# IOT BASED SMART STREET LIGHT MONITORING SYSTEM


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# ABSTRACT


- The Internet of Things (IoT) based Smart Street Light Monitoring System employs Arduino Uno, WiFi connectivity, Light Dependent Resistor (LDR) sensor, Infrared (IR) sensor, and LED technology to optimize street lighting efficiency. This system aims to intelligently control street lights based on real-time environmental conditions and traffic patterns. The Arduino Uno serves as the central processing unit, gathering data from the LDR sensor to detect ambient light levels and the IR sensor to detect the presence of vehicles or pedestrians. Through WiFi connectivity, the system transmits data to a central server for analysis and decision-making. By leveraging this data, the system dynamically adjusts street light intensity, conserving energy during low-traffic periods while ensuring adequate illumination for safety. Overall, this IoT-based solution offers a cost-effective and sustainable approach to street lighting management, enhancing urban infrastructure and promoting energy efficiency.

# INTRODUCTION

- In an era where technological advancements are reshaping urban landscapes, the Internet of Things (IoT) emerges as a transformative force, offering innovative solutions to age-old challenges. Among these solutions, the IoT-based Smart Street Light Monitoring System stands out as a beacon of efficiency and sustainability in urban infrastructure management.
- At the heart of this system lies the Arduino Uno, a versatile microcontroller, orchestrating a symphony of sensors and connectivity technologies to revolutionize street lighting. By harnessing WiFi connectivity, the system seamlessly integrates into the fabric of smart cities, enabling real-time data transmission to a central server for analysis and decision-making.
- The deployment of Light Dependent Resistor (LDR) and Infrared (IR) sensors empowers the system to perceive and respond to its environment with precision. The LDR sensor discerns ambient light levels, while the IR sensor detects the presence of vehicles and pedestrians, collectively informing intelligent adjustments to street light intensity.
- The implications of this innovation are profound. Not only does the IoT-based Smart Street Light Monitoring System optimize energy consumption by dynamically adapting to real-time conditions, but it also enhances safety and convenience for urban dwellers. By illuminating streets judiciously, the system reduces light pollution and mitigates environmental impact, paving the way for more sustainable cities.

# PROBLEM STATEMENT:

- Street lighting has become an essential commodity for human life as it provides lighting in cities, towns and most especially on roads to reduce risk of accidents at night.
- Though necessary, streetlight systems not properly managed can result in risk of accidents, excessive loss of energy, financial losses and dissatisfaction of customers.
- This project proposes a smart system to manage streetlight operation, relying on sensors and internet of things technologies.
- The proposed smart streetlight system consisted of hardware and software design.
- Results showed an effective operation, leading to reduced energy consumption of the streetlight, subsequent reduction of carbon footprint, effective detection of fault, effective location of fault owing to GPS devices and reduced downtime.

# MOTIVATON:

- The motivation for implementing a smart street light monitoring system using the IoT domain is to create more sustainable, efficient, and connected urban environments, with a focus on energy conservation, cost savings, and improved overall quality of life.
- Energy Efficiency
- Cost Savings
- Environmental Impact
- Remote Monitoring and Management
- Sustainable  Environment

# Existing System and Drawbacks

- Current street light systems are not well automated.
- Person has to go there and switch on the system and if there is any failure we don’t know until we see the light.
- Lights glow with same intensity in day and night.
- So, existing system has some drawbacks like more energy consumption and more cost.

