Industrial Internship Report on

"Automatic Street Lighting System"

Prepared by

Nikita Raj

Executive Summary

This report provides details of the Industrial Internship provided by Upskill Campus and The IoT Academy in collaboration with Industrial Partner UniConverge Technologies Pvt Ltd (UCT).

This internship was focused on a project/problem statement provided by UCT. We had to finish the project, including the report, in 6 weeks' time.

My project was the " Automatic Street Lighting System", which is designed to effectively control street lights based on ambient light conditions, eliminating the need for manual intervention. This system utilises an LDR sensor as a switch, automatically turning the lights on when the sunlight goes below the visible region. Conversely, it switches the lights off when sunlight becomes visible to the sensor. This system reduces energy consumption as the lights are not left on unnecessarily during daylight hours. The Arduino board acts as the controller, directly controlling the LEDs or street light bulbs based on the light level detected by the LDR sensor. This project offers energy efficiency and convenience by automatically adjusting the street lighting in response to the surrounding light conditions.

This internship gave me a very good opportunity to get exposure to Industrial problems and design solutions for them. It was an overall great experience to have this internship.

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1 Preface:

Summary of 6-Week Internship Experience

During my 6-week internship at USC/UCT, I had the opportunity to work on a challenging project that involved exploring a problem statement, understanding the company's operations, and developing and implementing a solution. The internship was a valuable learning experience that allowed me to apply my theoretical knowledge to practical situations while gaining insights into the organisation's inner workings.

Week 1: In the first week, I focused on understanding the problem statement assigned to me. I conducted in-depth research and analysed relevant data to understand the issue at hand comprehensively. Additionally, I familiarised myself with the company's mission, values, and operations to align my efforts with their objectives.

Week 2: During the second week, I closely followed the project instructions provided by my supervisor. I brainstormed potential solutions and evaluated their feasibility and potential impact. I carefully planned the project and ensured that my approach aligned with the company's goals and resources.

Week 3: The third week involved actively working on the project. I utilised my technical skills and knowledge to develop the proposed solution.

Week 4: In the fourth week, I analysed the initial results and identified areas for improvement. I conducted thorough testing and debugging to address any issues or errors that arose during the implementation process.

Week 5: During the fifth week, I conducted rigorous testing and evaluation to validate the implementation of the project. I analysed the solution's performance, comparing it against predefined metrics and benchmarks. This allowed me to assess the project's success and identify any potential areas for further optimisation.

Week 6: In the final week, I dedicated my efforts to preparing a detailed report about the project. The report included an overview of the problem statement, the methodology employed, key findings, implementation details, and the project's overall impact. I ensured that the report was well-structured, concise, and presented in a format that effectively communicated the project's objectives and outcomes. Finally, I submitted the report to my supervisor, marking the successful completion of the internship.

Overall, this 6-week internship provided me with a well-rounded experience in tackling real-world challenges. It allowed me to develop critical problem-solving skills, enhance my technical expertise, and

gain valuable insights into project planning, execution, and reporting. I am grateful for the opportunity to contribute to the company's objectives while furthering my own professional development.

In the assigned problem statement, I had to design and develop an automatic street lighting system that intelligently controls the illumination of streetlights based on real-time conditions such as sunlight intensity. The current street lighting infrastructure often relies on fixed schedules or manual switching, resulting in inefficient energy consumption, unnecessary light pollution, and compromised safety in certain areas.

I believe there is a need for such Internship opportunities in career development, as Internships offer a unique learning environment where one can apply theoretical knowledge to real-world scenarios. By actively engaging in problem-solving activities, one will develop practical skills that cannot be obtained through academic study alone.

Industry Exposure: This experience will enable them to understand the industry landscape better and enhance their knowledge of industry-specific challenges.

Problem-Solving Abilities: By working on industrial problems, it will strengthen one's critical thinking, analytical, and problem-solving skills. These abilities are highly sought-after in the industry and are essential for professional growth.

