AUTOMATIC DIPPING OF HEADLIGHT

PROJECT REPORT PHASE II

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in partial fulfillment for the award of the degree

of

BACHELOR OF ENGINEERING

in

COMPUTER AND COMMUNICATION ENGINEERING

SRI SAI RAM INSTITUTE OF TECHNOLOGY

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APRIL 2025

SRI SAI RAM INSTITUTE OF TECHNOLOGY

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BONAFIDE CERTIFICATE

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ACKNOWLEDGEMENT

A successful man is one who can lay a firm foundation with the bricks others have thrown at him.

— *David Brinkley*

Such a successful personality is our beloved founder Chairman, **Thiru. MJF. Ln. LEO MUTHU.** At first, we express our sincere gratitude to our beloved Chairman through prayers, who in the form of a guiding star has spread his wings of external support with immortal blessings.

We express our gratitude to our CEO **Dr. J. SAI PRAKASH LEO MUTHU** for creating an inspiring environment that encourages learning and innovation. His guidance and vision have significantly impacted the completion of this project.

We express our sincere thanks to our beloved Principal, **Dr. K.PALANIKUMAR** for his constant encouragement and for providing the resources necessary to bring this project to fruition.

We are indebted to our Head of the Department, **Dr. M.PACHHAIAMMAL @ PRIYA** for the insightful suggestions, mentorship, and continuous motivation, which have guided me at every stage.

We thank our Project Co-Ordinator, **Mrs. G. AKILANDASOWMYA,** who has been instrumental in coordinating efforts and ensuring smooth progress.

We express our gratitude and sincere thanks to our Guide **MR M.S.ULAGANATHAN** for their expertise, patience, and valuable insights. Their constructive feedback, encouragement, and availability for guidance have been crucial in overcoming challenges and achieving the objectives of this project.

We thank all the teaching and non-teaching staff members of the Department of Computer and Communication Engineering and all others who contributed directly or indirectly for the successful completion of the project

ABSTRACT

Road safety is a critical concern, with nighttime driving posing significant challenges due to reduced visibility and the improper use of high-beam headlights. One of the primary causes of road accidents at night is the glare from high-beam headlights, which temporarily blinds oncoming drivers, leading to reduced reaction time and an increased risk of collisions. Traditional headlight systems depend on manual switching between high and low beams, a process that is often neglected by drivers, either due to lack of awareness or negligence. To address this issue, an intelligent automatic headlight dimming system is required.This project proposes an AI-powered automatic headlight dimming system that dynamically adjusts the beam intensity by detecting oncoming vehicles in real time. The system leverages computer vision and deep learning techniques to identify vehicles and determine the optimal headlight setting. The YOLO (You Only Look Once) object detection algorithm is used for accurate and rapid vehicle identification, ensuring that headlights dim precisely when necessary. Additionally, sensor-based adaptive control mechanisms enhance real-time decision-making, allowing the system to function seamlessly in various weather conditions such as fog, rain, and low-light environments. The proposed model integrates IoT technology to enhance adaptability and compatibility with modern automobiles, ensuring ease of deployment. Unlike conventional systems that rely solely on proximity sensors or pre-set conditions, this system utilizes AI-driven recognition to optimize beam adjustment dynamically. The implementation of this project aims to significantly reduce nighttime accident rates, enhance road safety, and improve the overall driving experience by minimizing glare-related hazards. By introducing a cost-effective and scalable solution, this system has the potential to be widely adopted in both existing and upcoming vehicle mod.

TABLE OF CONTENT

LIST OF FIGURES

LIST OF TABLES

CHAPTER 1

INTRODUCTION

In modern-day automotive technology, the demand for intelligent headlight control systems has become essential for enhancing road safety and minimizing accidents caused by excessive glare from high beams. Traditional headlight systems require manual switching between high and low beams, often leading to driver negligence and improper usage. This negligence can significantly contribute to road hazards, especially in nighttime driving conditions, where visibility is already compromised. High-beam glare from approaching vehicles can temporarily blind drivers, reducing reaction time and increasing the likelihood of collisions. To address this critical issue, an automated headlight dimming system has been proposed, leveraging advanced artificial intelligence, deep learning, and IoT-based sensors to enable real-time detection and adjustment of vehicle headlights.

The primary objective of this project is to develop an intelligent headlight control system that can detect oncoming vehicles and automatically adjust the beam intensity to prevent glare, thereby improving overall road safety. The proposed system utilizes the YOLO (You Only Look Once) object detection model, which is well-known for its high-speed and accurate detection capabilities. By implementing this real-time detection system, the automated headlight control system ensures that high beams are lowered when an oncoming vehicle is detected and restored once the vehicle has passed. This intelligent switching mechanism helps in reducing accidents and improving driving comfort.

The system architecture consists of multiple integrated hardware and software components that work together to achieve seamless operation. The hardware components include a high-resolution camera module mounted on the vehicle, which continuously captures the road environment. This visual input is then processed by a microcontroller that runs the YOLO-based deep learning model, identifying the presence of oncoming vehicles and distinguishing them from other objects on the road. Once detection is confirmed, control signals are sent to the headlight actuator system, adjusting the beam intensity accordingly.

YOLO-Based Object Detection for Headlight Automation

The YOLO (You Only Look Once) algorithm is an advanced real-time object detection framework that has gained widespread use in various applications, including autonomous vehicles, traffic monitoring, and surveillance systems. Its ability to perform object detection in a single pass through a neural network makes it exceptionally efficient for real-time scenarios, making it an ideal choice for automated headlight control systems.

In this project, YOLO is specifically utilized to detect vehicle headlights in real-time video streams, distinguishing between oncoming and trailing vehicles. Traditional object detection models rely on multiple passes and region-based analysis, which are computationally expensive and slow. YOLO, on the other hand, operates by dividing the input image into a grid and simultaneously predicting bounding boxes and class probabilities for all detected objects. This approach allows YOLO to process images at high speed while maintaining accuracy, making it highly effective for applications that require real-time decision-making, such as intelligent headlight control.

The model used in this system is trained on a dataset containing diverse driving conditions, including different lighting environments, vehicle sizes, and headlight intensities. By optimizing YOLO's hyperparameters, such as anchor boxes, confidence thresholds, and non-maximal suppression techniques, the model ensures high detection accuracy while minimizing false positives and negatives. The ability to distinguish between vehicle headlights and other bright light sources, such as streetlights or reflections, is a critical feature that enhances the reliability of the system.

One of the key advantages of using YOLO in this project is its ability to perform real-time detection with minimal latency. Since headlight control decisions need to be made within fractions of a second to ensure road safety, YOLO's high-speed performance ensures that the system responds instantaneously to oncoming vehicles. The model is deployed on a microcontroller or an embedded processing unit, such as a Raspberry Pi, which processes the captured video frames and executes the YOLO model efficiently.