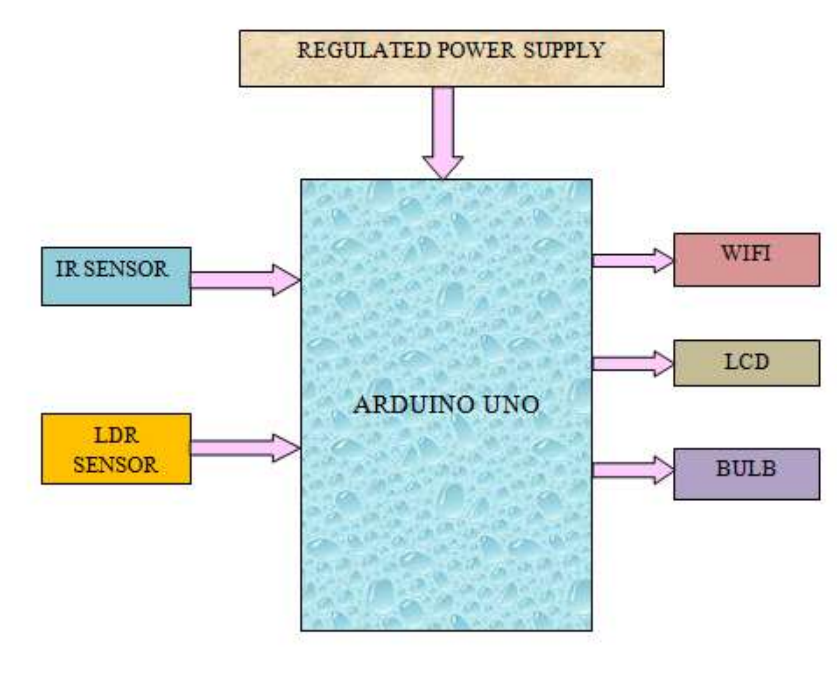
# OBJECTIVE

- The objective of the IoT-based Smart Street Light Monitoring System is to optimize street lighting efficiency by intelligently controlling light intensity based on real-time environmental conditions and traffic patterns. Utilizing Arduino Uno, WiFi connectivity, LDR, IR sensors, and LED technology, the system aims to conserve energy during low-traffic periods while ensuring adequate illumination for safety. By dynamically adjusting street light intensity, the system promotes energy efficiency, cost-effectiveness, and sustainability in urban infrastructure management.