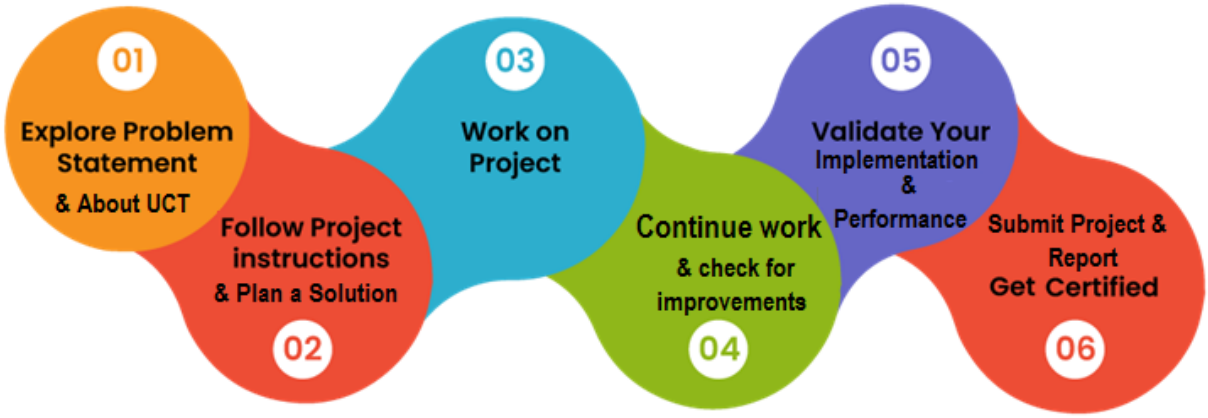
Practical Experience: Employers often seek candidates with practical experience when making hiring decisions. An industrial problem internship will significantly enhance one's resume and demonstrate their ability to apply theoretical knowledge in a real-world setting.

I am sincerely grateful for the wonderful opportunity to work on a project under USC/UCT. I am truly honoured to have been selected for this project and would like to take a moment to thank you for entrusting me with this valuable responsibility.

Working on this project has been an invaluable experience for me. It has provided me with an excellent platform to enhance my skills, broaden my knowledge, and develop professionally. The exposure to real-world challenges and the opportunity to work alongside a talented team has been immensely rewarding. I am truly grateful for the trust and confidence placed in me.

Once again, thank you for granting me this opportunity to work on such an impactful project within your esteemed company. I am grateful for your trust and faith in my abilities, and I am committed to delivering exceptional results.

The program was planned to complete the project within 6 weeks, along with an understanding of IoT and learning about the company UCT, which has this wonderful opportunity to work on industrial problems with the help of their guidance.



Through the project of developing an automatic street lighting system with LDR-based sunlight monitoring, I gained valuable career development opportunities. It helped me enhance my technical skills in electrical engineering, circuit design, and sensor integration. I developed strong problem-solving and innovation abilities by addressing challenges related to energy efficiency, light pollution reduction, and safety enhancement. The project also provided me with project management experience, showcasing my ability to plan, organise, and deliver results. Moreover, focusing on sustainability is aligned with the growing demand for eco-friendly solutions. This project expanded my career prospects in areas like automation, renewable energy, urban planning, and environmental engineering while highlighting my collaborative and communication skills.

I would like to express my gratitude to everyone who helped me complete this project. Firstly, I would like to thank my parents for their continuous support and encouragement throughout the project.

I would also like to thank my friends for providing me with the necessary suggestions. Their guidance and suggestions were very helpful in enhancing my knowledge about the topic.

Lastly, I would like to take this opportunity to express my gratitude to the Upskill Campus for providing me with such an opportunity to work on Industry Oriented Problems along with the guidance and necessary modules.

I would also like to leave a brief message for my juniors and peers- “Limitations on what you can achieve are set by one person only–yourself.” So try your best, and you will be able to achieve anything. Also, Upskill Campus, along with UCT, has given you this wonderful opportunity, so do your best without limiting yourself.

2 Introduction:

2.1 About UniConverge Technologies Pvt Ltd

A company established in 2013 and working in the Digital Transformation domain and providing Industrial solutions with a prime focus on sustainability and RoI.

