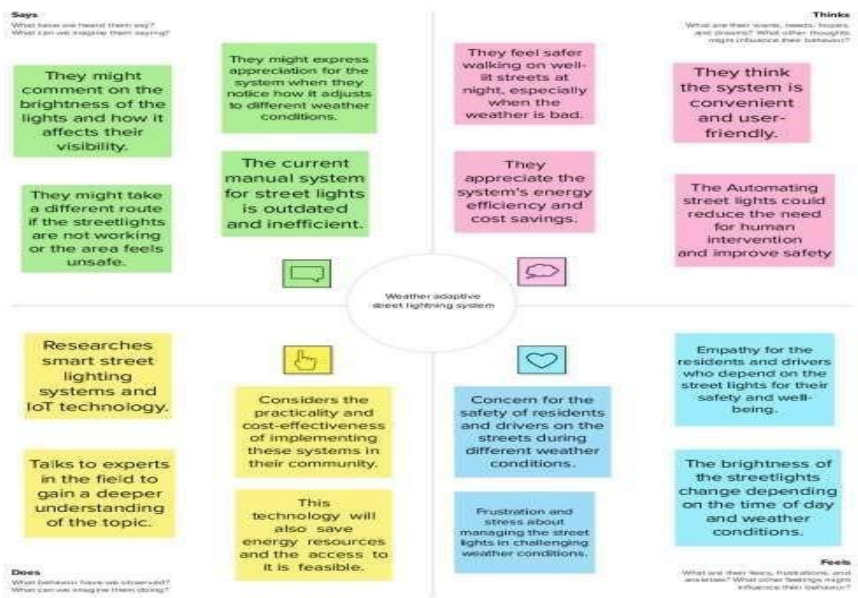
Problem Statement (PS)	I am (Lender)	I'm trying to	But	Because	Which makes me feel
PS-1	Using CIBIL score	Check the borrower has an eligible CIBILScore.	So far the weather is not detected	The weather condition is normal.	Confident.
PS-2	Based on Eligibility Criteria	Get the street light swith on.	Inadequate of salary	The borrower didn't have enough salary.	Sorrowful
PS-3	Based on PAN Card	Get a loan on a PAN card by providing a PAN card as documents.	The borrower didn't file income tax.	The interest rates are not apt for the borrower.	Depressed
PS-4	Based on Assets	Processing the property paper followed by a legal check	Unfortunately the property papers are illegal	The papersit's seems like duplicate	Melancholy
PS-5	Based on Age criteria	Provide a personal loan	The borrower under the age of 21	The age limit is not apt for borrowers	Frustrated

CHAPTER – 3
IDEATION & PROPOSED SYSTEM

3.1 EMPATHY MAP CANVAS

An empathy map is a collaborative tool teams can use to gain a deeper insight into their customers. Much like a user persona, an empathy map can represent a group of users, such as a customer segment. The empathy map was originally created by Dave Gray and has gained much popularity within the agile community. Have the team members speak about the sticky notes as they place them on the empathy map. Ask questions to reach deeper insights so that they can be elaborated for the rest of the team. To help bring the user to life, you may even wish to sketch out the characteristics this person may have on the center of the face.

3.2 IDEATION AND BRAINSTROMING



Brainstorming provides a free and open environment that encourages everyone within a team to participate in the creative thinking process that leads to problem solving. Prioritizing volume over value, out-of-the-box ideas are welcome.

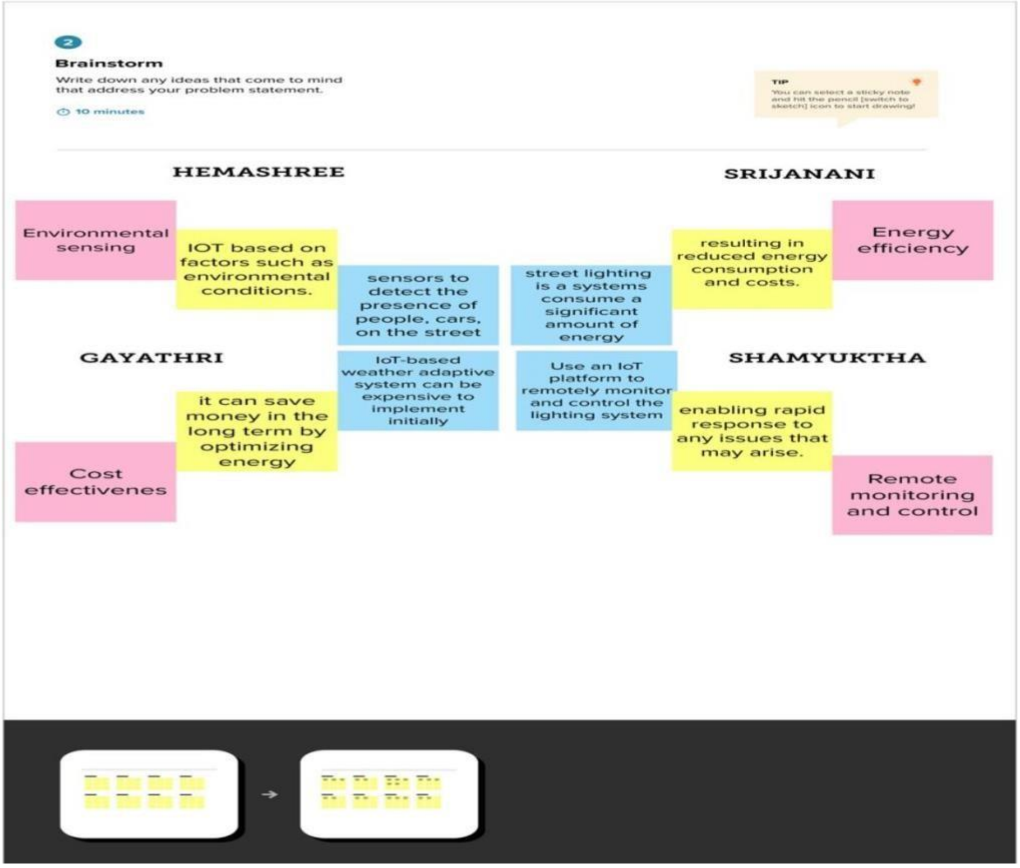


Fig 3.2.1.a BRAINSTROMING & IDEA PRIORITIZATION

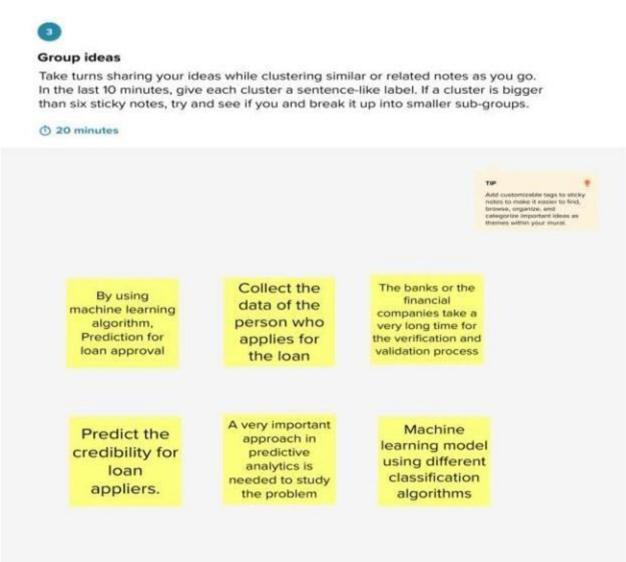


Fig 3.2.1.b BRAINSTROMING & IDEA PRIORITIZATION

3.3 PROPOSED SOLUTION

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	The problem statement is to predict the current street lighting systems in many cities and towns are outdated and inefficient. Traditional street lighting systems use high-pressure sodium lamps, which consume a lot of energy, have a short lifespan, and require frequent maintenance. The solution should satisfy the following user requirements: • User friendly • Reduce energy consumption provide a safer and

		more comfortable environment for motorists.

2.	Idea / Solution description	The solution is a IoT-based street lighting system would use sensors, communication technologies, and intelligent algorithms to monitor and control the lighting system in real-time. The system would adjust the intensity of light based on the surrounding environment, such as detecting the presence of pedestrians, cyclists, and vehicles, and adjust the lighting levels accordingly.
3.	Novelty / Uniqueness	detect ambient light levels and adjust the of street lighting accordingly. ueness of an IoT-based street lighting es in its ability to provide energy adaptive, and intelligent lighting oT-based street lighting system is its dapt and respond to changing mental onditions.