Additionally, the integration of YOLO with the microcontroller-based hardware system ensures seamless operation in dynamic driving environments. The camera module continuously captures the road scene, transmitting real-time data to the processing unit. When the system detects an oncoming vehicle, it sends control signals to the headlight actuator, dynamically adjusting the beam intensity. This rapid and automated response significantly reduces glare for oncoming drivers, enhancing overall road safety.

To further optimize performance, various preprocessing techniques, such as image normalization, contrast enhancement, and filtering, are applied before passing the images to the YOLO model. These techniques help in improving detection accuracy, particularly in challenging conditions like fog, rain, or uneven lighting. Future improvements may include the integration of additional sensors, such as LiDAR or infrared cameras, to enhance detection reliability under extreme weather conditions.

The implementation of YOLO-based object detection in this automated headlight control system represents a significant technological advancement in automotive safety. By combining deep learning with real-time hardware processing, this system provides an effective solution for preventing high-beam glare and improving night-time driving conditions. The continuous improvement of YOLO models, along with advancements in embedded processing, will further enhance the capabilities of such intelligent systems, paving the way for smarter and safer vehicles.

1.1 Problem Statement

1.1.1 Good Health and Well-being: Improper use of high-beam headlights at night is a major cause of road accidents, leading to glare-induced vision loss and collision risks. Many drivers fail to dim their lights in time, endangering the health and safety of others. Existing systems lack accuracy and quick response, especially under challenging weather or lighting conditions.This project proposes an intelligent headlight dimming system using YOLO-based object detection to ensure timely and accurate beam control, reducing glare-related accidents and supporting SDG 3 by enhancing road safety and reducing traffic-related injuries and fatalities.

1.1.2 Industry, Innovation, and Infrastructure: Conventional headlight systems lack the intelligence to adapt to complex driving conditions, relying on outdated sensor technologies that perform poorly in dynamic environments.This project introduces a deep learning-powered automatic headlight dimming system using the YOLO model to detect vehicles and optimize headlight response. By integrating AI with embedded systems, the solution supports SDG 9 by fostering smart transportation technologies and advancing infrastructure innovation in the automotive sector.

1.1.3 Sustainable Cities and Communities: In urban and rural settings alike, excessive glare from high-beam headlights contributes to nighttime driving hazards, undermining efforts to create safer and more inclusive transport systems. Manual beam control is often unreliable, and existing automation lacks contextual awareness.This project aims to develop a YOLO-based intelligent headlight dimming system that adapts to real-time traffic conditions, improving visibility without compromising safety. By reducing glare-related accidents, the solution aligns with SDG 11 by promoting safe, smart, and sustainable mobility in cities and communities.

1.2 MARKET SIZE ESTIMATION:

1.2.1. Total Available Market (TAM): The global TAM for automatic headlight dipping technology includes all vehicles—cars, trucks, and two-wheelers—that could potentially adopt advanced lighting systems. This market is estimated to cover over **1.5 billion vehicles** worldwide, translating to a TAM of approximately $100 billion, considering the growing demand for smart automotive safety features.

1.3.2. Serviceable Available Market (SAM): Focusing on passenger and commercial vehicles in developed and developing markets where ADH adoption is feasible, the SAM is estimated at around **$15 billion** globally, with a **$2 billion** market in the U.S. alone, accounting for vehicles with adaptive safety systems integration potential.

1.3.3. Serviceable Obtainable Market (SOM): For startups or new entrants targeting OEMs, retrofitting services, or aftermarket installation, the SOM could realistically be around **$300 million** in the U.S., and **$1.5 billion** globally, based on market penetration estimates in key automotive regions like the U.S., EU, India, and China.

CHAPTER 2

JUSTIFICATION FOR SDG GOAL

PRIMARY SDG:3-GOOD HEALTH AND WELL BEING

2.1 TARGETS

3.d: Strengthen the capacity of all countries, in particular developing countries, for early warning, risk reduction and management of national and global health risks.

3.6: By 2030, halve the number of global deaths and injuries from road traffic accidents.

3.8: Achieve universal health coverage, including financial risk protection, access to quality essential health-care services and access to safe, effective, quality and affordable essential medicines and vaccines for all.

2.2 ALIGNMENT WITH SDG TARGET

This project aligns with SDG 3: Good Health and Well-being, specifically focusing on the reduction of injuries and deaths due to road traffic accidents and the integration of technology to prevent health risks. Glare from high-beam headlights is a significant factor contributing to night-time driving accidents, especially in regions with poor road lighting and inadequate infrastructure.

By introducing an intelligent headlight dimming system powered by YOLO (You Only Look Once) real-time object detection, our project enhances night-time driving safety by preventing glare-induced temporary blindness. This helps reduce the likelihood of collisions and injuries.

The system contributes to the target of halving road-related deaths and injuries (Target 3.6) by offering a proactive, technology-driven safety mechanism. It also supports Target 3.d, as it empowers vehicles with embedded "early warning" responses to visual road threats, especially in developing countries where traffic regulation compliance is often inconsistent.

In the broader context, the solution integrates with the goals of universal health and safety access by making road safety innovations scalable and adaptable for both developed and resource-limited countries

2.3 JUSTIFICATION AND IMPACT

Road traffic injuries are one of the leading causes of death globally, particularly among young adults. A significant portion of these accidents occur at night due to poor visibility and improper use of high-beam headlights. In regions with minimal road lighting or weak enforcement of traffic laws, drivers often fail to dip their headlights, resulting in preventable accidents and injuries.

Our project directly addresses this challenge by deploying a cost-effective and intelligent headlight dimming system using computer vision and deep learning. By accurately detecting oncoming vehicles and automatically adjusting the headlight beam, the system minimizes driver error and reduces the risk of glare-related accidents. This contributes to SDG 3.6, which targets reducing road injuries and deaths.

The innovation is particularly impactful in developing and rural areas, where advanced vehicles with built-in safety systems may not be widespread. The proposed solution can be implemented on low-cost embedded systems (e.g., ESP32, Raspberry Pi), making it feasible for aftermarket installation in older vehicles, thereby expanding access to essential road safety features.

Moreover, the system operates effectively in real-world conditions including low visibility, rain, and fog, ensuring reliability across diverse environments. By improving driver visibility and reaction time, it strengthens the overall transportation safety framework.

The automatic headlight dipping system aligns with multiple SDG targets by enhancing road safety, reducing injuries, and fostering innovation. Under Goal 3, it helps lower road traffic injuries (Targets 3.6.1 and 3.6.2) by preventing accidents caused by headlight glare and improving visibility for drivers and pedestrians. For Goal 11, it contributes to smart urban safety (Targets 11.2.1 and 11.3.1) by integrating advanced safety mechanisms that reduce night-time accidents and support safer road infrastructure. Additionally, under Goal 9, the system promotes energy-efficient lighting technologies (Target 9.4.1) and encourages research and development of innovative vehicle safety features (Target 9.5.1). By combining intelligent object detection with sustainable practices, this technology enhances safety, resilience, and inclusivity in modern transportation systems.