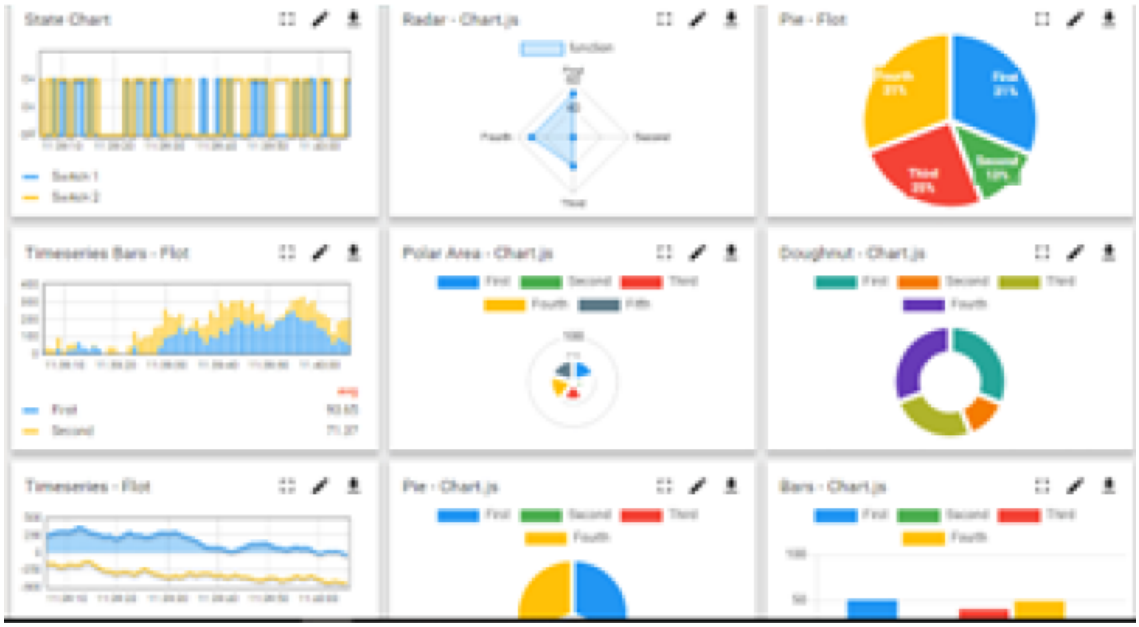
For developing its products and solutions, it is leveraging various **Cutting Edge Technologies, e.g. Internet of Things (IoT), Cyber Security, Cloud computing (AWS, Azure), Machine Learning, Communication Technologies (4G/5G/LoRaWAN), Java Full Stack, Python, Front end** etc.

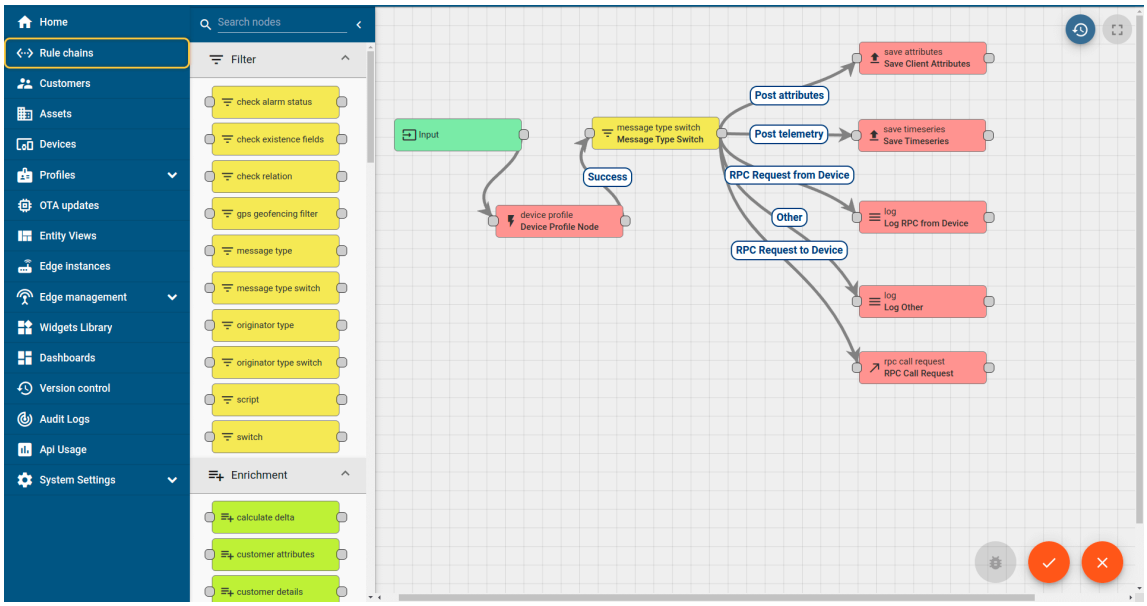
i. UCT IoT Platform (uct Insight)

UCT Insight is an IOT platform designed for quick deployment of IOT applications on the same time providing valuable "insight" for your process/business. It has been built in Java for the backend and ReactJS for the Front end. It has support for MySQL and various NoSQL Databases.

- It enables device connectivity via industry standard IoT protocols - MQTT, CoAP, HTTP, Modbus TCP, OPC UA
- It supports both cloud and on-premises deployments.

It has features to
• Build Your own dashboard
• Analytics and Reporting
• Alert and Notification
• Integration with third-party applications (Power BI, SAP, ERP)
• Rule Engine





ii. Smart Factory Platform (FACTORY WATCH)

Factory watch is a platform for smart factory needs.

It provides Users/ Factory

- with a scalable solution for their Production and asset monitoring
- OEE and predictive maintenance solution scaling up to digital twin for your assets.
- to unleash the true potential of the data their machines are generating and help identify the KPIs and improve them.
- A modular architecture that allows users to choose the service that they what to start and then can scale to more complex solutions as per their demands.

