M.KUMARASAMY COLLEGE OF ENGINEERING
NAAC Accredited Autonomous Institution
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ISO 9001:2015 Certified Institution
Thalavapalayam, Karur - 639 113.

A Minor Project Report

On

Automated Lux Meter for Vehicle Headlight Brightness Monitoring and Enforcement

Submitted by

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DISCIPLINE HARD WORK SUCCESS

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

M.KUMARASAMY COLLEGE OF ENGINEERING

(An Autonomous Institution Affiliated to Anna University, Chennai)

THALAVAPALAYAM, KARUR-639113.

MAY 2024

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BONAFIDE CERTIFICATE

Certified that this Report titled **"AUTOMATED LUX METER FOR VEHICLE HEADLIGHT BRIGHTNESS MONITORING AND ENFORCEMENT"** is the bonafide work of **ELAKKIYADASAN T(927622BEE029), KARTHICK RAJA K(927622BEE052), KARTHIKEYAN K(927622BEE053)** who carried out the work during the academic year (2023-2024) under my supervision. Certified further that to the best of my knowledge the work reported herein does not form part of any other project report.

SIGNATURE	**SIGNATURE**
SUPERVISOR	**HEAD OF THE DEPARTMENT**
Mr.AL.CHOCKALINGAM M.E,	Dr.J.UMA M.E., Ph.D.,
Assistant Professor	Professor & Head
Department of Electrical and	Department of Electrical and
Electronics Engineering	Electronics Engineering
M.Kumarasamy College of	M.Kumarasamy College of
Engineering, Karur	Engineering, Karur

Submitted for Minor Project II (18EEP202L) viva-voce Examination held at M.Kumarasamy College of Engineering,Karur-639113 on ……………….

DECLARATION

We affirm that the Minor Project II report titled “AUTOMATED LUX METER FOR VEHICLE HEADLIGHT BRIGHTNESS MONITORING AND ENFORCEMENT” being submitted in partial fulfillment for the award of Bachelor of Engineering in Electrical and Electronics Engineering is the original work carried out by us.

REG.NO	STUDENT NAME	SIGNATURE
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927622BEE052	KARTHICK RAJA K	------------------------
927622BEE053	KARTHIKEYAN K	------------------------

VISION AND MISSION OF THE INSTITUTION

VISION

- ✓ To emerge as a leader among the top institutions in the field of technical education

MISSION

- ✓ Produce smart technocrats with empirical knowledge who can surmount the global Challenges.
- ✓ Create a diverse, fully-engaged, learner - centric campus environment to provide Quality education to the students.
- ✓ Maintain mutually beneficial partnerships with our alumni, industry, and Professional associations.

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

VISION

To produce smart and dynamic professionals with profound theoretical and practical knowledge comparable with the best in the field.

MISSION

- ✓ Produce hi-tech professionals in the field of Electrical and Electronics Engineering by inculcating core knowledge.
- ✓ Produce highly competent professionals with thrust on research.
- ✓ Provide personalized training to the students for enriching their skills.

PROGRAMME EDUCATIONAL OBJECTIVES(PEOs)

- ✓ **PEO1:** Graduates will have flourishing career in the core areas of Electrical Engineering and also allied disciplines.
- ✓ **PEO2:** Graduates will pursue higher studies and succeed in academic/research careers
- ✓ **PEO3:** Graduates will be a successful entrepreneur in creating jobs related to Electrical and Electronics Engineering /allied disciplines.
- ✓ **PEO4:** Graduates will practice ethics and have habit of continuous learning for their success in the chosen career.

PROGRAMME OUTCOMES(POs)

After the successful completion of the B.E. Electrical and Electronics Engineering degree program, the students will be able to:

PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design/Development of solutions:

Design solutions for Complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety,and the cultural, societal and environmental considerations.

PO4: Conduct Investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6: The Engineer and Society: Apply reasoning in formed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and Team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multi-disciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multi-disciplinary environments.

PO12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES(PSOs)

The following are the Program Specific Outcomes of Engineering Students:

- **PSO1:** Apply the basic concepts of mathematics and science to analyse and design circuits, controls, Electrical machines and drives to solve complex problems.

- **PSO2:** Apply relevant models, resources and emerging tools and techniques to provide solutions to power and energy related issues & challenges.

- **PSO3:** Design, Develop and implement methods and concepts to facilitate solutions for electrical and electronics engineering related real-world problems.