4.	Social Impact / Customer Satisfaction	IoT-based street lighting system can have a positive social impact and increase customer satisfaction by enhancing safety, reducing energy consumption and associated costs, improving operational efficiency, and minimizing light pollution.
5.	Business Model (Revenue Model)	The revenue model for an IoT-based street lighting system can be based on energy savings, service subscriptions, public-private partnerships, advertising, or weather services. The choice of revenue model will depend on the business model adopted and the specific needs and preferences of the target customers and stakeholders.
6.	Scalability of the Solution	The scalability of an IoT-based street lighting system depends on the careful selection of technology, the design of the system, and the level of support and resources available for deployment and maintenance. With proper planning and execution, an IoT-based street lighting system can be scaled to meet the needs of any size community or urban area.

3.4 PROBLEM SOLUTION FIT

Fig 3.4.1 PROBLEM SOLUTION FIT

CHAPTER – 3

REQUIREMENT ANALYSIS

4.1 FUNCTIONAL REQUIREMENT

FR No.	**Functional Requirement (Epic)**	**Sub Requirement (Story / SubTask)**
FR-1	User Registration	Registration through form Registration through Gmail Registration through Linkedin
FR-2	User confirmation	Confirmation via Email Confirmation via OTP
FR-3	User Authentication	The solution should allow users to log in securely and authenticate their identity before accessing protected resources or functionality.
FR-4	Data Input and Output	The solution should allow users to input and retrieve data from the system in a clear and intuitive manner, using appropriate user interfaces and data formats.

FR-5	Workflow management	The solution should support the workflows and business processes of the organization, ensuring that tasks are routed to the appropriate users and completed in a timely and efficient manner.

4.2 NON-FUNCTIONAL REQUIREMENT

FR No.	**Non-Functional Requirement**	**Description**
NFR-1	**Usability**	The system should be easy to use and intuitive for all types of users.
NFR-2	**Security**	The system should be secure and protect user data from unauthorized access or breaches
NFR-3	**Reliability**	The solution should be available and operational at all times, with minimal downtime or disruption to users.
NFR-4	**Performance**	The system should be able to handle a large number of users and requests simultaneously without experiencing any delays or crashes

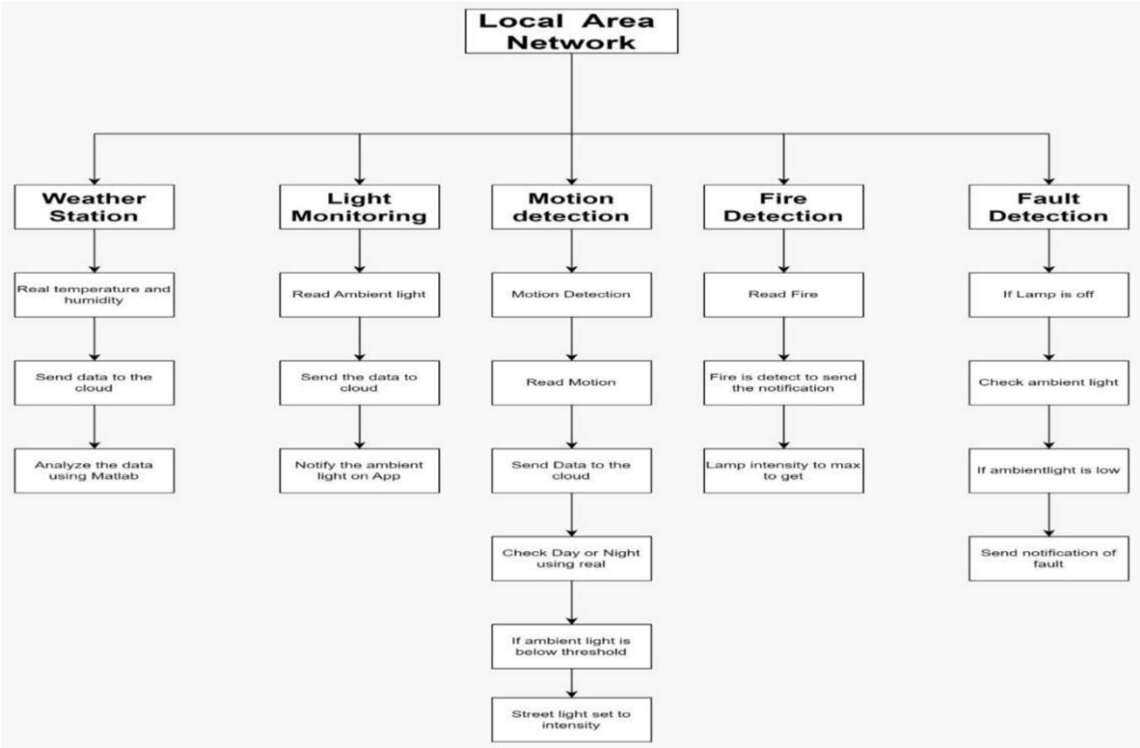
NFR-5	**Availability**	The system should be available 24/7 without any scheduled or unscheduled downtime.
NFR-6	**Scalability**	The solution should be able to scale its capacity up or down to handle changing volumes of users or transactions, without sacrificing performance or reliability.

CHAPTER - 5

PROJECT DESIGN

5.1 DATA FLOW DIAGRAMS

A Data flow Diagram (DFD) is a traditional visual representation of the information flows within a system. A neat and clear DFD can depict the right amount of the system requirement graphically. It shows how data enters and leaves the system, what changes the information, and where data stored.



5.2

Fig 5.1.1 DATA FLOW DIAGRAM

SOLUTION & TECHNICAL ARCHITECTURE

A solution architecture (SA) is an architectural description of a specific solution. SAs combine guidance from different enterprise architecture viewpoints (business, information and technical), as well as from the enterprise solution architecture (ESA).