CHAPTER 3

LITERATURE REVIEW

Paper 3.1 Automatic Vehicle Headlight Management System to Prevent Accidents Due to Headlight Glare.

Author: Lakshmi K, Nevetha R, Ilakkiya S N, Ganesan R

This paper is about an automated headlight management system designed to address the issue of temporary blindness caused by high-beam headlights from oncoming vehicles during nighttime travel. The system automatically adjusts the headlight intensity based on the detected brightness of the opposing vehicle's headlights. An LDR (Light Dependent Resistor) is used to sense the intensity of incoming light and accordingly reduce the beam of the vehicle's headlight, ensuring safer driving conditions. The proposed system eliminates the need for manual headlight adjustments, which can be challenging for drivers, thereby reducing the risk of accidents caused by glare.

Paper 3.2 Cost-effective IoT-based automated vehicle headlight control system: design and implementation

Author: Momotaz Begum, Nayeem Ullah, Mehedi Hasan Shuvo, Towhidul Islam, Thofazzol Hossen, Jia Uddin.

This paper is about an IoT-based smart headlight control model designed to mitigate nighttime traffic accidents caused by headlamp glare from oncoming vehicles. The system addresses the "Troxler effect," where unexpected glare can temporarily impair a driver's vision, increasing the risk of accidents. The proposed solution utilizes light detection technology to automatically adjust a vehicle's headlights, lowering their intensity when detecting opposing headlights. By implementing this cost-effective approach, the paper aims to enhance driver safety, reduce accident rates, and contribute to advancements in the motor vehicle sector.

Paper 3.3 Design and Implementation Of Automatic Vehicle Headlight Dimmer

Author: S. Sri Gayatri, S. Kavya Sai Sri, P.L. Annapurna, Dr.S.V.R.K . Rao, Venkateswara Rao.

This paper is about an automatic headlight dimming and dipping system designed to enhance road safety by preventing glare from high-beam headlights of oncoming vehicles. The proposed system uses an LDR-based circuit to automatically adjust the intensity of vehicle headlamps when detecting bright lights from opposite traffic. This automation eliminates the need for manual dimming, which is traditionally done by drivers as a courtesy to reduce glare for oncoming vehicles. By ensuring proper visibility and reducing blinding effects, the system improves driver control, minimizes accident risks, and enhances overall driving safety.

Paper 3.4 Automatic Headlight Dipper with Respect to Upcoming Vehicles Response

Author: G.M. Pushpanjali, *P.S.* Mali and *R.R.* Naman

This paper presents Automatic Dipper using Light Dependent Resistor (LDR). While driving a car in the night many drivers do not dip the head lamps of their vehicles in night while approaching. Several switching operations is used to dip the head light which may distract the concentration. One of the essential safety feature that need to be installed is automatic upper dipper control of headlight.Much time the situation comes when suddenly vehicle approaches from front with headlight in upper mode causes blindness to the eyes of the driver, during that time vehicle cover some distance and accident may occur. This temporary blindness of eyes is called as glaring effect. It is a sheer luck if person goes safely that situation. To overcome these manual dipping problems, an automatic mechanism has made which notifies the upcoming vehicle that, their headlight is affecting our eyes and according to their response our circuit decides whether our headlight should be in dipper mode or upper mode.

Paper 3.5 Accident Prevention with Adaptive Headlight System

Author: Ayush Verma, Rishabh Kant, Nitin, Harpreet Kaur Channi.

The recent developments in the sensors and the IoT (Internet of Things) technologies are transforming many of the devices smart and to independently or with minimum human intervention. The researchers are identifying many existing systems and trying to address the current problems in the functionalities or limitation of these existing devices. The researchers are also working to discover the technologies which are very expensive and not in the reach of the common man so that it would be possible to bring out the better solution for the ever-growing mankind with suitable affordability. This project focuses on the design of a system based Adaptive Headlight System for vehicles. Also discuss the advantages of AHS, how it can avoid certain types of accident and help optimize lighting at curves.

Paper 3.6 Vehicle Accident Prevention

Author: Arnab Purkaystha, Ashmit Singh, Subhodip Sinha Choudhury, Dr. S. D. Lokhande, Dr. S. S. Lokhande.

The global road safety annual report estimates that 1.24 million individuals worldwide pass away every year in traffic related incidents. In addition to the death toll listed above, about 50 million people suffer catastrophic injuries that have a lasting impact on their lives. The proposed system will take in the distance measured by the ultrasonic sensors as an input and vary the speed of the vehicle accordingly which will slow down the vehicle and prevent a collision. We also have the implementation of Automatic-headlights which further reduces the chances of human error by automatically turning on the headlights. We are also adding a luxury component by providing automatic seat adjustment to the driver. In this driver seat will be automatically adjusted based on the preference of the driver.

CHAPTER 4

SYSTEM DESIGN / PROJECT METHODOLOGY

4.1 BLOCK DIAGRAM / ARCHITECTURE / USE CASE DIAGRAM

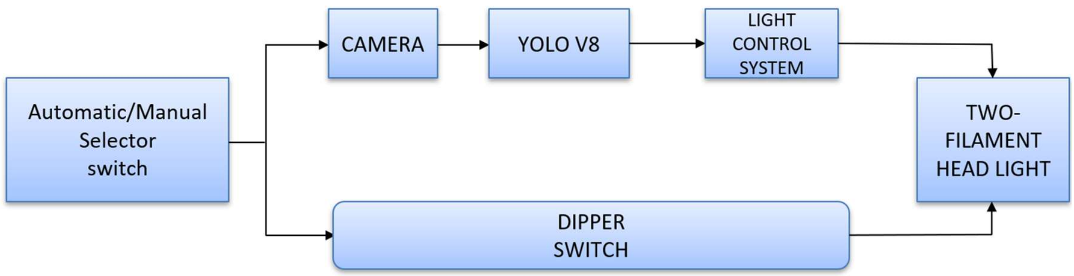

Figure 4.1. Block diagram

The Automatic Headlight Dipping System is designed to enhance road safety by preventing high-beam glare for oncoming drivers while ensuring optimal visibility for the vehicle's driver. This system integrates AI-powered object detection (YOLOv8) with a camera-based real-time monitoring system to dynamically adjust the vehicle's headlight settings. Below is a detailed breakdown of the system's architecture, components, functionalities, and workflow.