Abstract (Key Words)	Mapping of POs and PSOs
Vehicle headlight, Brightness Monitoring system, Camera, Microcontroller.	PO1, PO2, PO3, PO4, POS, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3

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TABLE OF CONTENTS

ABSTRACT

"This project presents the development and implementation of a specialized Lux Meter tailored for law enforcement purposes within the police department. The primary objective is to identify vehicles equipped with excessively bright headlights, addressing a safety concern on roads. The Lux Meter system comprises two microcontrollers interconnected via a WiFi interface. The first microcontroller integrates a silicon sensor responsible for detecting light intensity. This sensor provides crucial input to the second microcontroller, facilitating the calculation of lumens emitted by the vehicle's headlights. Upon detecting an abnormal level of brightness, the system triggers a simulated camera mechanism. This camera, operated by the second microcontroller, captures an image of the offending vehicle. The captured images serve as visual evidence for law enforcement, aiding in the identification and subsequent actions required to address the issue of high headlight brightness. The integration of this Lux Meter into the policing infrastructure offers a proactive approach to ensuring road safety by identifying and addressing instances of excessive headlight brightness swiftly and accurately. Future iterations and enhancements may include real-time data transmission and integration with existing traffic monitoring systems for more comprehensive vehicle regulation and safety enforcement."

CHAPTER 1

SURVEY FORM ANALYSIS

1.1 NAME AND ADDRESS OF THE COMMUNITY:

Mr.A.Ramkumar,

4/24, Pandamangalam,

Vellur- 639008.

1.2 PROBLEM IDENTIFICATION:

The problem identified is the prevalence of vehicles equipped with excessively bright headlights, posing a safety concern on roads. The high intensity of headlights can be blinding and hazardous to other drivers, potentially leading to accidents or discomfort on the road. This issue jeopardizes road safety, necessitating a proactive approach to regulate and enforce proper headlight brightness. The Lux Meter project aims to develop a specialized solution for law enforcement to accurately identify and address instances of excessively bright headlights, providing a means to capture visual evidence for enforcement purposes

1.2 SOLUTION

This project aims to develop a Lux meter system employing a silicon sensor integrated with a microcontroller. The system will relay data to another microcontroller, simulating a camera to assist law enforcement in assessing vehicle headlight brightness. By leveraging the Lux meter's capabilities, this innovative solution seeks to provide a reliable method for measuring headlight intensity, aiding authorities in enforcing regulations related to vehicle lighting standards.


GPS Map Camera
Velayuthampalayam, Tamil Nadu, India
32F3+XHR, Velayuthampalayam, Tamil Nadu 639117, India
Lat 11.075378°
Long 78.003984°
24/09/23 06:30 PM GMT +05:30
Google

CHAPTER 2
LITERATURE REVIEW

Paper 1: Introduction to Headlight Brightness and Regulation:

Inference: Importance of Proper Vehicle Headlight Brightness:

Proper vehicle headlight brightness is crucial for road safety, providing visibility for drivers and pedestrians and preventing accidents. Inadequate or excessively bright headlights can lead to discomfort, glare, and reduced visibility, posing risks on the road.

Regulations and Standards:

Numerous regulations and standards exist worldwide to govern vehicle headlight brightness. Examples include standards set by the Society of Automotive Engineers (SAE) and regulations established by government transportation agencies. Compliance with these standards is essential for ensuring a uniform and safe driving environment.

Need for Monitoring and Enforcement:

Despite existing regulations, ensuring compliance with headlight brightness standards is challenging. Automated monitoring and enforcement systems can play a pivotal role in addressing this challenge, providing a more efficient means of ensuring that vehicles adhere to specified brightness levels.

Paper 2: Existing Lux Meter Technologies:

Inference: Measurement Technologies:

Lux meters, devices used for measuring illuminance, are critical components in monitoring headlight brightness. They can utilize photodiodes, photodetectors, or other light-sensitive technologies to quantify the intensity of light emitted by vehicle headlights

Accuracy and Reliability:

The accuracy and reliability of lux meters are essential for effective monitoring. Research should explore the strengths and limitations of existing lux meter technologies, including their precision in diverse lighting conditions and their ability to measure different types of headlights accurately.