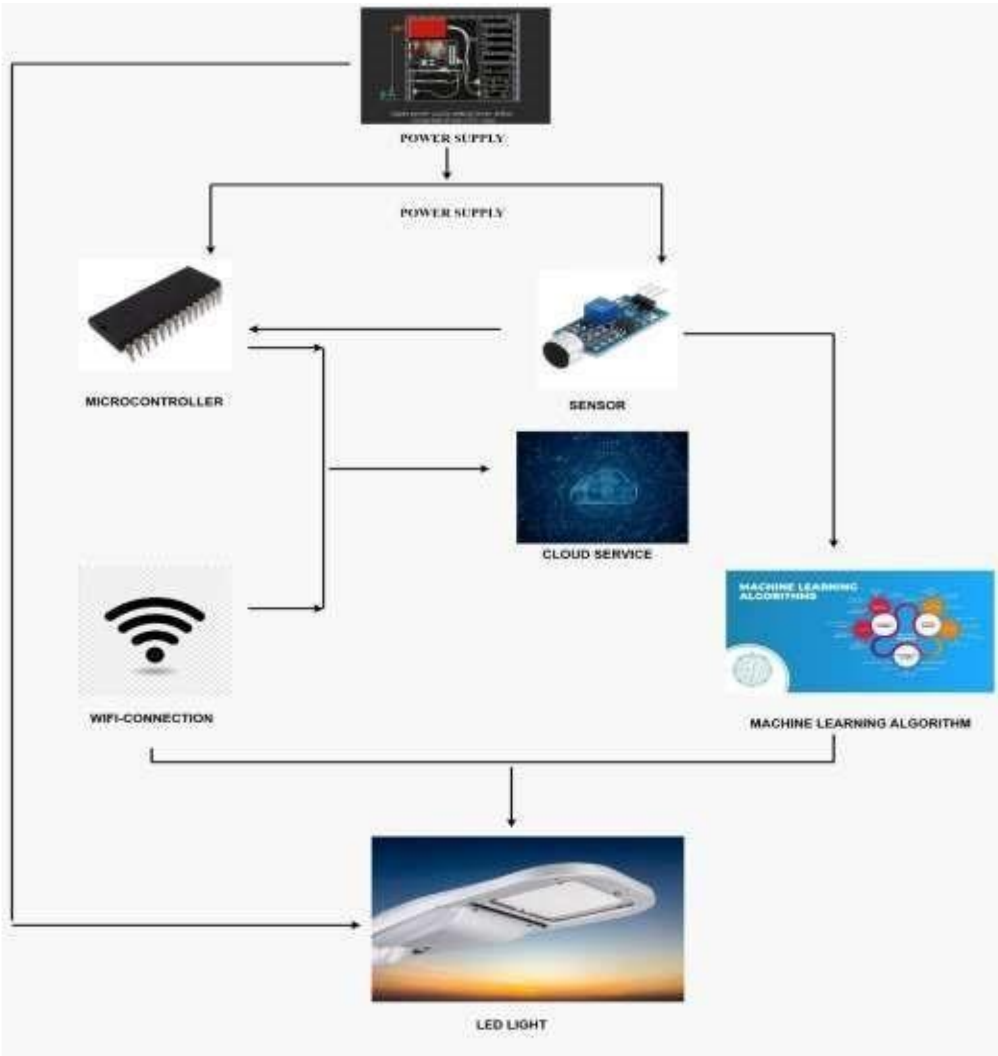


Fig 5.2.1 TECHNICAL ARCHITECTURE

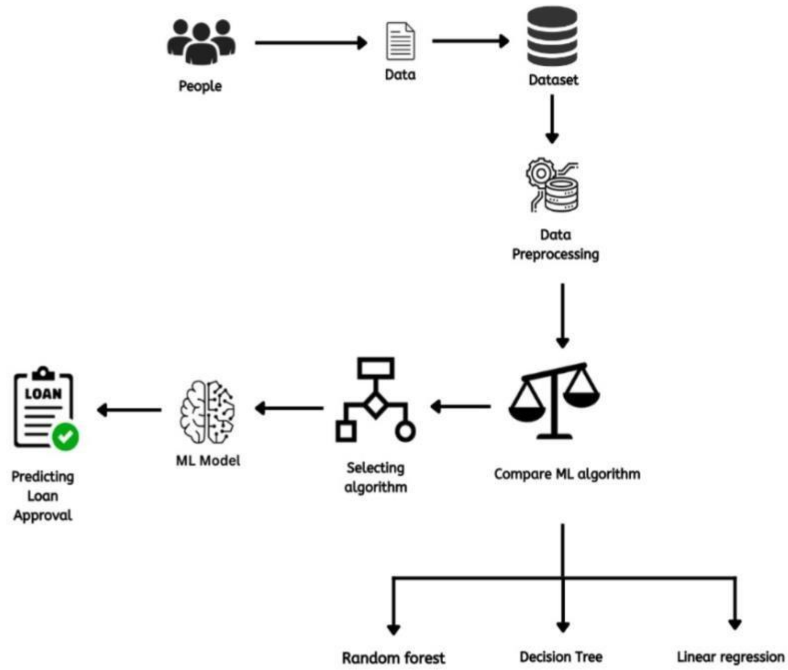


Fig 5.2.2 SOLUTION ARCHITECTURE

5.3 USER STORIES

Weather station	Light monitoring	Motion Detection	Fire detection	Fault detection
Detecting the humidity and temperature of the weather	Read the ambient light	Motion detection	Read fire	If the lamp is off check the ambient light

After the detection the data is sent to the cloud	Send the data to the cloud	Read motion of the weather	Fire is detected to send the notification	If ambient light is low

Analyse the data using MATLAB	Notify the ambient light on map	Send the data to the cloud	Increase the intensity of the lamp	Send the notification to fault.
		Check day or night using real		
		Suppose the ambient light is below threshold ,the light is set to intensity		

CHAPTER - 7
CODING & SOLUTIONING

7.1 FEATURE 1

- Integration: The system integrates with weather data sources or APIs to gather real-time weather information such as temperature, precipitation, wind speed, and visibility.

- Light Control: The system allows remote control of street lights based on weather conditions. It automatically adjusts the brightness or on/off state of the lights depending on the weather data received. For example, it may dim the lights during clear nights or increase brightness during foggy conditions.

- Intelligent Algorithms: The system utilizes intelligent algorithms to analyze weather data and make decisions about Weather light adjustments. These algorithms take into account factors such as time of day, season, and specific weather conditions to optimize energy consumption and visibility.

- Energy Efficiency: The system focuses on energy efficiency by adjusting the lighting levels based on real-time requirements. It helps reduce energy consumption during favorable weather conditions and increases it when needed, optimizing energy usage and reducing costs.

- Remote Monitoring and Maintenance: The system provides remote monitoring and maintenance capabilities, allowing administrators to monitor the status of street lights, detect failures or malfunctions, and perform necessary maintenance tasks remotely.

7.2 FEATURE 2

- Energy Consumption Analytics: The system collects and analyzes energy consumption data to provide insights into the usage patterns of street lights. It generates reports and statistics to help administrators make informed decisions regarding energy management and infrastructure planning.

- Integration with Existing Infrastructure: The system is designed to integrate seamlessly with existing street lighting infrastructure, making it compatible with a wide range of street light fixtures and control systems.

- Scalability: The system is designed to be scalable, allowing for the addition of new street lights and the expansion of the lighting network as the city grows or requirements change.

- Security: The system incorporates security measures to ensure the integrity and confidentiality of data exchanged between devices and the central management system. It may use encryption, authentication mechanisms, and access control to protect against unauthorized access or tampering.

- User Interface: The system provides a user-friendly interface for administrators to configure settings, monitor the system's performance, and access analytics and reports. It may also include a mobile application for on-the-go monitoring and control.

ADVANTAGES

1.Energy Efficiency: IoT-based weather adaptive street lighting systems can adjust the brightness levels of street lights based on real-time weather conditions. By using sensors to detect ambient light, precipitation, and fog, the system can automatically dim or brighten the lights accordingly. This leads to significant energy savings by reducing unnecessary lighting during periods of adequate natural light or by reducing the brightness during clear weather conditions.

2.Cost Savings: The energy efficiency achieved through IoT-based weather adaptive street lighting systems translates into cost savings for municipalities and organizations responsible for street lighting. By reducing energy consumption, these systems can lower electricity bills and operational costs in the long run.

DISADVANTAGES

1.Initial Cost: Implementing an IoT-based weather adaptive street lighting system involves significant upfront costs. The installation of sensors, communication infrastructure, and the necessary software and hardware can be expensive, especially for large-scale deployments.

2.Complex Implementation: Integrating various components, such as sensors, communication networks, and control systems, into a cohesive IoT solution requires careful planning and expertise. The complexity of implementation can be a challenge for organizations without prior experience or technical knowledge.

CHAPTER – 10

CONCLUSION

10.1 CONCLUSION

In conclusion, an IoT-based weather adaptive street lighting system brings numerous benefits and advancements to urban lighting infrastructure. By integrating weather data, intelligent algorithms, and remote monitoring capabilities, the system optimizes energy consumption, enhances visibility, and improves overall operational efficiency. It dynamically adjusts street lighting based on real-time weather conditions, ensuring appropriate brightness levels and reducing energy waste during favorable weather. The system enables remote monitoring and maintenance, allowing administrators to detect and address issues promptly. Furthermore, energy consumption analytics provide valuable insights for effective energy management and planning. With its scalability, compatibility, and security measures, the system can seamlessly integrate into existing infrastructure and adapt to changing requirements. Overall, an IoT-based weather adaptive street lighting system enhances sustainability, cost-effectiveness, and safety in urban environments.

10.2 FUTURE ENHANCEMENT

Predictive Analytics:

Incorporating predictive analytics algorithms to anticipate weather conditions and make proactive lighting adjustments. By analyzing historical weather data and patterns, the system can optimize lighting settings in advance, ensuring smooth transitions during weather changes. Machine Learning and Artificial Intelligence: Implementing machine learning and AI algorithms to continuously improve the system's performance. These algorithms can learn from real-time data and user feedback to enhance the accuracy of weather predictions and lighting adjustments over time .Smart Grid Integration: Integrating the street lighting system with the smart grid infrastructure to achieve better coordination and energy management. By leveraging data from the smart grid, the system can optimize lighting schedules based on overall energy demand, grid load, and renewable energy availability .Adaptive Light Distribution: Expanding the capabilities of the system to adjust not only the brightness but also the distribution of light. This could involve dynamically controlling the direction and focus of street lights based on weather conditions and specific areas requiring illumination. Environmental Sensors: Integrating additional environmental sensors into the system, such as air quality sensors or noise sensors. This would enable the system to respond not only to weather conditions but also to other environmental factors, enhancing the overall quality of the urban environment.