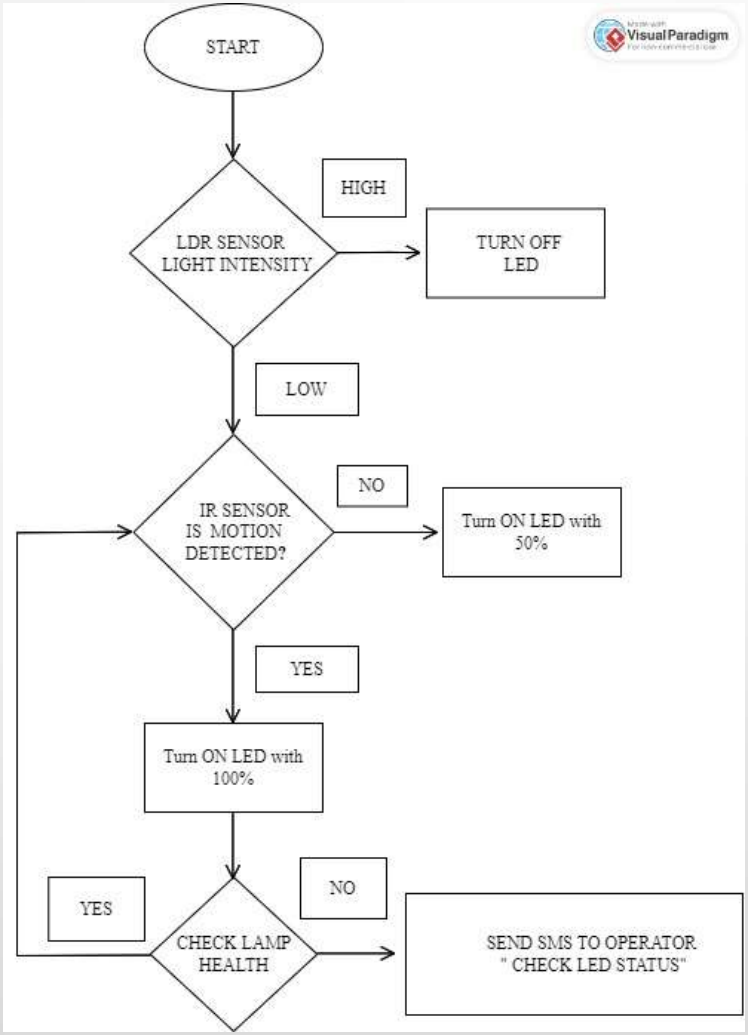
# PROPOSED SYSTEM

- The proposed system, an IoT-based Smart Street Light Monitoring System, integrates Arduino Uno, WiFi connectivity, Light Dependent Resistor (LDR) sensor, Infrared (IR) sensor, and LED technology. Arduino Uno acts as the central processor, utilizing data from the LDR sensor to monitor ambient light levels and the IR sensor to detect vehicle or pedestrian presence. Through WiFi, the system transmits data to a central server for analysis. By dynamically adjusting street light intensity based on real-time environmental conditions and traffic patterns, the system optimizes energy consumption while ensuring safety. This solution offers a cost-effective and sustainable approach to street lighting management, enhancing urban infrastructure and promoting energy efficiency.

# BLOCK DIAGRAM



# DATA FLOW DIAGRAM



# ADVANTAGES OF PROPOSED SYSTEM

- Dynamic adjustment of street light intensity conserves energy, reducing costs and environmental impact.
- Real-time monitoring ensures adequate illumination, promoting pedestrian and vehicular safety.
- Optimal use of resources leads to reduced energy bills and maintenance costs for municipalities.
- IoT integration improves urban infrastructure, aligning with sustainable development goals and environmental initiatives.

# FEASIBILITY STUDY

- In this proposed system, we have designed a Smart IOT based Street Light Monitoring and Auto Control System. This street light automatically switches on / Off on detection of Day and Night .
- In the manual streetlight system lights its powered from sunset to sunrise with maximum intensity even when there is sufficient light available. This energy wastage can be avoided by switching off lights automatically.

- This entire street light system is interfaced with IoT Technology.
- Sensing Circuits is used to Monitor the Working status of the Streetlight. If there is any failure then it will automatically send a notification to the Blynk Application.
- This Project is cost effective, practical, eco-friendly and also the safest thanks to save energy.