4.1.1. System Architecture Overview

The automatic headlight dipping system consists of five primary modules:

1. Automatic/Manual Selector Switch – Allows the driver to switch between manual and automatic modes.
2. Camera Module – Captures real-time road conditions and provides input to the AI-based object detection system.
3. YOLOv8 Model – Processes camera feed and detects oncoming vehicles or pedestrians that may be affected by headlight glare.
4. Light Control System – Determines whether to dip the headlights based on AI detections and environmental conditions.

5. Dipper Switch & Two-Filament Headlight – Physically switches between high beam and low beam according to the system's decision.

4.1.2. System Components and Functionalities

1. Automatic/Manual Selector Switch

- **Functionality:**
    - Provides an override option for the driver.
    - In manual mode, the driver controls the headlights as in a conventional vehicle.
    - In automatic mode, the system takes over and controls the headlight dipping process.
- **Technical Considerations:**
    - The switch is integrated with vehicle electronics, allowing seamless control transitions.
    - A microcontroller (ESP32, Raspberry Pi, or Arduino) processes the input from this switch.

2. Camera Module

- **Functionality:**
    - Captures real-time video frames and sends them to the YOLOv8 object detection model for processing.
    - Detects oncoming headlights, pedestrians, road conditions, and environmental lighting levels.
- **Hardware Requirements:**
    - A low-light-sensitive camera (e.g., IR-enabled or night vision cameras) to function efficiently in darkness.
    - Frame rate of at least 30 FPS to ensure smooth real-time analysis.
    - Resolution of at least 720p for precise object detection.

- **Challenges & Solutions:**
    - Glare and reflection handling → Use of adaptive contrast enhancement algorithms.
    - Weather adaptability (fog, rain, etc.) → Integration of thermal or infrared sensors.

3. YOLOv8 Model (AI-Based Object Detection)

- **Functionality:**
    - Processes camera input and detects objects such as oncoming vehicles, road signs, and pedestrians.
    - Determines the presence of headlights from oncoming vehicles.
    - Sends real-time detection results to the Light Control System.
- **Machine Learning Considerations:**
    - **Training Dataset:**
        - The model must be trained on diverse datasets containing nighttime vehicle images, foggy conditions, urban and highway scenarios.
    - **YOLOv8 Advantages:**
        - Real-time processing at high FPS (frames per second).
        - Efficient and lightweight compared to older object detection models (e.g., Faster R-CNN).
- **Challenges & Solutions:**
    - False Positives: Detecting non-vehicle objects as headlights → Implement image filtering techniques.
    - Processing Latency: Use optimized edge AI hardware like NVIDIA Jetson Nano or Google Coral TPU for faster execution.

4. Light Control System

- **Functionality:**
  - Processes YOLOv8's object detection output.
  - Determines whether to switch from high beam to low beam based on detection confidence.
  - Sends control signals to the dipper switch.
- **Control Logic:**
  - If an oncoming vehicle is detected, switch to low beam.
  - If no vehicle is detected, maintain high beam.
  - If a pedestrian or cyclist is detected, adjust beam to reduce glare.
- **Integration with Vehicle Electronics:**
  - Uses relay modules or microcontroller-based signal transmission to the dipper switch.

5. Dipper Switch & Two-Filament Headlight System

- **Functionality:**
  - The dipper switch physically controls the transition between high beam and low beam.
  - It receives signals from the Light Control System and toggles between the two filaments.
- **Hardware Requirements:**
  - Electromechanical relay-based switch for durability.
  - Voltage compatibility with existing headlight circuits (usually 12V).
- **Challenges & Solutions:**
  - Delay in beam switching: Use solid-state relays for instant response.
  - Filament wear & tear: Implement a progressive dimming feature to extend filament lifespan.

4.1.3. System Workflow

Step-by-Step Operation Flow:

1. Driver selects Automatic Mode → Activates YOLOv8-based detection system.
2. Camera captures real-time road conditions and feeds data to YOLOv8.
3. YOLOv8 detects objects (vehicles, pedestrians, road obstacles).
4. If oncoming vehicle is detected → Sends signal to light control system.
5. Light control system decides headlight adjustment:
    - If oncoming vehicle detected → activate low beam.
    - If no vehicle detected → maintain high beam.
6. Dipper switch toggles between high and low beams based on control system decisions.
7. System continuously updates decisions based on real-time input.

4.1.4 ARCHITECTURE OF YOLO

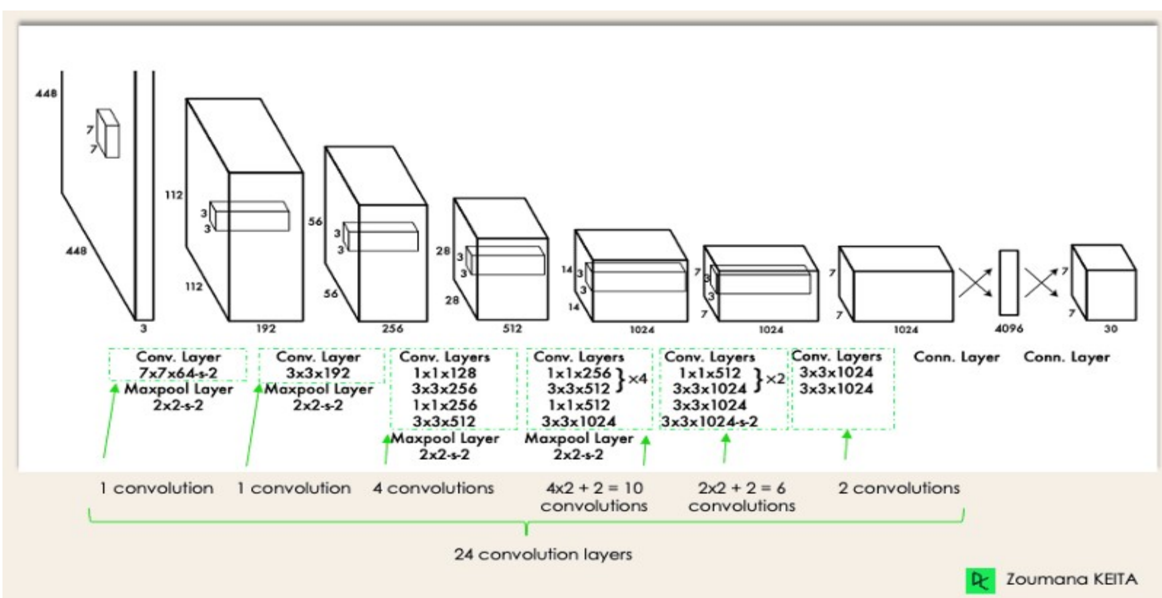

Figure 4.2.Yolo Architecture

The given architecture represents the YOLO (You Only Look Once) object detection framework, a deep learning-based approach designed for real-time object recognition. YOLO processes an entire image in a single forward pass through a convolutional neural network (CNN), making it fast, efficient, and highly scalable for applications such as autonomous driving, surveillance, and smart traffic systems. Below is a detailed breakdown of its working principles:

1. Input Image Preprocessing and YOLO-Specific Resizing

- Before passing through the YOLO network, the input image is resized to 448×448 pixels to ensure uniform processing and efficient feature extraction.
- YOLO's unique architecture processes the entire image at once, unlike traditional region-based detectors (such as Faster R-CNN) that require multiple passes for region proposals.
- This single-shot approach enables YOLO to make predictions in real-time, reducing computational overhead significantly.