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},
{
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"type": "ui_button",
"z": "086b0842461f7bda",
"name": "",
"group": "6168f17c33a6d349",
"order": 0,
"width": "6",
"height": "1",
"passthru": false,

"label": "LIGHT ON",
"tooltip": "",
"color": "",
"bgcolor": "",
"className": "",
"icon": "",
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"payloadType": "str",
"topic": "topic",
"topicType": "msg",
"x": 90,
"y": 200,
"wires": [
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"a884fbb91cdf4364"
]
],
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},
{
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"type": "ui_button",
"z": "086b0842461f7bda",

"name": "",
"group": "6168f17c33a6d349",
"order": 1,
"width": "6",
"height": "1",
"passthru": false,
"label": "LIGHT OFF",
"tooltip": "",
"color": "",
"bgcolor": "",
"className": "",
"icon": "",
"payload": "lightoff2",
"payloadType": "str",
"topic": "topic",
"topicType": "msg",
"x": 150,
"y": 240,
"wires": [
[
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"a884fbb91cdf4364"
]
],
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\"7bb309f6643cd3ec\",\r\n \"327dec5f82b8488f\"\r\n]\r\n]\r\n }"
},
{
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"type": "ui_button",
"z": "086b0842461f7bda",
"name": "",
"group": "c3b21e13f73adc77",
"order": 0,
"width": "6",
"height": "1",
"passthru": false,
"label": "LIGHT ON",
"tooltip": "",
"color": "",
"bgcolor": "",
"className": "",
"icon": "",
"payload": "lighton3",
"payloadType": "str",
"topic": "topic",
"topicType": "msg",
"x": 110,
"y": 340,
"wires": [
[
"c9daa8aa4b6c149e",
"22bb3cf001aa81ce"
]
],
"info": "{\r\n \"id\": \"8534f27ba7baa437\",\r\n \"type\": \"ui_button\",\r\n \"z\": \"8dcb92d02eccd986\",\r\n \"name\": \"\",\r\n \"group\": \"dc260121cfbfae29\",\r\n

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\"order\": 1,\r\n       \"width\": 6,\r\n       \"height\": 1,\r\n
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\"tooltip\": \"\",\r\n       \"color\": \"\",\r\n       \"bgcolor\":
\"\",\r\n       \"className\": \"\",\r\n       \"icon\": \"\",\r\n
\"payload\": \"lighton3\",\r\n       \"payloadType\": \"str\",\r\n
\"topic\": \"topic\",\r\n       \"topicType\": \"msg\",\r\n       \"x\":
260,\r\n       \"y\": 500,\r\n       \"wires\": [\r\n           [\r\n
\"766732f45dc01a02\",\r\n               \"2a52760315997a17\"\r\n
]\r\n       ]\r\n    }"
  },
  {
    "id": "febd45f8fe8a9d6a",
    "type": "ui_button",
    "z": "086b0842461f7bda",
    "name": "",
    "group": "c3b21e13f73adc77",
    "order": 1,
    "width": "6",
    "height": "1",
    "passthru": false,
    "label": "LIGHT OFF",
    "tooltip": "",
    "color": "",
    "bgcolor": "",
    "className": "",
    "icon": "",
    "payload": "lightoff3",
    "payloadType": "str",
    "topic": "topic",
    "topicType": "msg",
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      [
        "c9daa8aa4b6c149e",
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]
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},
{
"id": "d760bf2411d1795e",
"type": "ibmiot out",
"z": "086b0842461f7bda",
"authentication": "apiKey",
"apiKey": "bfbbd9f3b98a974d",
"outputType": "cmd",
"deviceId": "12345",
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"format": "String",
"data": "Data",
"qos": 0,
"name": "IBM IoT",
"service": "registered",
"x": 560,
"y": 60,
"wires": [],
"info": "{\r\n \"id\": \"484bc6909d8f04cf\",\r\n