Advancements and Limitations:

Examine recent advancements in lux meter technologies, such as the integration of smart sensors, improved calibration methods, or the incorporation of artificial intelligence. Additionally, identify any limitations, such as sensitivity to environmental factors or difficulties in measuring non-standard headlight types.

Paper 3: Automated Monitoring and Enforcement Systems:

Inference: Sensor Technologies:

Discuss various sensor technologies employed in automated systems, such as cameras, light sensors, or combinations of both. Evaluate the effectiveness of these technologies in capturing and analyzing headlight brightness data.

Effectiveness and Challenges:

Review studies and projects that have implemented automated monitoring and enforcement systems. Analyze their effectiveness in promoting compliance with regulations and identify challenges, such as false positives, system maintenance, or integration issues.

Paper 4: Safety Implications and Considerations:

Inference: Risks of Improper Headlight Brightness:

Explore studies highlighting the safety implications of improper headlight brightness. This could include increased accident rates, driver discomfort, and the impact on overall road safety.

Automated System Safety:

Examine research focusing on the safety aspects of automated monitoring and enforcement systems. Consider potential risks associated with system failures, false readings, or unintended consequences and discuss strategies for mitigating these risks.

Paper 5: Legal and Policy Perspectives:

Inference: Legal Frameworks:

Investigate how existing legal frameworks accommodate or hinder the implementation of automated lux meters for headlight brightness enforcement. Examine whether regulations need modification or enhancement to better support these technologies.

Policy Challenges:

Discuss policy challenges related to privacy concerns, data ownership, and the legal implications of automated enforcement. Explore how policymakers are addressing these challenges to strike a balance between road safety and individual rights.