# NON – FUNCTIONAL REQUIREMENTS

HARDWARE REQUIREMENTS

- ARDUINO UNO
- IR SENSOR
- LDR SENSOR
- WIFI
- LCD
- BULB
- DC MOTORREGUATED POWER SUPPLY

SOFTWARE REQUIREMENTS

- Arduino ide
- Embedded c programming
- Windows OS

# FUNCTIONAL REQUIREMENTS

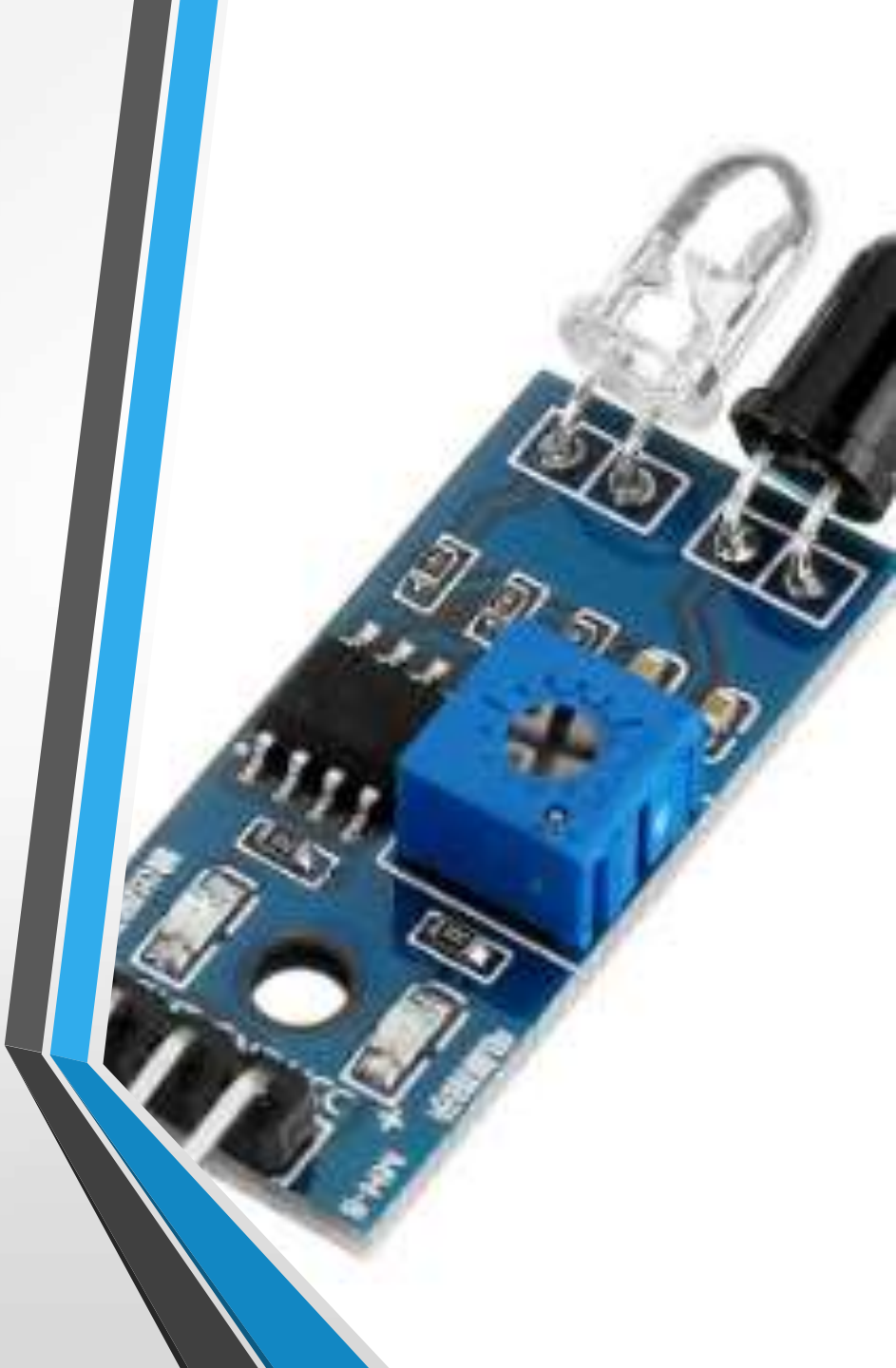
1. **Performance :** Ensure efficient obstacle detection, response time, GPS accuracy and battery life.
2. **Usability :** This system having audio alert clarity, volume control and also weight and balance.
3. **Reliability :** It ensures system uptime, sensor accuracy and GSM connectivity**.**
4. **Security :** Data Privacy should be ensured during the process.
5. **Maintainability :** The system is designed for ease of repair and software updates.
6. **Environmental Factors :**The system should function reliably in different weather conditions (e.g., rain, extreme temperatures).
7. **Cost Effective :**The overall cost of the system (including components and maintenance) should be affordable for the target user group.

# ARDUINO UNO

- The most common version of Arduino is the Arduino Uno. This board is what most people are talking about when they refer to an Arduino. The Uno is one of the more popular boards in the Arduino family and a great choice for beginners. There are different revisions of Arduino Uno, below detail is the most recent revision (Rev3 or R3).