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\"type\": \"ibmiot out\",\r\n        \"z\": \"8dcb92d02eccd986\",\r\n
\"authentication\": \"apiKey\",\r\n        \"apiKey\":
\"bfbbd9f3b98a974d\",\r\n        \"outputType\": \"cmd\",\r\n
\"deviceId\": \"12345\",\r\n        \"deviceType\":
\"streetlight\",\r\n        \"eventCommandType\": \"test\",\r\n
\"format\": \"String\",\r\n        \"data\": \"Data\",\r\n        \"qos\":
0,\r\n        \"name\": \"IBM IoT\",\r\n        \"service\":
\"registered\",\r\n        \"x\": 620,\r\n        \"y\": 300,\r\n
\"wires\": []\r\n    }"
  },
  {
    "id": "a884fbb91cdf4364",
    "type": "ibmiot out",
    "z": "086b0842461f7bda",
    "authentication": "apiKey",
    "apiKey": "bfbbd9f3b98a974d",
    "outputType": "cmd",
    "deviceId": "12345",
    "deviceType": "streetlight",
    "eventCommandType": "test",
    "format": "String",
    "data": "Data",
    "qos": 0,
    "name": "IBM IoT",
    "service": "registered",
    "x": 560,
    "y": 220,
    "wires": [],
    "info": "{\r\n        \"id\": \"327dec5f82b8488f\",\r\n
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\"authentication\": \"apiKey\",\r\n        \"apiKey\":
\"bfbbd9f3b98a974d\",\r\n        \"outputType\": \"cmd\",\r\n
\"deviceId\": \"12345\",\r\n        \"deviceType\":
\"streetlight\",\r\n        \"eventCommandType\": \"test\",\r\n
\"format\": \"String\",\r\n        \"data\": \"Data\",\r\n        \"qos\":
```

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    },
    {
        "id": "22bb3cf001aa81ce",
        "type": "ibmiot out",
        "z": "086b0842461f7bda",
        "authentication": "apiKey",
        "apiKey": "bfbbd9f3b98a974d",
        "outputType": "cmd",
        "deviceId": "12345",
        "deviceType": "streetlight",
        "eventCommandType": "test",
        "format": "String",
        "data": "Data",
        "qos": 0,
        "name": "IBM IoT",