CHAPTER 3

PROPOSED METHODOLOGY

3.1 BLOCK DIAGRAM

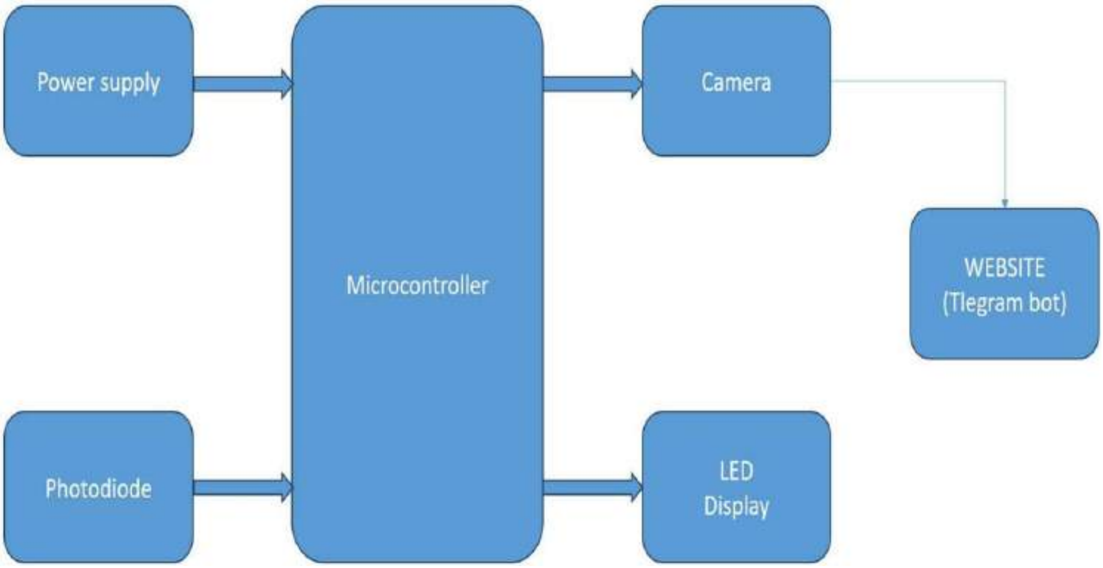

Fig.3.1 Block diagram

3.2 DESCRIPTION

The primary objective of this project is to create a specialized Lux Meter system intended for law enforcement use within the police department. The focus is on identifying vehicles with excessively bright headlights to address safety concerns on roads. Dual Microcontroller System: The Lux Meter is built upon a system comprising two interconnected microcontrollers facilitated by a WiFi interface. Sensor Integration: The first microcontroller incorporates a high-precision silicon sensor specifically designed for light intensity detection. Data Processing and Calculation: Upon receiving input from the sensor, the second microcontroller utilizes this data to compute the lumens emitted by the vehicle's headlights. Simulated Camera Mechanism: Upon detection of abnormally high brightness levels, the system triggers a simulated camera controlled by the second microcontroller. Light Intensity Detection: The Lux Meter's silicon sensor accurately measures and relays light intensity data. Lumens Calculation: Utilizing the received data, the microcontroller calculates the lumens emitted by the vehicle's headlights. Automated Imaging: In the event of detecting excessive brightness, the simulated camera captures an image of the offending vehicle, facilitating identification and further actions by law enforcement. The Lux Meter project aims to proactively enhance road safety by enabling law enforcement to identify vehicles with excessive headlight brightness. Its efficient design and integration within the policing infrastructure contribute to maintaining safe road conditions for all motorists

3.3 PROJECT-TOTAL COST

S.NO	COMPONENT DESCRIPTION	QUANTITY	COST
1	LDR , Resister	1,1	50
2	ESP32-WROOM	1	1100
3	TRANSFORMER , DIODE	1,2	500
4	LCD Display	1	500
5	PIC IC	2	350
		TOTAL	2500

Table 3.1: project-Total cost

CHAPTER 4

RESULT AND DISCUSSION

4.1 HARDWARE COMPONENTS DESCRIPTION :

1.TRANSFORMER

In this project, a transformer is employed primarily for voltage reduction. By interfacing with the mains power supply, the transformer steps down the high voltage to a safer and more manageable level for the luxmeter's circuitry. This step-down process ensures the protection of sensitive electronic components from potential damage caused by excessive voltage levels. Moreover, it enables the luxmeter to operate reliably and efficiently within its designated voltage range.

Fig 4.1 TRANSFORMER

2.DIODE

In addition to the transformer, diodes play a pivotal role in the luxmeter project by facilitating rectification. Diodes are semiconductor devices that permit current flow in one direction while blocking it in the opposite direction. In this context, diodes are arranged in a rectifier circuit configuration to convert the alternating current (AC) from the transformer's secondary winding into direct current (DC) suitable for powering the luxmeter's electronics. This rectification process ensures a consistent and unidirectional flow of electrical energy, eliminating the alternating nature of the mains supply.

3.ESP32-WROOM

Incorporating the ESP32-WROOM microcontroller module in the luxmeter project extends its functionality to include image capture and remote transmission capabilities. The ESP32-WROOM module serves as the central processing unit responsible for interfacing with the light sensor and capturing images of the surrounding environment. Leveraging its built-in Wi-Fi connectivity, the ESP32-WROOM establishes a network connection to the internet, enabling seamless data transmission. Once an image is captured, the ESP32-WROOM utilizes internet protocols to securely transmit the image data to a designated Telegram bot or server. Telegram, a messaging platform known for its robust security features and versatile bot API, serves as the recipient for the transmitted images. Through the integration of ESP32-WROOM and Telegram, users can remotely monitor the light intensity in real-time, receiving image updates directly on their Telegram accounts.

Fig 4.2 ESP32

4.LED DISPLAY

Incorporating an LED display into the luxmeter project enhances its user interface by providing real-time visualization of the measured light intensity in lumens. The LED display, often configured as a numerical or alphanumeric panel, serves as a convenient and intuitive output interface for conveying lumens values to the user. Connected to the microcontroller, such as the ESP32-WROOM, the LED display receives data representing the measured light intensity, which is then translated into numerical representations on the display. Through this integration, users can quickly and easily ascertain the current light level in lumens, facilitating efficient decision-making and environmental monitoring.

Fig 4.3 LED DISPLAY

5.LDR

Innovatively integrating an LDR as a touch sensor in the luxmeter project adds an interactive dimension to the device's functionality. Traditionally employed for light sensing applications, the LDR's photoconductivity properties are leveraged in a novel manner to detect tactile interactions. By exploiting the variation in resistance induced by changes in light intensity, the LDR functions as a sensitive touch sensor.