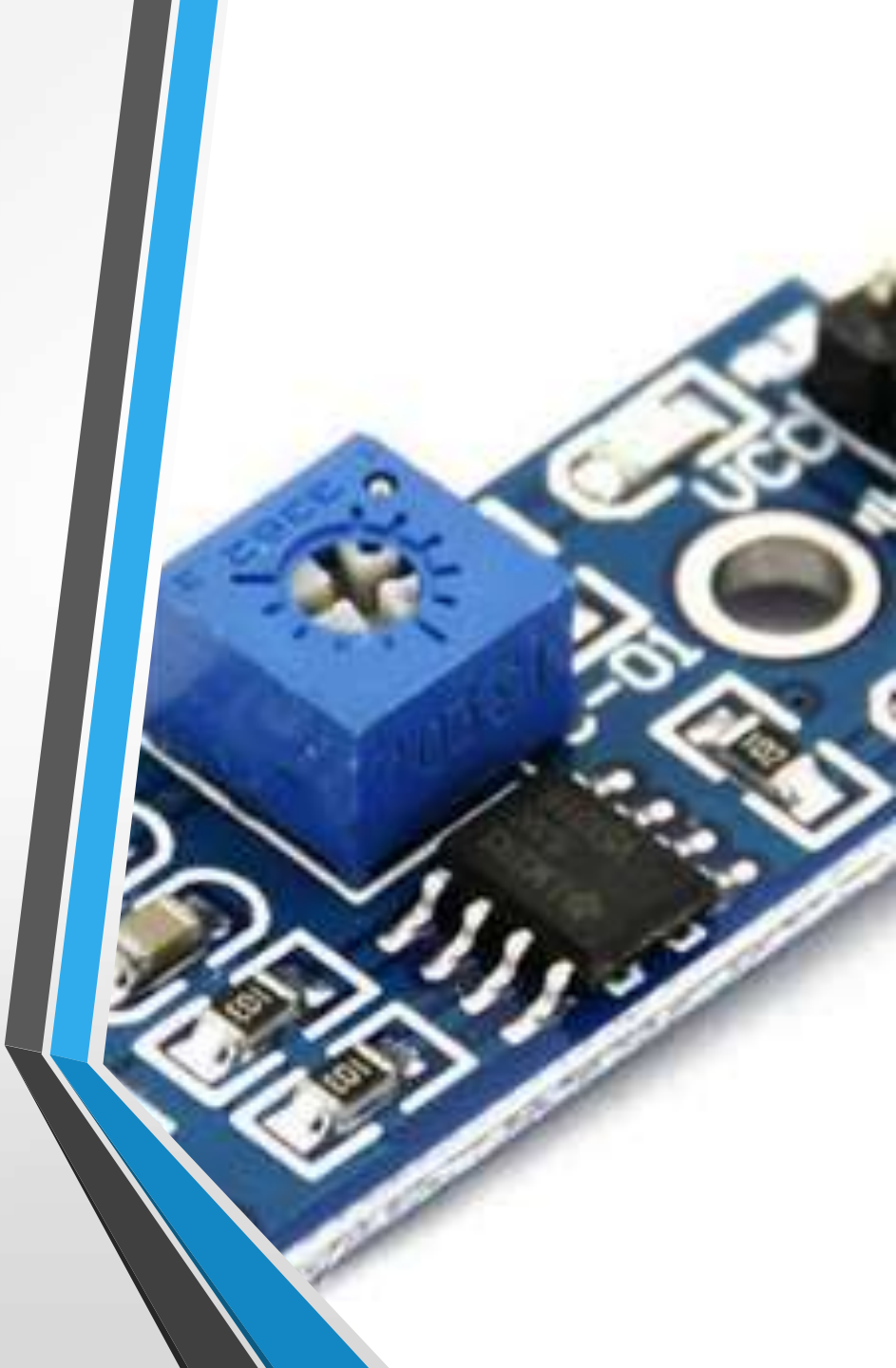
# IR SENSOR

- Infrared radiation, or simply infrared or IR, is electromagnetic radiation (EMR) with longer wavelengths than those of visible light, and is therefore invisible, although it is sometimes loosely called infrared light. It extends from the nominal red edge of the visible spectrum at 700 nanometers (frequency 430 THz), to 1000000 nm (300 GHz) (although people can see infrared up to at least 1050 nm in experiments). Most of the thermal radiation emitted by objects near room temperature is infrared. Like all EMR, IR carries radiant energy, and behaves both like a wave and like its quantum particle, the photon.