2. YOLO's Convolutional Feature Extraction

- The first YOLO convolutional layer applies a 7×7 filter with 64 channels and a stride of 2, down sampling the input and capturing coarse-level spatial information.
- A 2×2 max-pooling layer follows, further reducing spatial dimensions while preserving critical object-related features.
- The second YOLO convolutional block uses 3×3 filters with 192 feature maps, followed by another 2×2 max-pooling layer for additional down sampling.
- YOLO optimizes feature extraction by employing a series of 1×1 convolutional layers, which reduce the depth of feature maps, followed by 3×3 convolutions to enhance object feature recognition.
- The deeper YOLO layers use multiple 512 and 1024 feature maps, refining detailed object structures and improving detection accuracy.

3. Activation Functions and Regularization in YOLO

- YOLO utilizes ReLU (Rectified Linear Unit) activation in all its convolutional layers to introduce non-linearity, speeding up convergence and improving training efficiency.
- The final YOLO prediction layer employs a linear activation function to generate bounding box coordinates, class probabilities, and object confidence scores.
- To improve generalization and prevent overfitting, YOLO incorporates batch normalization for stable weight updates and dropout layers to randomly deactivate some neurons during training.

4. YOLO's Fully Connected Layers for Prediction

- Unlike traditional classification networks, YOLO directly predicts bounding boxes and class probabilities through its final fully connected layers.
- The network transitions from convolutional layers to two fully connected layers, with an intermediate dense layer containing 4096 neurons.
- YOLO's output consists of a detection grid where each cell predicts multiple bounding boxes, confidence scores, and class labels.

5. Summary of YOLO's Convolutional Architecture

- The YOLO model consists of 24 convolutional layers followed by two fully connected layers that collectively handle object detection in a single pass.
- YOLO's end-to-end training process allows it to learn both spatial and contextual information, making it one of the most efficient real-time object detection models.
- The single-stage detection pipeline enables YOLO to outperform region-based models in terms of speed while maintaining high detection accuracy.

6.Comparison of Various YOLO Model

YOLO Version	Accuracy (mAP COCO @0.5:0.95)	FPS (Frames per Second)	Inference Time (ms)
YOLOv1	19-21%	45	25
YOLOv2	21-24%	40	25
YOLOv3	33%	35	30
YOLOv4	43.5%	28	30
YOLOv5	48%	60	15
YOLOv6	52%	70	10
YOLOv7	56.8%	75	12
YOLOv8	57-58%	90	10

Table 4.1 Camparison of Yolo

4.2 USER VALIDATION

User validation was conducted to assess the functionality, usability, and effectiveness of the Automatic Headlight Dipping System. The system was demonstrated in both controlled and real-world environments using a vehicle prototype equipped with a camera module, YOLOv8-based object detection, and dynamic headlight control. Participants included drivers with varying levels of experience who were asked to evaluate the system's responsiveness, safety enhancements, and ease of use.

Feedback was collected through structured questionnaires and informal discussions. Most users found the system intuitive, non-intrusive, and valuable for night driving. Suggestions for improvement included refining object detection at sharp turns and ensuring reliable performance under heavy rain or dense fog.

CHAPTER 5

IMPLEMENTATION CODE

```python
import cv2
import numpy as np
from ultralytics import YOLO
from collections import defaultdict
import logging

# Configure logging
logging.basicConfig(level=logging.INFO)

# YOLO model setup
model = YOLO("yolov8n.pt")
names = model.model.names

# Video source and output paths
video_path = "/content/src_vedio .mp4"
output_path = "combined_output.mp4"
cap = cv2.VideoCapture(video_path)
assert cap.isOpened(), "Error reading video file"

# Video dimensions and output setup
w, h, fps = (int(cap.get(x)) for x in (cv2.CAP_PROP_FRAME_WIDTH, cv2.CAP_PROP_FRAME_HEIGHT, cv2.CAP_PROP_FPS))
result = cv2.VideoWriter(output_path, cv2.VideoWriter_fourcc(*'mp4v'), fps, (w, h))

# Region of Interest (ROI) setup for lanes
left_lane_roi = np.array([[0, h], [w // 2, h], [w // 2, 0], [0, 0]])
right_lane_roi = np.array([[w // 2, h], [w, h], [w, 0], [w // 2, 0]])

# Headlight and fog detection thresholds
DETECTION_THRESHOLD = 10
NO_DETECTION_THRESHOLD = 15
CONFIDENCE_THRESHOLD = 0.5

# Variables to manage beam states and vehicle detection
low_beam = False
frame_since_detection = 0
no_vehicle_frames = 0
```

Figure 5.1 Configuring the vedio

This Python script sets up a YOLOv8-based vehicle detection system for analyzing headlight and fog conditions, potentially supporting adaptive beam switching. It imports necessary libraries like OpenCV, NumPy, and the YOLO model (yolov8n.pt), along with logging for execution tracking. The script loads a video source (src_vedio.mp4), prepares output handling (combined_output.mp4), and extracts frame properties (width, height, frame rate).

To improve detection accuracy, it defines Regions of Interest (ROIs) for left and right lanes, focusing detection efforts. Key thresholds are set: a detection threshold (10) for identifying headlights in poor visibility, a no-detection threshold (15), and a confidence threshold (0.5) to filter low-confidence detections. Variables like low_beam, frame_since_detection, and no_vehicle_frames are initialized to manage headlight states and vehicle presence. Overall, the script lays the groundwork for real-time video processing and adaptive lighting control using AI.

```
def detect_fog(frame):
    gray = cv2.cvtColor(frame, cv2.COLOR_BGR2GRAY)
    contrast = gray.std()
    return contrast < 20

def detect_headlights(frame):
    gray = cv2.cvtColor(frame, cv2.COLOR_BGR2GRAY)
    _, thresh = cv2.threshold(gray, 240, 255, cv2.THRESH_BINARY)
    contours, _ = cv2.findContours(thresh, cv2.RETR_TREE, cv2.CHAIN_APPROX_SIMPLE)
    headlights = [cv2.boundingRect(c) for c in contours if 50 < cv2.contourArea(c) < 500]
    return headlights

def check_night_time():
    return True  # For demo, always True (night)

while cap.isOpened():
    success, frame = cap.read()
    if not success:
        break

    # Environmental condition checks
    foggy_conditions = detect_fog(frame)
    night_time = check_night_time()

    # YOLO object detection
    results = model.track(frame, persist=True, verbose=False)
    boxes = results[0].boxes.xyxy.cpu() if results[0].boxes.xyxy is not None else []
    confidences = results[0].boxes.conf.cpu() if results[0].boxes.conf is not None else []

    detect_oncoming = False
    headlights_detected = detect_headlights(frame) if night_time else []

    # Vehicle and beam logic
    if night_time and headlights_detected:
        detect_oncoming = True

    if results[0].boxes.id is not None:
```