Its unique SaaS model helps users to save time, cost and money.

Machine	Operator	Work Order ID	Job ID	Job Performance	Job Progress		Output		Rejection	Time (mins)				Job Status	End Customer
					Start Time	End Time	Planned	Actual		Setup	Pred	Downtime	Idle		
CNC_S7_81	Operator 1	WO0405200001	4168	58%	10:30 AM		55	41	0	80	215	0	45	In Progress	i
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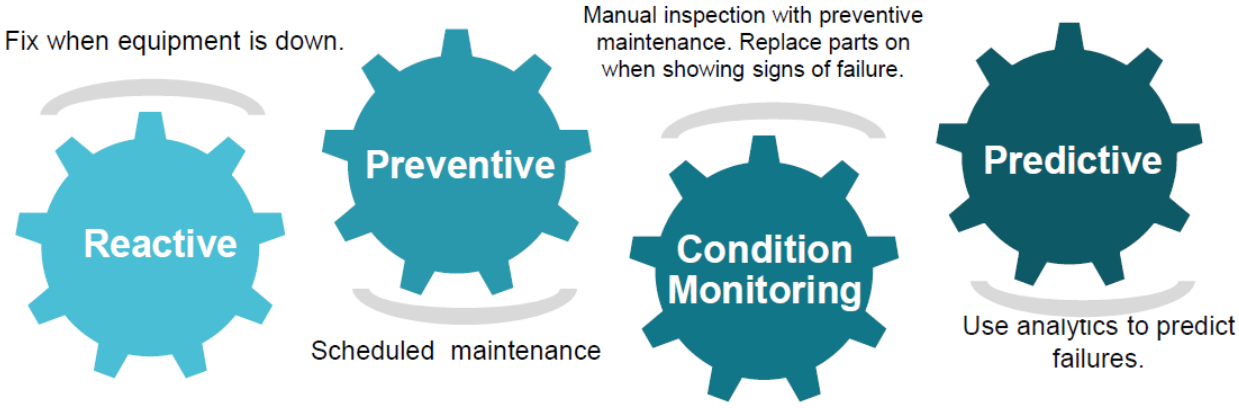
iii. LoRaWAN based Solution

UCT is one of the early adopters of LoRAWAN technology and provides solutions in Agritech, Smart Cities, Industrial Monitoring, Smart Street lights, Smart Water/ Gas/ Electricity metering solutions etc.

iv. Predictive Maintenance

UCT is providing Industrial Machine health monitoring and Predictive maintenance solution leveraging Embedded systems, Industrial IoT and Machine Learning Technologies by finding the Remaining useful lifetime of various Machines used in the production process.



2.2 About Upskill Campus (USC):

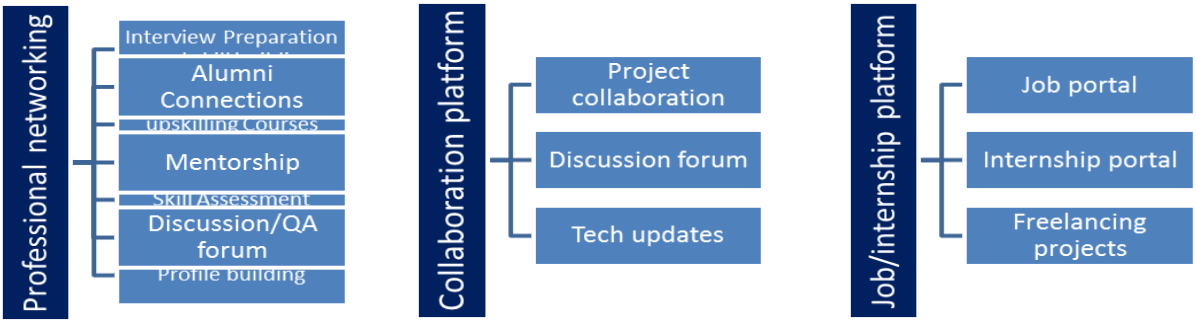
Upskill Campus, along with The IoT Academy and in association with Uniconverge Technologies, has facilitated the smooth execution of the complete internship process.

USC is a career development platform that delivers **personalised executive coaching** in a more affordable, scalable and measurable way.

Seeing need of upskilling in self paced manner along-with additional support services e.g. Internship, projects, interaction with Industry experts, Career growth Services

upSkill Campus aiming to upskill 1 million learners in next 5 year

https://www.upskillcampus.com



2.3 The IoT Academy:

The IoT academy is the EdTech Division of UCT that is running long executive certification programs in collaboration with EICT Academy, IITK, IITR and IITG in multiple domains.