# LDR SENSOR

- The controlling of lights and home appliances are generally operated and maintained manually in several occasions. But the process of appliances controlling may cause wastage of power due to carelessness of human beings or unusual circumstances. To overcome this problem we can use the light dependent resistor circuit for controlling the loads based on the intensity of light. An LDR or a photo resistor is a device which is made up of high resistance semiconductor material. This article gives an overview of what is LDR, light dependent resistor circuit and its working.



# WIFI

- The ESP8266 is a low-cost Wi-Fi chip with full TCP/IP stack and MCU (microcontroller unit) capability produced by Shanghai-based Chinese manufacturer, Espressif Systems.[1]
- The chip first came to the attention of western makers in August 2014 with the ESP-01 module, made by a third-party manufacturer, AI-Thinker. This small module allows microcontrollers to connect to a Wi-Fi network and make simple TCP/IP connections using Hayes-style commands. However, at the time there was almost no English-language documentation on the chip and the commands it accepted.[2] The very low price and the fact that there were very few external components on the module which suggested that it could eventually be very inexpensive in volume, attracted many hackers to explore the module, chip, and the software on it, as well as to translate the Chinese documentation.[3]

# LCD

- LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters (unlike in seven segments), animationsand so on.

# BULB


- An LED lamp or LED light[1] is an electric light that produces light using light-emitting diodes (LEDs). LED lamps are significantly more energy-efficient than equivalent incandescent lamps and fluorescent lamps.[2][3][4] The most efficient commercially available LED lamps have efficiencies exceeding 200 lumens per watt (lm/W) and convert more than half the input power into light.[5][6][7] Commercial LED lamps have a lifespan several times longer than both incandescent and fluorescent lamps.

# What is ThingSpeak:

- ThingSpeak is an Internet of Things (IoT) platform and open API provided by MathWorks, the company behind MATLAB. It allows you to collect, analyze, and visualize data from IoT devices in real time.

**Key features of ThingSpeak include**:

- Data Collection
- Data Analysis
- Visualization
- Integration
- Alerts and Actions:
- ThingSpeak provides a platform for IoT data collection, analysis, and visualization, making it easier for developers and enthusiasts to build IoT applications and systems.