        "service": "registered",
        "x": 560,
        "y": 340,
        "wires": [],
        "info": "{\r\n   \"id\": \"2a52760315997a17\",\r\n   \"type\": \"ibmiot out\",\r\n   \"z\": \"8dcb92d02eccd986\",\r\n   \"authentication\": \"apiKey\",\r\n   \"apiKey\": \"bfbbd9f3b98a974d\",\r\n   \"outputType\": \"cmd\",\r\n   \"deviceId\": \"12345\",\r\n   \"deviceType\": \"streetlight\",\r\n   \"eventCommandType\": \"test\",\r\n   \"format\": \"String\",\r\n   \"data\": \"Data\",\r\n   \"qos\": 0,\r\n   \"name\": \"IBM IoT\",\r\n   \"service\": \"registered\",\r\n   \"x\": 680,\r\n   \"y\": 540,\r\n   \"wires\": []\r\n   }"
    },
    {
        "id": "d7cfcc256a61dc78",

"type": "ui_group",
"name": "street light 1",
"tab": "d6409f41ce44cf26",
"order": 1,
"disp": true,
"width": "6",
"collapse": false,
"className": ""
},
{
"id": "6168f17c33a6d349",
"type": "ui_group",
"name": "street light 2",
"tab": "d6409f41ce44cf26",
"order": 2,
"disp": true,
"width": "6",
"collapse": false,
"className": ""
},
{
"id": "c3b21e13f73adc77",
"type": "ui_group",
"name": "street light 3",
"tab": "d6409f41ce44cf26",
"order": 3,
"disp": true,
"width": "6",
"collapse": false,
"className": ""
},
{
"id": "bfbbd9f3b98a974d",
"type": "ibmiot",

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        "name": "",
"keepalive": "60",
"serverName":
"bwz5xz.messaging.internetofthings.ibmcloud.com",
        "cleansession": true,
        "appId": "",
        "shared": false,
        "credentials": {}
    },
    {
        "id": "d6409f41ce44cf26",
        "type": "ui_tab",
        "name": "weather Adaptive lighting",
        "icon": "",
        "order": 1,
        "disabled": false,
        "hidden": false
    }
]
```
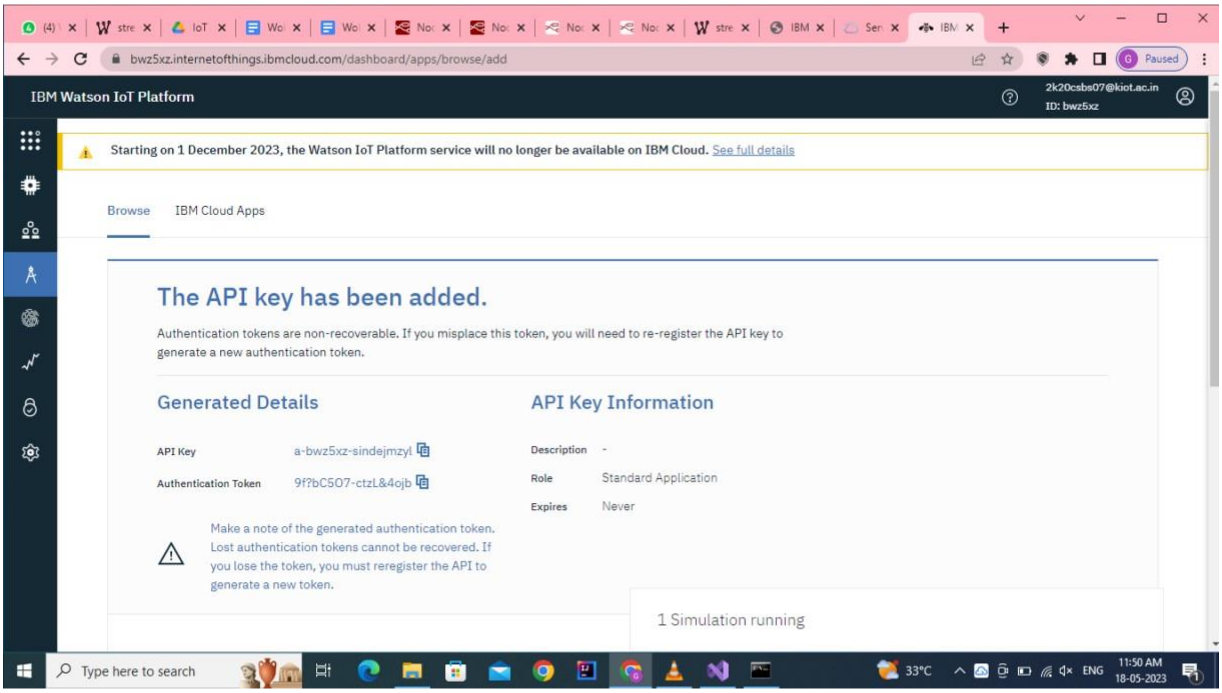
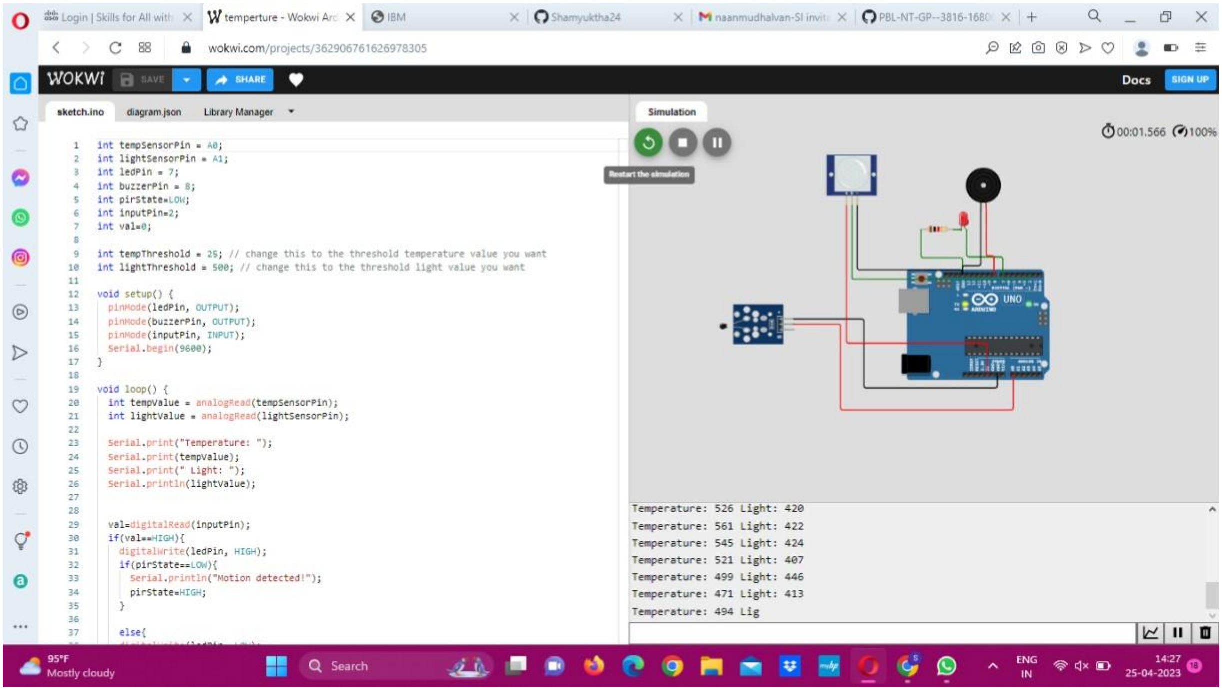
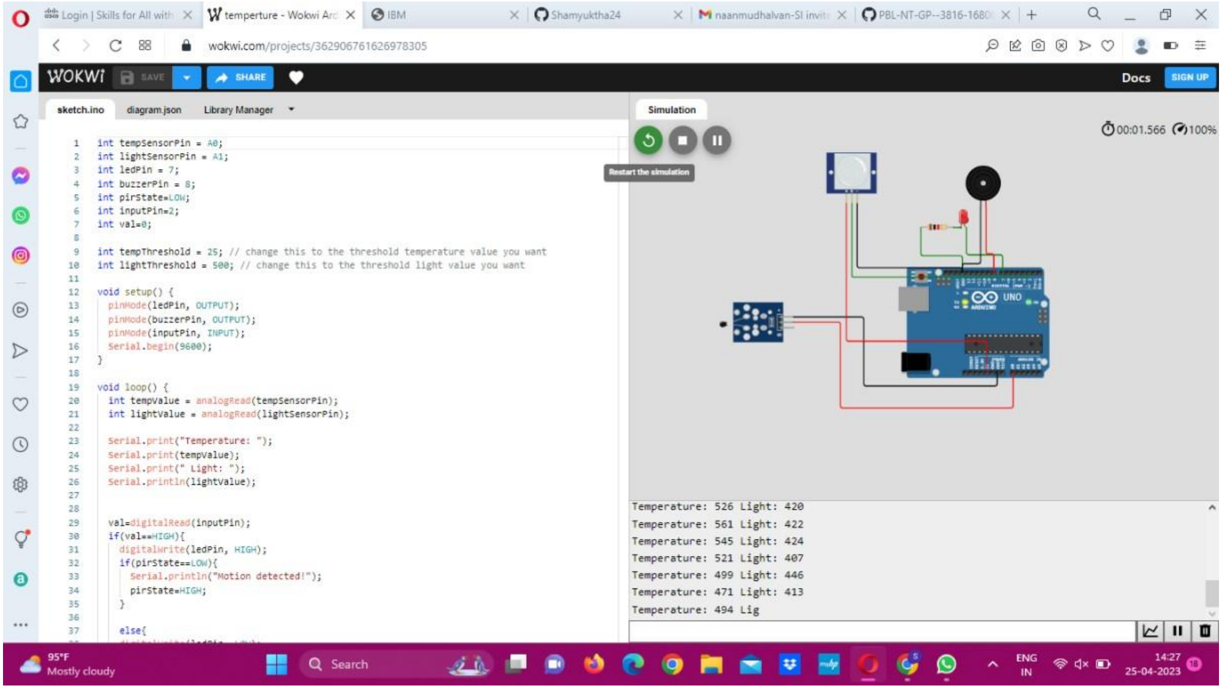
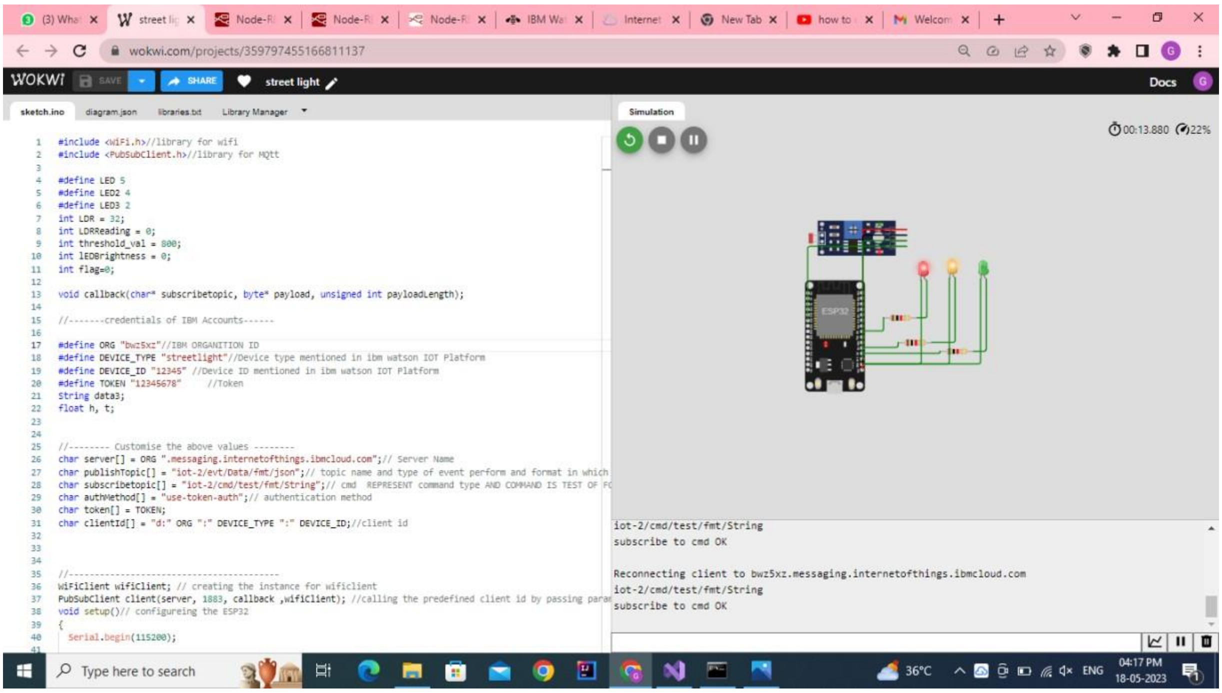
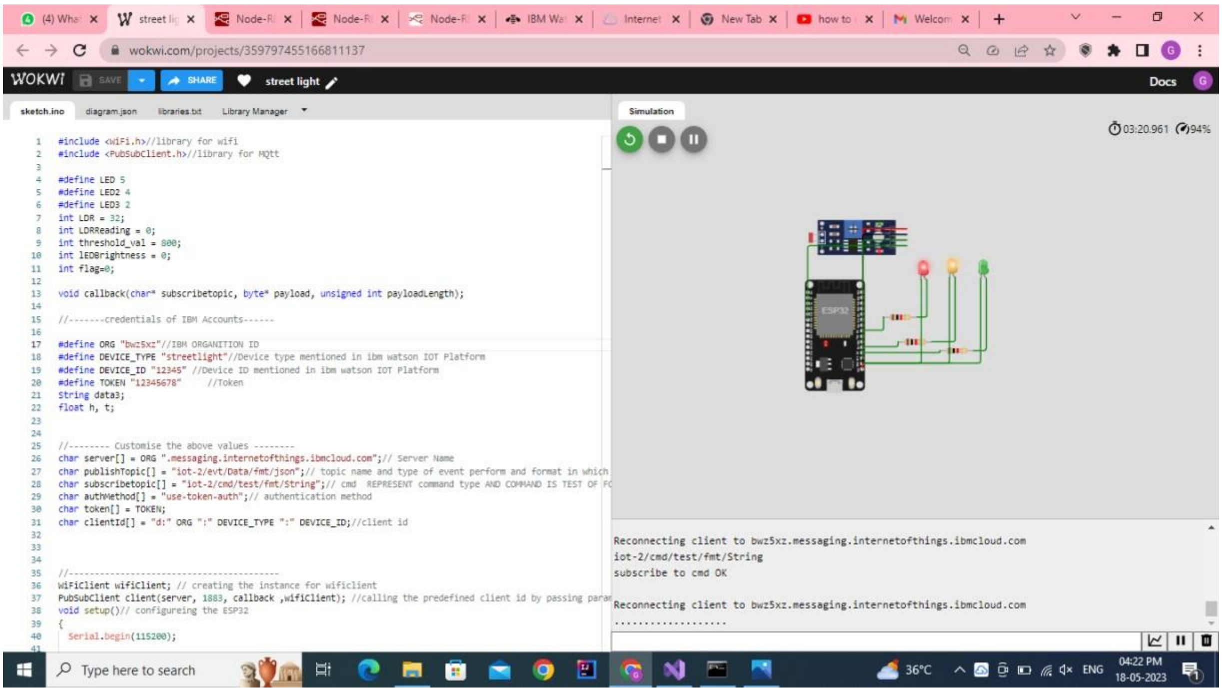