2.4 Objectives of this Internship Program:

The objective of this internship program was to

- ☛ get practical experience of working in the industry.
- ☛ to solve real-world problems.
- ☛ to have improved job prospects.
- ☛ to have an Improved understanding of our field and its applications.
- ☛ to have Personal growth like better communication and problem-solving.

2.5 References:

[1] M. Revathy, S. Ramya, R. Sathiyavathi, B. Bharathi and V. M. Anu, "*Automation of street light for smart city*," 2017 International Conference on Communication and Signal Processing (ICCSP), Chennai, India, 2017.

[2] P. P. F. Dheena, G. S. Raj, G. Dutt and S. V. Jinny, "*IOT based smart street light management system*," 2017 IEEE International Conference on Circuits and Systems (ICCS), Thiruvananthapuram, India, 2017.

[3] Priyasree, Radhi & H Kauser, Rafiya & E, vinitha & Gangatharan, N. (2012). "Automatic Street Light Intensity Control and Road Safety Module Using Embedded System," International Conference on

Computing and Control Engineering (ICCCE 2012), At Coimbatore Institute of Information Technology, 2012.

[4] C.Bhuvaneswari, R.Rajeswari and C.Kalaiarasan "Analysis of Solar Energy Based Street Light with Auto Tracking System," International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, Vol. 2, Issue 7, July 2013.

[5] "Wireless internet lighting control system", Budike. E.S. Lothar (Power web Technologies), US patent 7,167,777, Jan 23, 2007

2.6 Glossary

Terms	Acronym
Metal-Oxide-Semiconductor Field-Effect Transistor	MOSFET
Bipolar Junction Transistor	BJT
Light Emitting Diode	LED

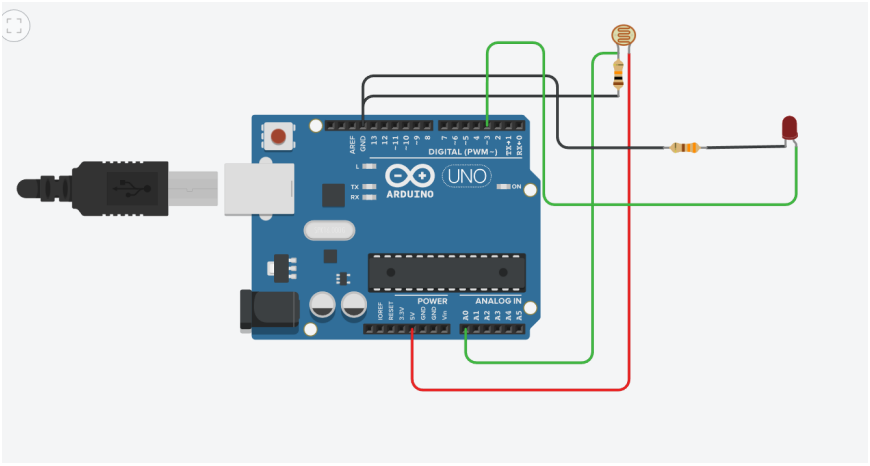
3 Problem Statement:

In the assigned problem statement, I had to design and develop an automatic street lighting system that intelligently controls the illumination of streetlights based on real-time conditions such as sunlight intensity. The current street lighting infrastructure often relies on fixed schedules or manual switching, resulting in inefficient energy consumption, unnecessary light pollution, and compromised safety in certain areas.

4 Existing and Proposed solution

Existing solution:

Circuit:



Simulation done on TinkerCad.

LDR is connected to analog pin A0 and an LED to digital pin 3. The code reads the sensor value from the LDR, prints it to the serial monitor (for debugging purposes), and controls the LED based on the LDR value and the threshold.

If the LDR value is less than the threshold value, the LED will glow (turned on). If the LDR value exceeds or equals the threshold value, the LED will not glow (turned off). We can adjust the threshold value to set the desired threshold point for the LDR.

LDR Sensor: A Light Dependent Resistor (LDR), also known as a photoresistor or photocell, is a type of electronic component that exhibits a change in resistance in response to variations in light levels. It is a passive component that belongs to the family of resistors, but its resistance value depends on the intensity of light falling on its surface.

The LDR consists of semiconductor material with high resistance in dark or low-light conditions. As the light intensity increases, the LDR resistance decreases proportionally. This characteristic makes it a valuable sensing device for detecting and measuring light levels in various applications.

They provide a cost-effective and reliable solution for detecting changes in light levels and triggering appropriate actions or adjustments. The resistance of an LDR can be measured using an analog-to-digital converter (ADC) or by interfacing it with microcontrollers like Arduino.