# Interface


ThingSpeak™
ThingSpeak for IoT Projects
Data collection in the cloud with advanced analysis using MATLAB
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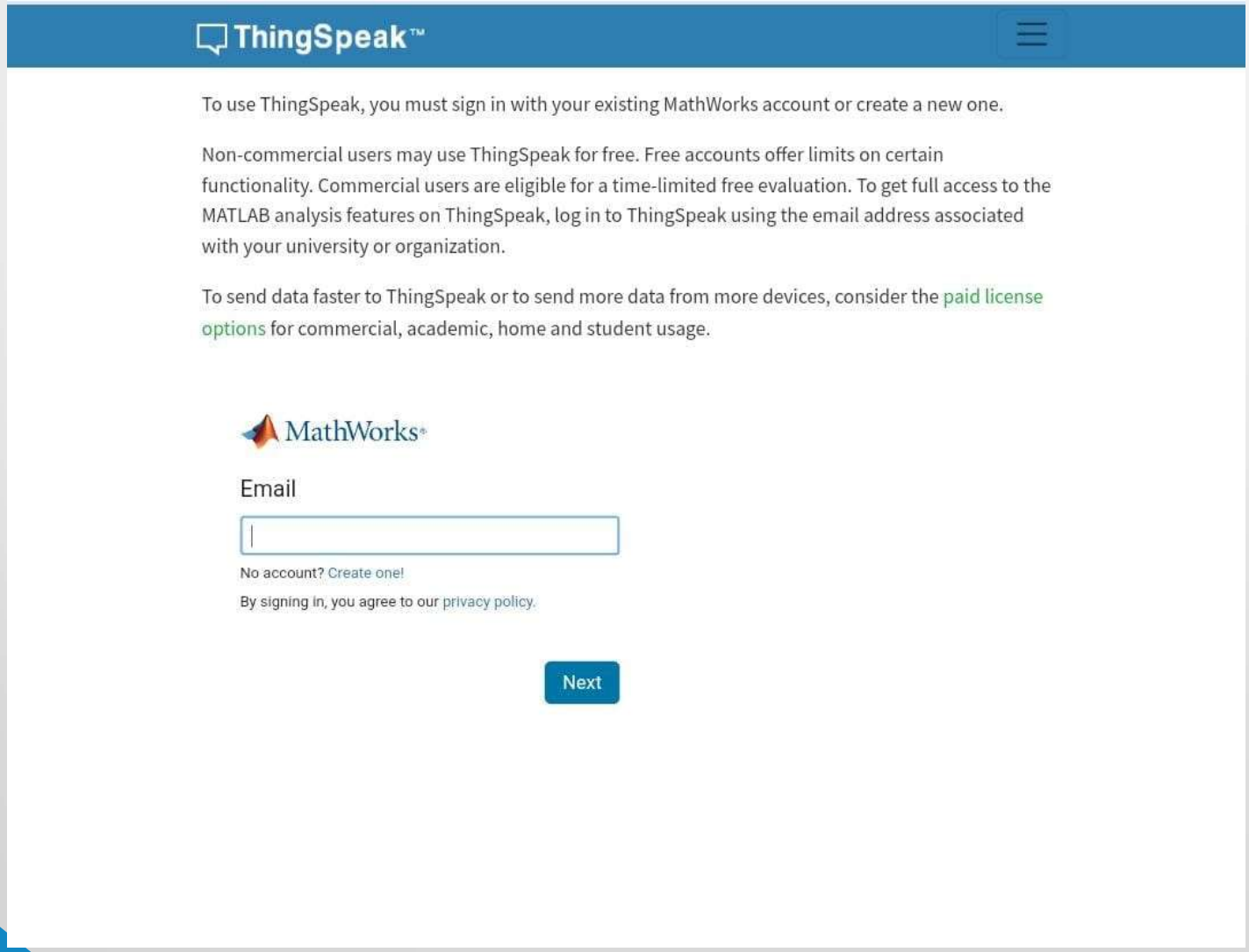
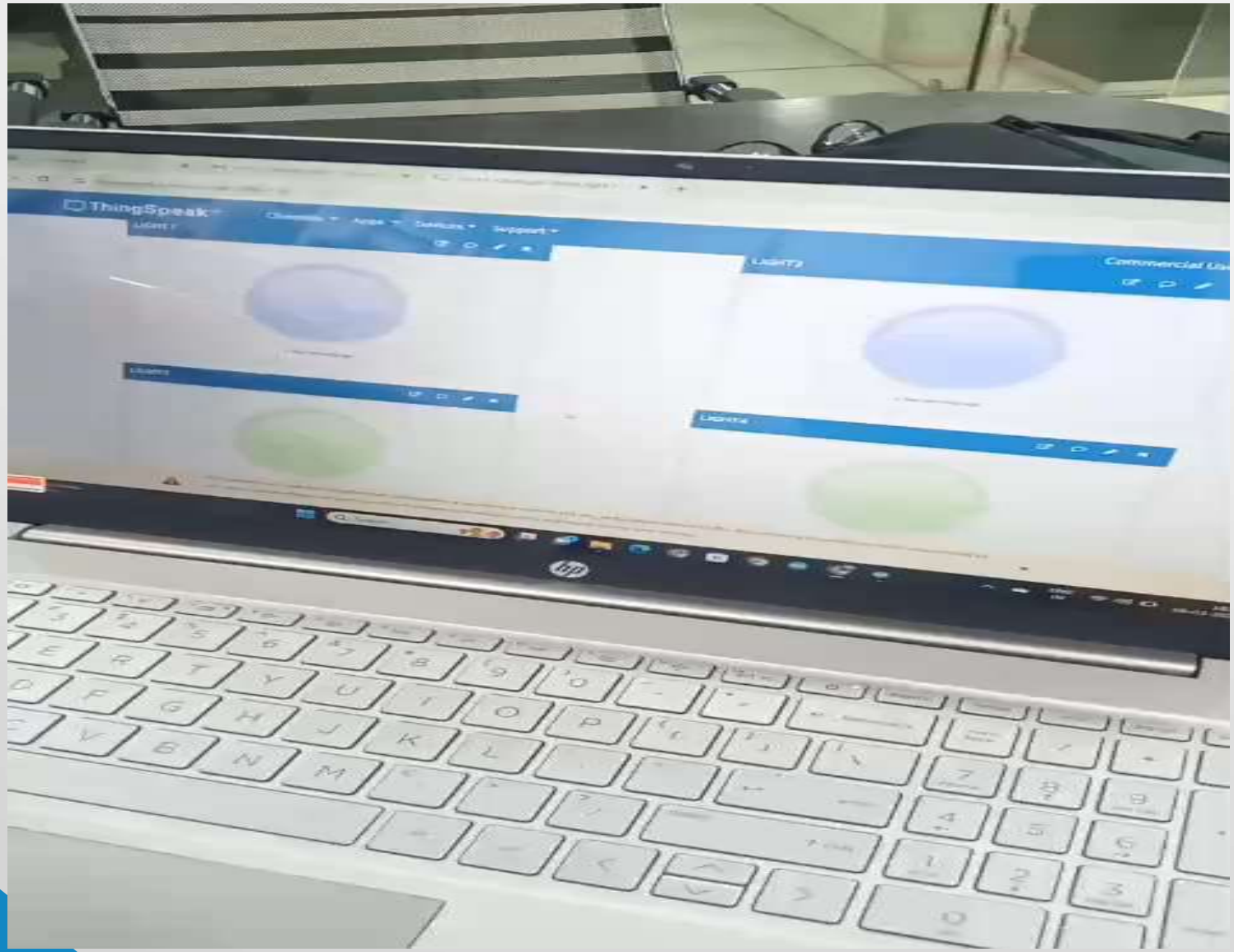
About ThingSpeak
ThingSpeak is an IoT analytics platform service that allows you to aggregate, visualize, and analyze live data streams in the cloud. You can send data to ThingSpeak from your devices, create instant visualization of live data, and send alerts.
Collect
Send sensor data privately to the cloud.
Analyze
Analyze and visualize your data with MATLAB.
Act
Trigger a reaction.
ThingSpeak Features
Collect data in private channels
Share data with public channels
RESTful and MQTT APIs
MATLAB® analytics and visualizations
Event scheduling
Alerts
Works With
MATLAB® & Simulink®
Arduino®
Particle devices
ESP8266 and ESP32 WiFi Modules
Raspberry Pi™
LoRaWAN®