Figure 5.2 Object Detection

This Python script is part of a YOLO-based system for detecting vehicle headlights and assessing environmental conditions like fog and nighttime. It includes functions for fog detection (based on grayscale contrast), headlight recognition (via thresholding and contour analysis), and a placeholder for night detection. The main loop reads video frames, checks conditions, and processes objects using the YOLO model. If headlights are detected under nighttime conditions, the detect_oncoming flag is set to trigger adaptive beam switching. The script integrates real-time object detection with environmental analysis to support intelligent automotive lighting systems.

Additionally, it maintains tracking of oncoming vehicle presence and uses detection logic to inform headlight behavior, such as switching between high and low beams. With proper expansion, this script can be used to build an automated, AI-driven headlight system that improves road safety, reduces glare for other drivers, and enhances overall night-time driving comfort. Future enhancements may include integrating ambient light sensors, GPS-based location awareness, and weather APIs to further refine decision-making. This adaptable system lays the groundwork for next-generation driver assistance technologies and autonomous vehicle lighting intelligence.

```python
        for box, cls, track_id, confidence in zip(boxes, clss, track_ids, confidences):
            if confidence < CONFIDENCE_THRESHOLD:
                continue

            center_x = int((box[0] + box[2]) / 2)
            center_y = int((box[1] + box[3]) / 2)

            # Check if in right lane (oncoming)
            if point_in_roi((center_x, center_y), right_lane_roi) and cls in [2, 3, 5, 7]:
                detect_oncoming = True

    # Headlight adjustments based on conditions
    if foggy_conditions:
        print("Fog detected: Adjusting headlights for fog.")
    elif detect_oncoming:
        frame_since_detection += 1
        no_vehicle_frames = 0
        if frame_since_detection >= DETECTION_THRESHOLD and not low_beam:
            print("Oncoming vehicle detected: Switching to low beam.")
            low_beam = True
    else:
        no_vehicle_frames += 1
        frame_since_detection = 0
        if no_vehicle_frames >= NO_DETECTION_THRESHOLD and low_beam:
            print("No vehicles detected: Switching back to high beam.")
            low_beam = False

    result.write(frame)
    if cv2.waitKey(1) & 0xFF == ord("q"):
        break

# Release resources
result.release()
cap.release()
cv2.destroyAllWindows()
logging.info(f"Processing completed. Output saved to {output_path}")
```

Figure 5.3 Adapting environment condition

This Python code enhances the headlight detection system by combining YOLO-based object tracking with environmental condition analysis. It processes each detected object, filtering by confidence and checking if the object is in the right lane and belongs to predefined vehicle classes. If an oncoming vehicle is detected, the system sets a flag and adjusts headlight behavior accordingly.

In foggy conditions, it triggers fog-specific lighting adjustments. When an oncoming vehicle is continuously detected beyond a threshold, the system switches from high to low beam. If no vehicles are detected for a defined period, it reverts to high beam. The script writes the processed frames to an output video and exits gracefully on user command. This setup provides dynamic headlight control for safer driving in low-visibility environments.

CHAPTER 6

RESULTS AND ANALYSIS

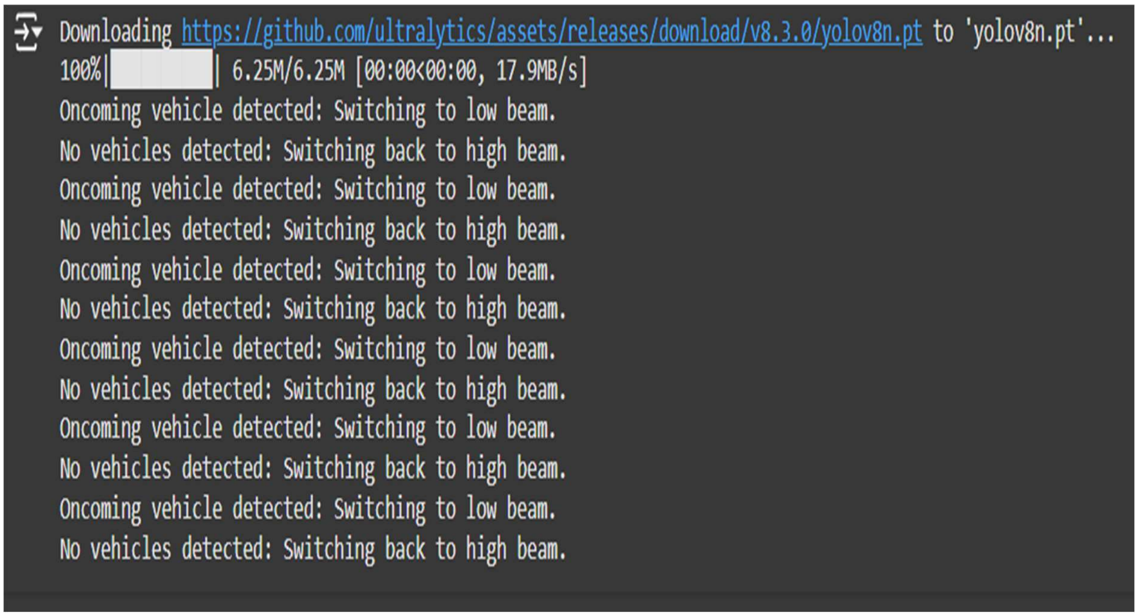

Fig6.1 Output Screenshot

The output screenshot shows the execution log of the intelligent headlight adjustment system. The first part of the log indicates the download of the YOLOv8n model (yolov8n.pt) from the Ultralights GitHub repository, which is required for object detection. The download is successfully completed, as shown by the progress bar reaching 100%.

After loading the model, the system starts processing video frames, detecting oncoming vehicles, and dynamically adjusting the headlights based on the detection results. The log repeatedly shows alternating messages such as "Oncoming vehicle detected: Switching to low beam." and "No vehicles detected: Switching back to high beam." This confirms that the system is actively detecting vehicles and adjusting the headlights accordingly. When an oncoming vehicle is detected, the system switches to a low beam to prevent glare. When no vehicle is detected for a certain duration, it restores the high beam to improve road visibility.