Arduino UNO: The Arduino Uno board is one of the most popular and widely used microcontroller boards in the Arduino family. It is based on the ATmega328P microcontroller and provides a versatile platform for prototyping and creating interactive electronic projects.

The board features a compact design with a range of input and output pins, making it suitable for various applications. It includes 14 digital input/output pins, six analog input pins, and various dedicated pins for power, ground, and communication interfaces. These pins allow users to connect sensors, actuators, displays, and other electronic components to create complex and interactive systems.

One of the key advantages of the Arduino Uno board is its ease of use. It comes with an integrated development environment (IDE) that simplifies the programming process. The IDE provides a user-friendly interface for writing, compiling, and uploading code to the board.

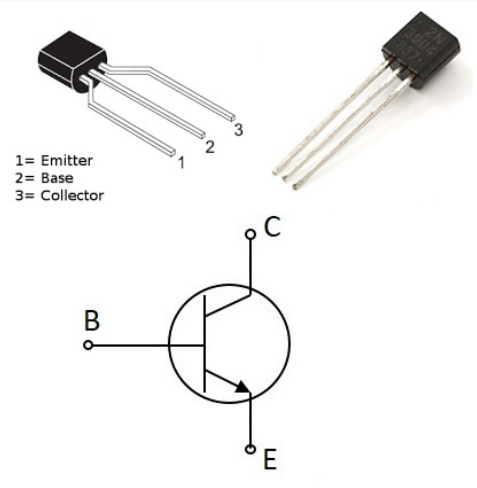
The Arduino Uno board also supports serial communication interfaces, including Universal Serial Bus (USB), Serial Peripheral Interface (SPI), and Inter-Integrated Circuit (I2C). These interfaces enable seamless connectivity with other devices such as computers, sensors, displays, and wireless modules.

But it has some limitations, in the previous circuit, we can see that this case is easily working on a simulation basis but if we try to work it in a practical case then it won't be feasible as we have given the power to LED from ARDUINO, which in the case gives an output of 20mA. Hence there is a need for a system where we are supplying power to LED from our power source.

To overcome this limitation I proposed the use of BJT and supplying power directly to the LED.

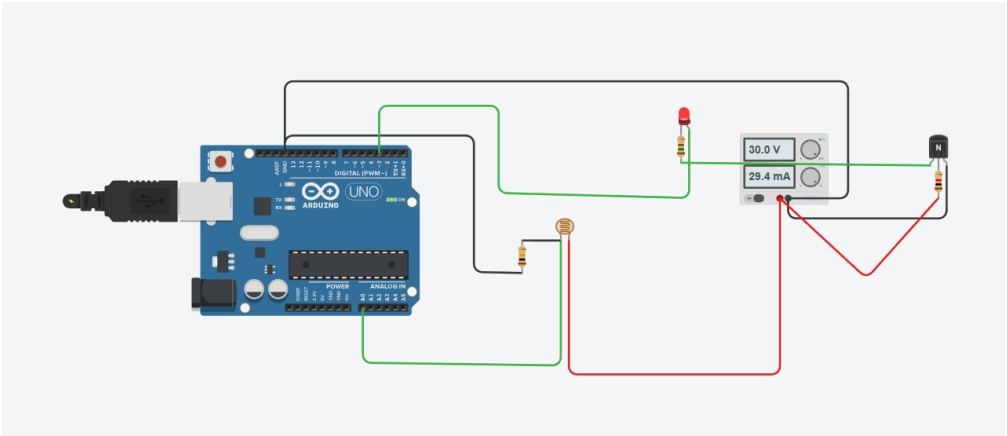
BJT: A Bipolar Junction Transistor (BJT) is a semiconductor device utilized in electronic circuits for amplifying or switching electrical signals. It is a commonly employed transistor type and is available in two variations: NPN (negative-positive-negative) and PNP (positive-negative-positive).

A BJT consists of three semiconductor layers, which can be either p-type or n-type. These layers are named the base, emitter, and collector. The BJT operates based on the interaction between majority and minority charge carriers in these regions.



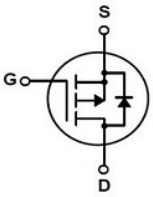
Here I have used NPN transistor.

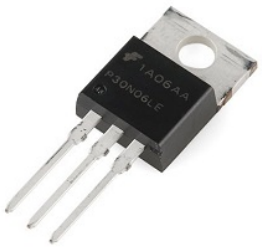
The terminal connection sequence is C(collector), B(base), E(emitter).



But as we see that MOSFET can be an even better option than BJT to be used as a switch.