SCREENSHOTS

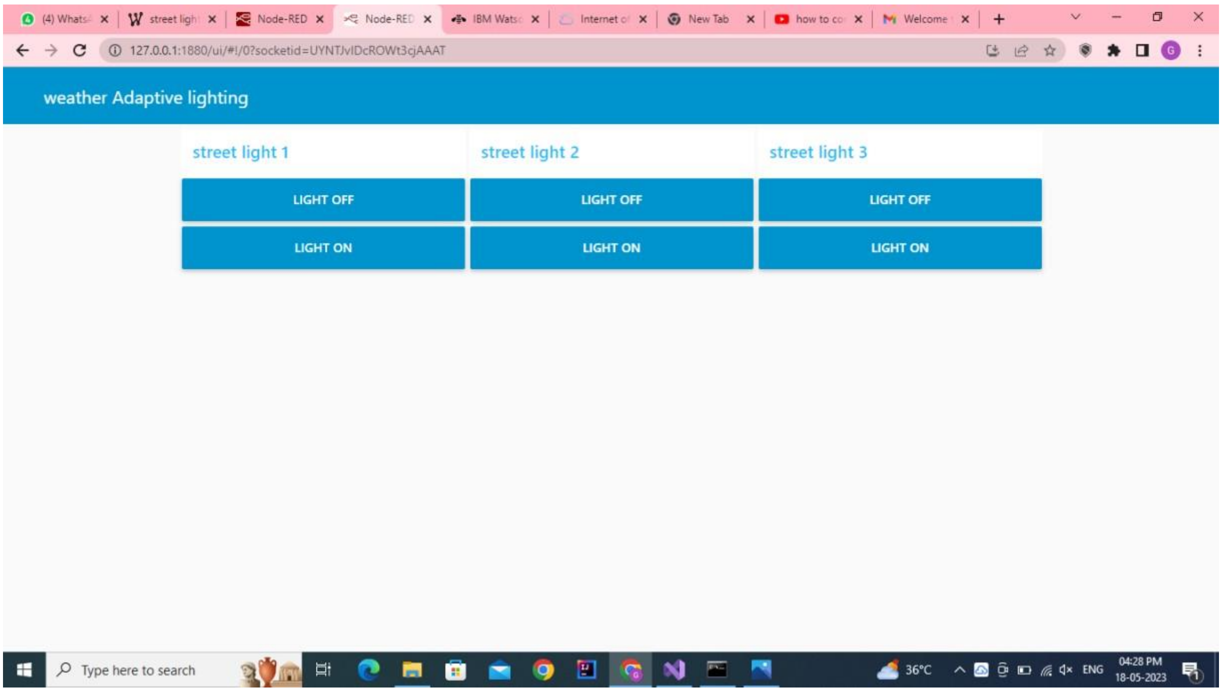


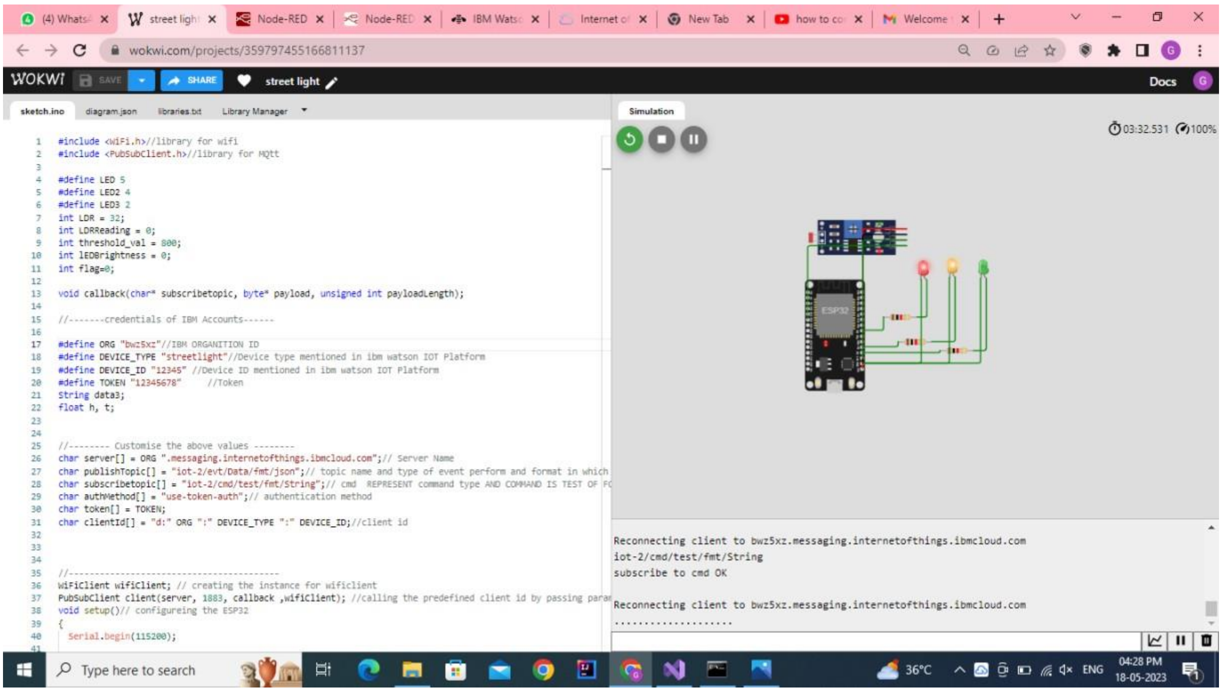


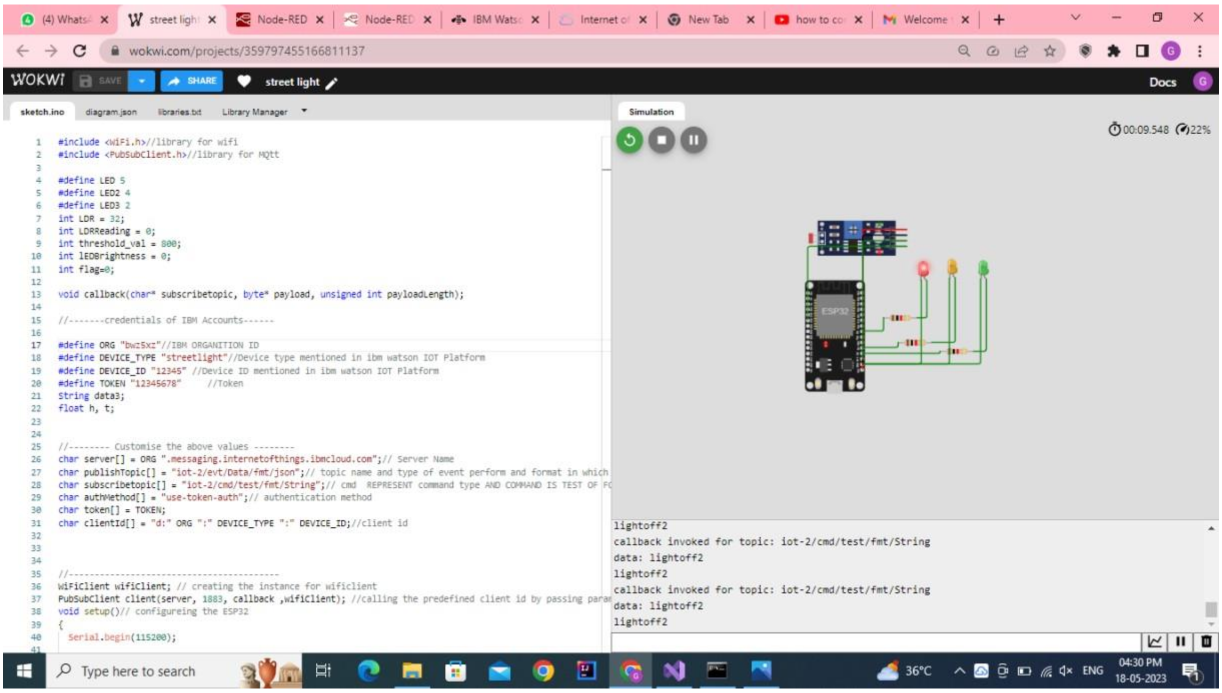


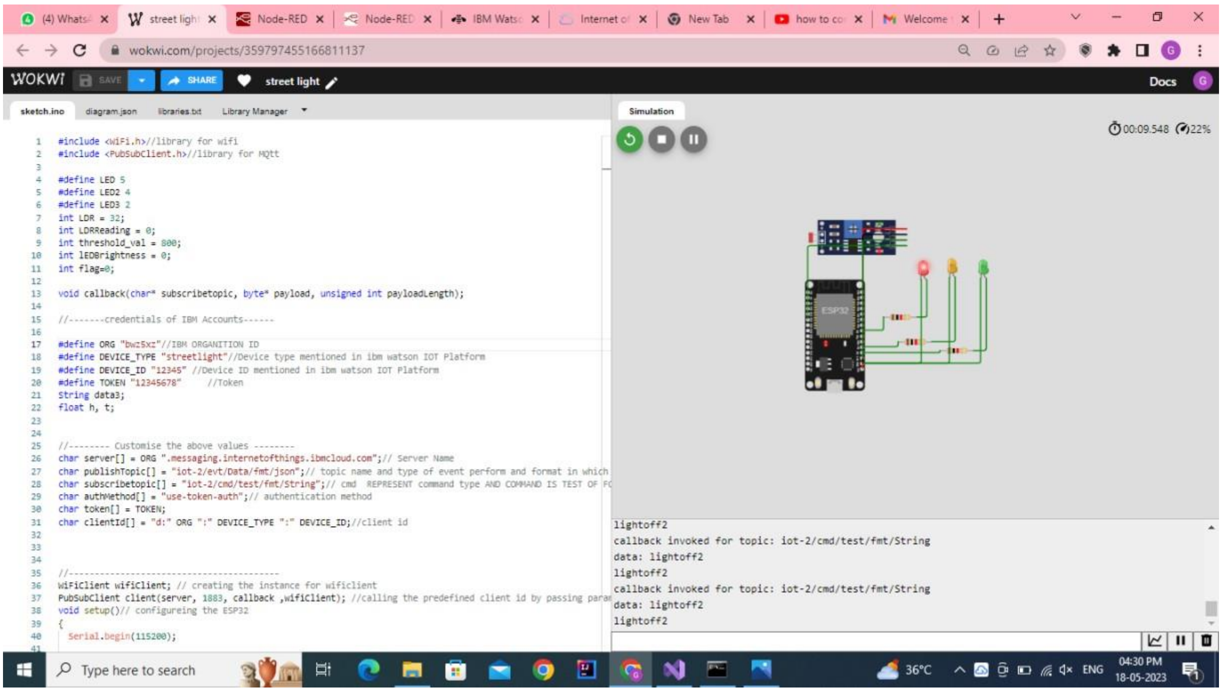


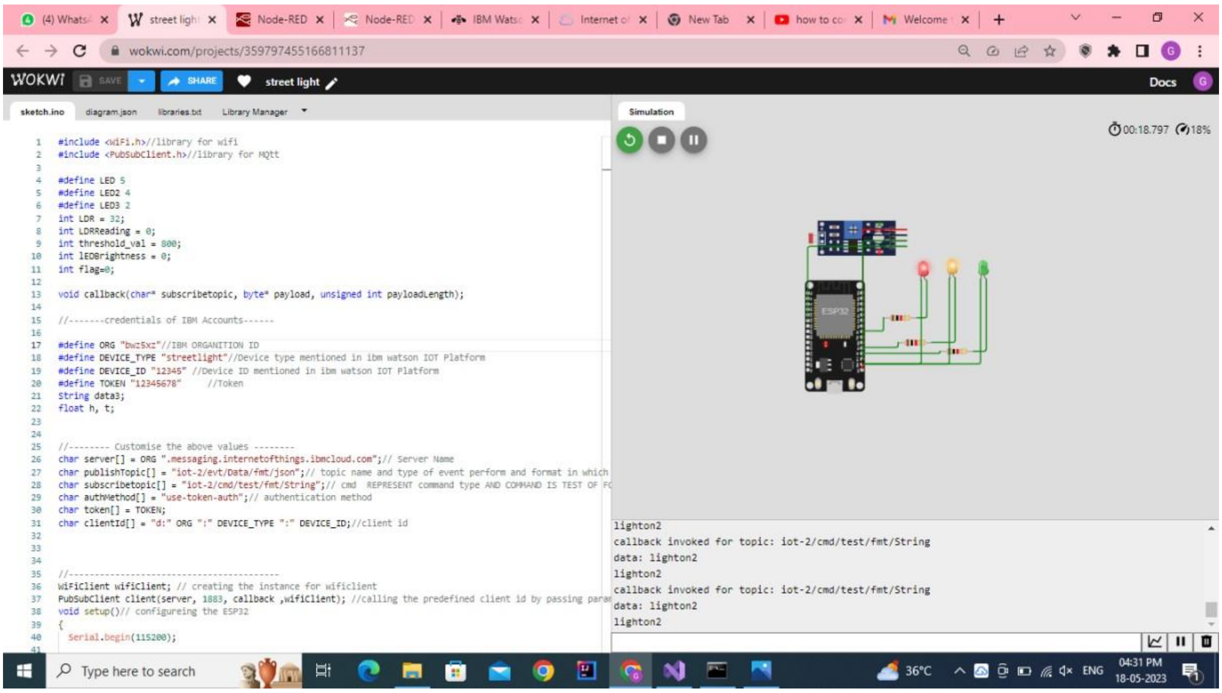

wokwi.com/projects/359797455166811137
WOKWI
SAVE
SHARE
street light
Docs
sketch.ino
diagram.json
libraries.txt
Library Manager
#include <WiFi.h>//library for wifi
#include <PubSubClient.h>//library for MQtt
#define LED 5
#define LED2 4
#define LED3 2
int LDR = 32;
int LDRReading = 0;
int threshold_val = 800;
int lEDBrightness = 0;
int flag=0;
void callback(char* subscribetopic, byte* payload, unsigned int payloadLength);
//-------credentials of IBM Accounts------
#define ORG "bwz5xz"//IBM ORGANITION ID
#define DEVICE_TYPE "streetlight"//Device type mentioned in ibm watson IOT Platform
#define DEVICE_ID "12345" //Device ID mentioned in ibm watson IOT Platform
#define TOKEN "12345678" //Token
String data3;
float h, t;
//-------- Customise the above values --------
char server[] = ORG ".messaging.internetofthings.ibmcloud.com";// Server Name
char publishTopic[] = "iot-2/evt/Data/fmt/json";// topic name and type of event perform and format in which
char subscribetopic[] = "iot-2/cmd/test/fmt/String";// cmd REPRESENT command type AND COMMAND IS TEST OF FO
char authMethod[] = "use-token-auth";// authentication method
char token[] = TOKEN;
char clientId[] = "d:" ORG ":" DEVICE_TYPE ":" DEVICE_ID;//client id
//---------------------------------------
WiFiClient wifiClient; // creating the instance for wificlient
PubSubClient client(server, 1883, callback ,wifiClient); //calling the predefined client id by passing param
void setup()// configureing the ESP32
{
Serial.begin(115200);
Simulation
03:20.961
94%
ESP32
Reconnecting client to bwz5xz.messaging.internetofthings.ibmcloud.com
iot-2/cmd/test/fmt/String
subscribe to cmd OK
Reconnecting client to bwz5xz.messaging.internetofthings.ibmcloud.com
Type here to search
36°C
ENG
04:22 PM
18-05-2023

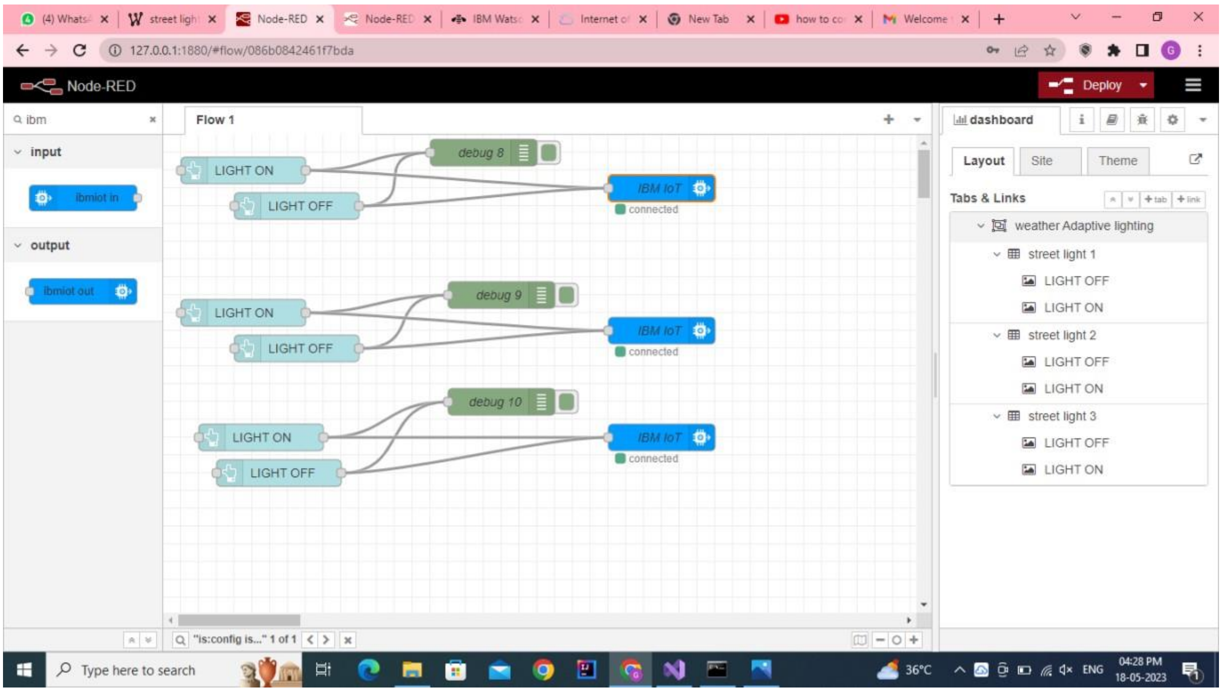

127.0.0.1:1880/ui/#!/0?socketid=UYNTJvIDcROWt3cjAAAT
weather Adaptive lighting
street light 1
street light 2
street light 3
LIGHT OFF
LIGHT OFF
LIGHT OFF
LIGHT ON
LIGHT ON
LIGHT ON
Type here to search
36°C
ENG
04:28 PM
18-05-2023






wokwi.com/projects/359797455166811137
WOKWI
SAVE
SHARE
street light
Docs
sketch.ino
diagram.json
libraries.txt
Library Manager
Simulation
00:09.548
22%
#include <WiFi.h>//library for wifi
#include <PubSubClient.h>//library for MQtt
#define LED 5
#define LED2 4
#define LED3 2
int LDR = 32;