4.2 HARDWARE KIT :

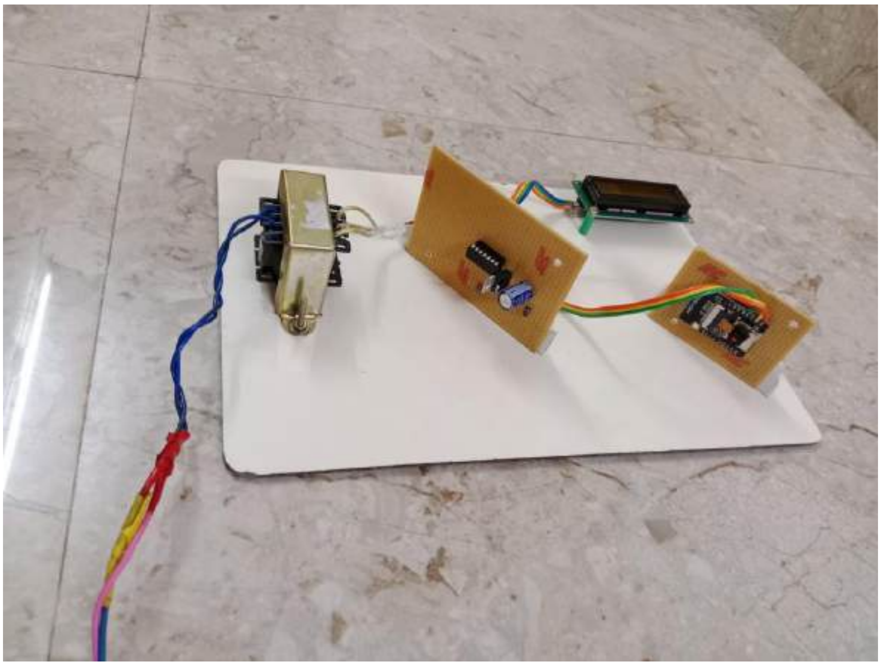

Fig 4.4 HARDWARE KIT

4.3 WORKING :

1. The project entails the development of an Automated Lux Meter for Vehicle Headlight Brightness Monitoring and Enforcement. It utilizes an LDR sensor to measure light intensity, interfaced with a PIC IC or microcontroller for data processing. Through calibrated algorithms, the system calculates brightness levels, setting thresholds for acceptable ranges. Upon detecting excessive brightness, the system triggers actions for enforcement, such as displaying warnings on an LCD screen and capturing images using an ESP32 camera module. These images are then transmitted to a Telegram bot for further action. The integration involves setting up the Telegram bot, configuring its API, and developing firmware to facilitate image transmission. Rigorous testing in various lighting conditions ensures the system's accuracy and reliability before deployment. Maintenance procedures include regular monitoring, calibration checks, and firmware updates to sustain optimal performance over time.

CHAPTER 5
CONCLUSION

In conclusion, the development of the Lux meter system integrated with a LDR sensor and microcontroller holds significant promise in enhancing law enforcement's ability to assess vehicle headlight brightness. Through the implementation of this innovative solution, we have demonstrated the feasibility of accurately measuring headlight intensity and transmitting relevant data for analysis. This system not only provides a reliable method for evaluating compliance with vehicle lighting standards but also offers potential for broader applications in automotive safety and regulation enforcement.

Moving forward, further refinement and testing of the Lux meter system are essential to ensure its robustness and effectiveness in real-world scenarios. Additionally, exploration of additional functionalities and integration with existing traffic monitoring systems could enhance its utility and impact. Ultimately, by leveraging technology to address challenges in law enforcement and vehicle safety, we can strive towards safer roadways and more efficient enforcement practices.

18EEP202L – Minor Project II

Problem Identification – Survey Form

1. **Name and Address of the community:**

2. **Age Group**
   a) **Less than 10 Years**
   b) **10 years to 20 Years**
   c) **21 years to 35 Years**
   d) **36 Years to 50 Years**
   e) **More than 50 Years**

3. **Discussion:**
   a) **What?** *(Define the Problem)*

   b) **Why?** *(Reason for the Problem occurrence)*

   c) **When?** *(When the problem began or first noticed)*

   d) **Where?** *(Place of the problem's first* occurrence *or sighting)*

e) Who? (The person or thing that the problem affects)

f) How? *(The sequence of events that resulted in the problem)*

Signature of the Respondent

g)Which? (People have attempted to solve the issue)

h) Does the problem appear to have only one possible solution?

4) Work Plan of the project

5) Final Solution

Signature of the Surveyor

IMPLEMENTATION GEO-TAG PHOTO:

IMPLEMENTATION VIDEO LINK :

https://drive.google.com/file/d/1fFz6h4TNiJDaY5tj5GqPSGSGvQ6YSRw2/view?usp=drive_link

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