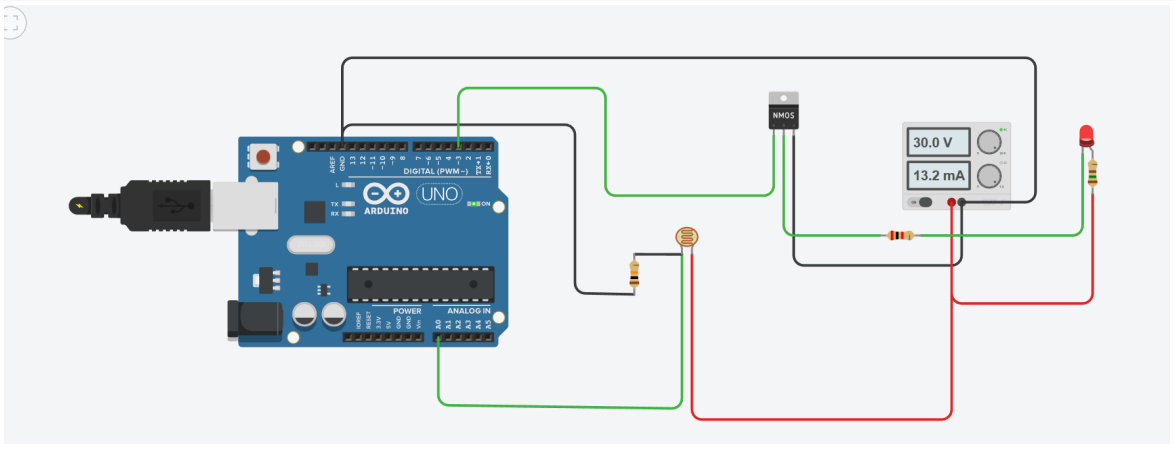
MOSFET: A Metal-Oxide-Semiconductor Field-Effect Transistor (MOSFET) is a type of semiconductor device commonly used in electronic circuits for amplifying, switching, and controlling electrical signals. Compared to a Bipolar Junction Transistor (BJT), the MOSFET offers several advantages.





- The MOSFET operates based on the principle of controlling the flow of current through a semiconductor channel by applying an electric field.
- MOSFETs have an extremely low input current requirement, making them more efficient and less prone to loading effects on the input signal source.
- MOSFETs have a very low output impedance, which allows them to deliver a high amount of current to the load without significant voltage drop. This characteristic makes MOSFETs ideal for power amplification applications, as they can provide high power output with low distortion.
- MOSFETs also have a higher switching speed compared to BJTs.
- MOSFETs compatibility with complementary metal-oxide-semiconductor (CMOS) technology allows the integration of both p-type and n-type MOSFETs on a single chip, enabling the design of complex digital systems such as microprocessors and memory devices.
- CMOS technology also offers low power consumption, making MOSFET-based circuits more energy-efficient.

Here NMOS is used and the terminal connection sequence is G(gate), D(drain), and S(source).



4.1 Code submission (Github link):

https://github.com/Nikkie2810/Automatic_Street-Lighting_Project/blob/main/Arduino_code_ASLP.txt