# SignUp/SignIn Page



# TEST CASES



# CONCLUSION

- In conclusion, the IoT-based Smart Street Light Monitoring System offers a transformative solution for urban street lighting management. By integrating Arduino Uno, WiFi connectivity, LDR and IR sensors, and LED technology, the system enables intelligent control of street lights based on real-time environmental conditions and traffic patterns. Through dynamic adjustments in light intensity, it optimizes energy usage while ensuring safety and visibility on the streets. Moreover, the system's ability to transmit data to a central server facilitates comprehensive analysis and decision-making, enhancing overall efficiency and sustainability. This innovative approach not only reduces energy consumption and operational costs but also contributes to the development of smart cities with improved infrastructure. With its cost-effective and environmentally friendly features, the IoT-based Smart Street Light Monitoring System stands as a testament to the potential of technology in creating smarter and more livable urban environments.

# FUTURE SCOPE

- Future enhancements could involve integrating advanced machine learning algorithms for more precise accident detection and severity assessment. Incorporating additional sensors such as accelerometers and cameras could provide richer data for analysis and enable features like driver behavior monitoring. Furthermore, cloud connectivity could be leveraged for storing and analyzing vast amounts of collected data, facilitating continuous system optimization and the development of predictive maintenance algorithms to ensure system reliability.

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