int LDRReading = 0;
int threshold_val = 800;
int lEDBrightness = 0;
int flag=0;
void callback(char* subscribetopic, byte* payload, unsigned int payloadLength);
//-------credentials of IBM Accounts------
#define ORG "bwz5xz"//IBM ORGANITION ID
#define DEVICE_TYPE "streetlight"//Device type mentioned in ibm watson IOT Platform
#define DEVICE_ID "12345" //Device ID mentioned in ibm watson IOT Platform
#define TOKEN "12345678" //Token
String data3;
float h, t;
//-------- Customise the above values --------
char server[] = ORG ".messaging.internetofthings.ibmcloud.com";// Server Name
char publishTopic[] = "iot-2/evt/Data/fmt/json";// topic name and type of event perform and format in which
char subscribetopic[] = "iot-2/cmd/test/fmt/String";// cmd REPRESENT command type AND COMMAND IS TEST OF FO
char authMethod[] = "use-token-auth";// authentication method
char token[] = TOKEN;
char clientId[] = "d:" ORG ":" DEVICE_TYPE ":" DEVICE_ID;//client id
WiFiClient wifiClient; // creating the instance for wificlient
PubSubClient client(server, 1883, callback ,wifiClient); //calling the predefined client id by passing param
void setup()// configureing the ESP32
{
Serial.begin(115200);
lightoff2
callback invoked for topic: iot-2/cmd/test/fmt/String
data: lightoff2
lightoff2
callback invoked for topic: iot-2/cmd/test/fmt/String
data: lightoff2
lightoff2
Type here to search
36°C
ENG
04:30 PM
18-05-2023


wokwi.com/projects/359797455166811137
WOKWI
street light
Simulation
00:18.797
18%
lighton2
callback invoked for topic: iot-2/cmd/test/fmt/String
data: lighton2
lighton2
callback invoked for topic: iot-2/cmd/test/fmt/String
data: lighton2
lighton2
Type here to search
36°C
ENG
04:31 PM
18-05-2023


Node-RED
Deploy
Flow 1
input
ibmiot in
output
ibmiot out
LIGHT ON
LIGHT OFF
debug 8
debug 9
debug 10
IBM IoT
connected
dashboard
Layout
Site
Theme
Tabs & Links
weather Adaptive lighting
street light 1
street light 2
street light 3

CHAPTER – 12

REFERENCE

1. https://smartinternz.com/saas-guided-project/1/smart-lenderapplicantcredibility-prediction-for-loan-approval-1987

2. https://www.ijraset.com/research-paper/bank-loan-approval-predictionusingdata-science-technique

3. https://ieeexplore.ieee.org/document/9853160

4. https://www.itmconferences.org/articles/itmconf/pdf/2022/04/itmconf_ica cc20 22_03019.

5. https://towardsdatascience.com/ml-basics-loan-prediction-d695ba7f31f6

GITHUB: https://github.com/naanmudhalvan-SI/PBL-NT-GP-3816-1680688681.

YOUTUBE VEDIO LINK:
https://drive.google.com/file/d/1U03CafO8cHpu4jrg8zW1LeeV5QDg1O2/view?usp=share_link

R1