4.2 Report submission (Github link):

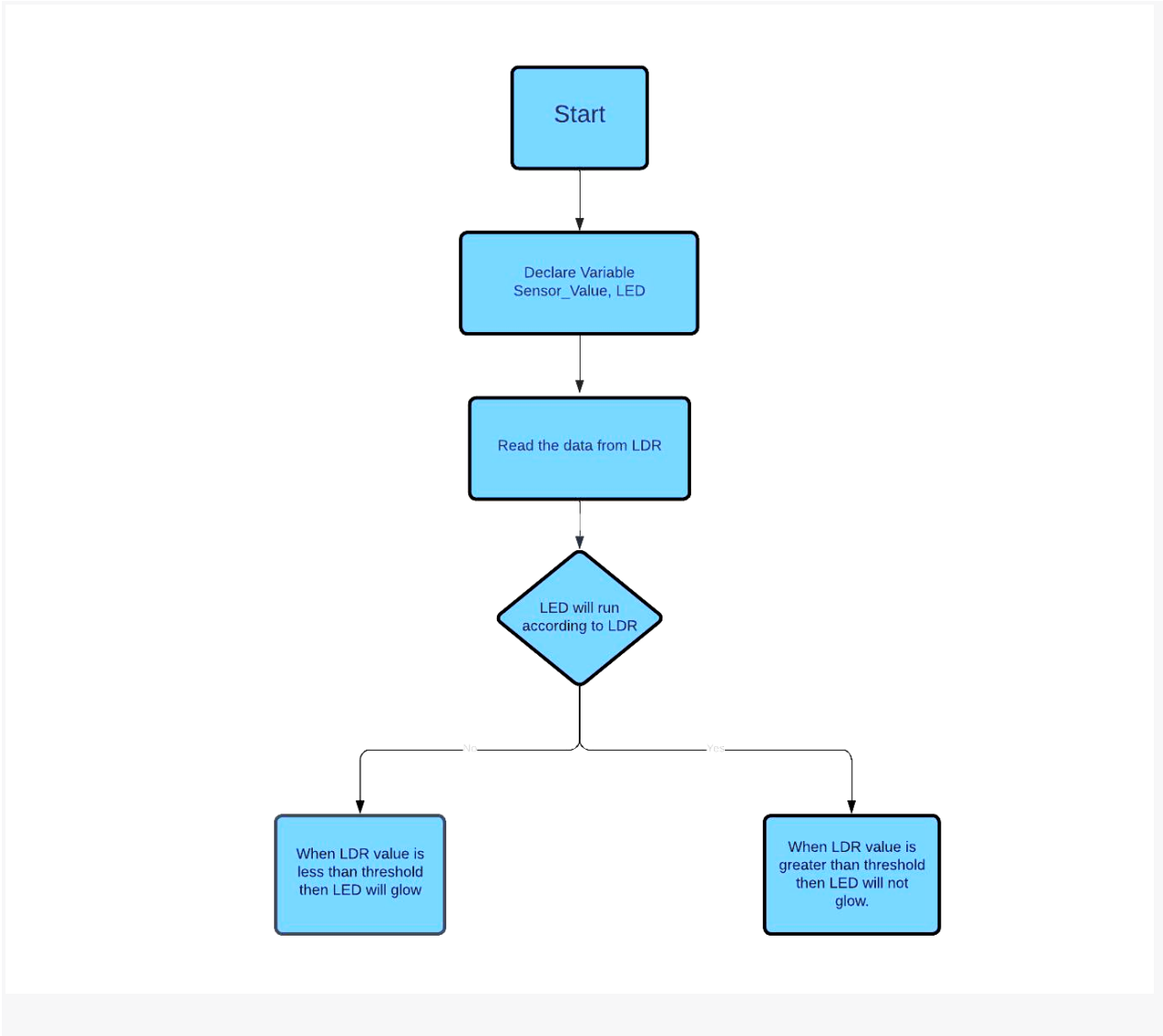
https://github.com/Nikkie2810/Automatic_Street-Lighting_Project

4.3 Simulation Link: https://www.tinkercad.com/things/bXQbr6ADVm1

5 Proposed Design/ Model

Given below is the architecture of Arduino code implemented in this project. The code is available in the GitHub repository.

ARCHITECTURE:



6 My learnings

Technical Skills: I acquired a strong understanding of electrical engineering principles, including circuit design, sensor integration, and control systems. Developing the automatic street lighting system required me to work with components such as LDRs, microcontrollers, and power management circuits. These technical skills can be applied to a wide range of projects and industries involving automation, sensor integration, and energy efficiency.

Problem-solving and Innovation: I learnt to analyse complex problems, identify potential solutions, and implement effective strategies to address them. Such a project will encourage one to think creatively and innovatively to optimise energy usage, reduce light pollution, and enhance safety. These problem-solving and innovative thinking skills are highly transferable and sought after in various professional settings.

Project Management: Managing a project from start to finish involves planning, organising, and coordinating various tasks and resources. Throughout this project, I learnt project management skills, such as setting objectives, creating timelines, allocating resources, and monitoring progress. These skills are essential in any career, as they demonstrate one's ability to manage projects, meet deadlines, and deliver results effectively.

Sustainable Solutions: Developing an automatic street lighting system that prioritises energy efficiency and reduces light pollution aligns with the growing global focus on sustainability. This experience will be valuable for career paths related to renewable energy, sustainable development, urban planning, and environmental engineering.

The knowledge and skills gained from this project can open doors to various career opportunities. One may explore roles in electrical engineering, automation, smart city development, energy management, or sustainable infrastructure. These valuable skills and experiences can enhance one's career development prospects, increasing their marketability and potential for impactful contributions in the field of engineering and beyond.

7 Future work scope

The proposed system utilises an LDR (light-dependent resistor) to make decisions based on external light intensity. Initially, the system controls a 5mm LED, but it can also be interfaced with a relay to control an AC circuit. This opens up the possibility of using the system in applications such as solar-based street lighting, where higher-power lights are required. With the inclusion of a relay, the system can control a 5-watt light or even higher power loads.

Furthermore, it can be integrated with a Bluetooth module to enhance the system's functionality and convenience. This integration allows the entire system to be controlled remotely from a smartphone with a simple click, providing a user-friendly interface and flexibility in managing the system's operations.