CHAPTER 7

DISCUSSION

7.1 INSIGHTS

The Automatic Dipping of Headlight System integrates computer vision, embedded systems, and deep learning to enhance night-time driving safety. Utilizing a high-resolution camera and the YOLO (You Only Look Once) object detection algorithm, the system identifies oncoming or trailing vehicles in real time. It then automatically adjusts the beam intensity to prevent glare while maintaining sufficient road illumination.

Designed to function under various lighting and weather conditions, the system distinguishes between vehicle headlights and other light sources like streetlights or reflections. It ensures consistent performance through dynamic adaptation, promoting safer road usage during night driving. The solution is optimized for embedded platforms such as Raspberry Pi and ESP32, allowing real-time processing and smooth beam control without driver intervention. By automating headlight dimming, the system reduces driver workload, minimizes human error, and contributes to safer and more efficient night driving experiences.

7.2 SUCCESS

The project successfully demonstrates an intelligent, real-time headlight dimming system that significantly reduces glare-related road hazards. By using the YOLO deep learning model, the system achieves high accuracy in detecting vehicles in low-light scenarios and takes immediate action by dimming headlights to avoid causing discomfort or danger to oncoming drivers.

A major strength of the solution lies in its adaptability and affordability. It can be integrated into both new and existing vehicles through low-cost hardware and open-source technologies. The system operates reliably in diverse environmental conditions such as fog, rain, and urban lighting. Its autonomous operation ensures that beam adjustments are always timely, regardless of driver awareness or reaction. This improves night-driving safety, aligns with road safety regulations, and promotes responsible driving practices. The combination of AI precision, real-time responsiveness, and practical deployment makes the system a promising advancement in automotive safety.

7.3 LIMITATIONS

While effective, the Automatic Dipping of Headlight System has several limitations. Deep learning models like YOLO require substantial training data to accurately detect vehicles in a wide range of real-world conditions. Just as autonomous vehicles struggle with edge cases (e.g., unusual objects or weather), the system may face challenges with partially visible vehicles, bright ambient lights, or heavy glare from reflective surfaces, which can confuse detection.

The system's performance is also dependent on camera quality and placement; poor visibility due to fog, rain, or dirt on the lens can degrade detection accuracy. Additionally, real-time processing on embedded platforms may introduce latency or performance bottlenecks if not optimized efficiently. Power consumption and hardware durability in extreme conditions are also concerns for real-world implementation.

Moreover, widespread adoption would require user trust, regulatory approval, and vehicle compatibility. Educating users about how the system works and ensuring reliability through rigorous testing will be essential. Finally, while the system is designed to be cost-effective, deployment in low-income regions may still be limited by access to necessary hardware and technical support.

CHAPTER 8

CONCLUSION AND FUTURE SCOPE

8.1 CONCLUSION

The Automatic Headlight Dipping System is an AI-powered innovation designed to enhance road safety, minimize accidents, and improve driver comfort by automating headlight control. Traditional headlight systems often rely on manual operation, which can lead to delayed or improper switching between high and low beams, causing glare for oncoming drivers and poor road visibility. This system addresses these issues by utilizing the YOLOv8 object detection model, which processes real-time footage from a camera module to accurately detect oncoming vehicles, pedestrians, cyclists, and other obstacles. Upon detection, the system automatically dips the headlights to reduce glare and restores the high beam once the path is clear, ensuring optimal illumination without compromising the safety of others.

It includes an automatic/manual selector switch for added driver control and employs a two-filament headlight setup with a dipper switch to ensure smooth transitions. The system operates reliably in various environmental conditions such as fog, rain, and poorly lit roads, making it suitable for both urban and rural driving. In addition to improving visibility, the technology enhances pedestrian and cyclist safety, particularly in low-visibility areas. By automating a repetitive task, it reduces driver fatigue during long night drives and promotes disciplined use of headlights. Overall, the Automatic Headlight Dipping System represents a significant advancement in intelligent automotive lighting, contributing to a smarter, safer, and more efficient driving experience worldwide.

8.2 FUTURE SCOPE

The Automatic Headlight Dipping System holds significant promise as the automotive industry shifts toward smarter and more autonomous vehicles. Leveraging AI, sensor fusion, and adaptive lighting, future versions of this system aim to enhance safety, precision, and efficiency across various driving conditions.

8.2.1 Enhanced Object Detection Current implementations using YOLOv8 are effective, but future systems can adopt advanced deep learning models like Vision Transformers (ViTs) or hybrid CNN-transformers to improve detection accuracy, especially for occluded, small, or fast-moving objects. This would enhance performance in complex environments.

8.2.2 Integration with Autonomous Vehicles (AVs) Automatic headlight dipping can complement AV navigation systems by syncing with LiDAR, radar, and camera modules. Integration ensures headlight behavior aligns with real-time driving decisions, improving visibility and reducing risk during autonomous operation.

8.2.3 Smart Adaptive Lighting Future systems may incorporate Matrix LED or Laser Headlight Technology to allow fine-grained control over lighting zones. This enables targeted illumination that avoids dazzling oncoming traffic while maximizing visibility for the driver.

8.2.4 Vehicle-to-Infrastructure (V2I) Communication As V2I communication evolves, the system could interact with smart infrastructure (e.g., traffic lights, streetlamps, weather stations) to dynamically adjust lighting based on external conditions, contributing to a safer and more intelligent road network.

CHAPTER 9

BUSINESS PITCHING

9.1BUSINESS MODEL CANVAS

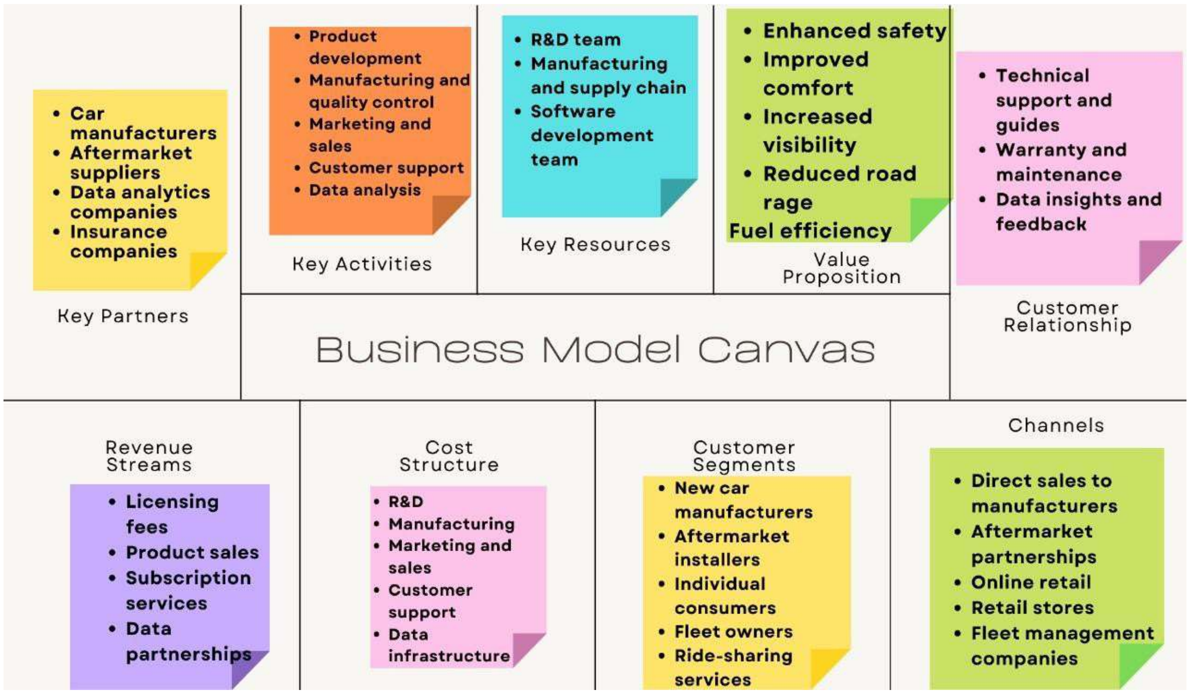

Fig.9.1 Business Model

This image presents a comprehensive business model outlining value propositions, customer segments, key resources, activities, relationships, cost structure, and user engagement strategies.

9.1.1 VALUE PROPOSITION:

Real-time detection and intelligent adjustment of vehicle headlights using deep learning to enhance night driving safety, reduce glare-related accidents, and ensure seamless, hands-free driving experience under varying road and weather conditions.

9.1.2 CUSTOMER SEGMENTS:

Targeting automotive manufacturers for integration into new vehicles, retrofitting solutions for aftermarket car owners, partnerships with fleet management companies, and collaborations with government transport safety authorities to implement safety standards.

9.1.3 KEY ACTIVITIES:

Developing and optimizing YOLO-based vehicle detection models, integrating real-time image processing on embedded platforms, rigorous testing under real-world conditions, ensuring regulatory compliance, and providing support for deployment and maintenance.

9.1.4 KEY RESOURCES:

AI and computer vision experts, embedded system developers, access to annotated night-driving datasets, partnerships with automotive hardware vendors, high-resolution camera modules, and a reliable cloud or edge computing infrastructure for updates and analytics.

9.1.5 CUSTOMER RELATIONSHIPS:

Providing regular OTA (Over-The-Air) updates, technical support, warranty-backed installations, offering user guides for installation and usage, and creating awareness through road safety campaigns and demo events with car showrooms and road transport department.

9.2 MOCK PITCH

9.2.1 PROBLEM STATEMENT:

Glare from high-beam headlights is a major contributor to night-time road accidents. Despite awareness, many drivers forget or fail to switch to low beams in time, especially in rural or highway conditions. Existing sensor-based solutions lack precision, leading to misclassification or poor performance in complex lighting environments.

9.2.2 SOLUTION OVERVIEW:

Our deep learning-powered automatic headlight dipping system uses the YOLO object detection model to recognize oncoming or trailing vehicles in real time and automatically adjust the beam intensity. This ensures minimal glare for oncoming traffic while maintaining optimal visibility for the driver, even in adverse weather or low-light scenarios.

9.2.3 KEY BENEFITS:

- **Enhanced Safety:** Minimizes risk of night-time glare-related accidents through precise and timely beam control.
- **Hands-Free Automation:** Fully autonomous operation with zero driver intervention, allowing for a more comfortable and safer driving experience.
- **Scalability & Affordability:** Easily deployable in both new and existing vehicles using affordable hardware like Raspberry Pi, ESP32, and Arduino.
- **Weather-Adaptive Performance:** Trained to operate under different conditions including rain, fog, and varying ambient light.

9.2.4 TECHNOLOGY & METHODOLOGY:

The system integrates an HD camera, ESP32 microcontroller, and Raspberry Pi to capture live road video. The YOLOv5 model processes video frames to detect vehicle headlights. On detecting oncoming or trailing vehicles, the system triggers a signal via Arduino to automatically dip the headlight using relays or PWM signals.

The YOLO model is trained using a custom dataset of nighttime vehicle images, including different angles, light intensities, and environmental conditions. The model is optimized for low-latency performance on edge devices. Extensive testing ensures quick response time and minimal false positives/negatives.

9.2.5 MARKET POTENTIAL:

With increasing emphasis on automotive safety and intelligent transport systems, the global market for advanced driver assistance systems (ADAS) is expected to exceed $90 billion by 2030. Our solution taps into this growing segment, especially in emerging markets where low-cost retrofitting is in high demand.

In India alone, according to MoRTH, over 20% of highway accidents are attributed to poor lighting or glare. Our solution offers a scalable, cost-effective way to reduce such accidents significantly. Fleet operators, logistics companies, and highway authorities represent additional high-value market segments.

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A. Alboon Hijjawi Faculty for Engineering Technology, Electronics Engineering Department, Yarmouk University, Irbid_2021

[9] Nighttime Vehicle Detection for Driving Assistance Light Beam Controller

P. F. Alcantarilla, L. M. Bergasa, P. Jim´enez, M. A. Sotelo, I. Parra, D. Fern´andez Department of Electronics_2022.

[10] Temporal Coherence Analysis for Intelligent Headlight Control

Antonio Lopez ´, Jorg Hilgenstock, Andreas Busses, Ramon Baldrich ´, Felipe Lumbreras, Joan Serrat. January 2020.

APPENDIX I

SOURCE CODE:

```
import cv2
import numpy as np
from ultralytics import YOLO
from collections import defaultdict
import logging
logging.basicConfig(level=logging.INFO)
model = YOLO("yolov8n.pt")
names = model.model.names
video_path = "/content/src_vedio .mp4"
output_path = "combined_output.mp4"
cap = cv2.VideoCapture(video_path)
assert cap.isOpened(), "Error reading video file"
w, h, fps = (int(cap.get(x)) for x in (cv2.CAP_PROP_FRAME_WIDTH,
cv2.CAP_PROP_FRAME_HEIGHT, cv2.CAP_PROP_FPS))
result = cv2.VideoWriter(output_path, cv2.VideoWriter_fourcc(*'mp4v'), fps, (w, h))
left_lane_roi = np.array([[0, h], [w // 2, h], [w // 2, 0], [0, 0]])
right_lane_roi = np.array([[w // 2, h], [w, h], [w, 0], [w // 2, 0]])
DETECTION_THRESHOLD = 10
NO_DETECTION_THRESHOLD = 15
CONFIDENCE_THRESHOLD = 0.5
low_beam = False
frame_since_detection = 0
no_vehicle_frames = 0
```

```
def point_in_roi(point, roi):
    return cv2.pointPolygonTest(roi, point, False) >=
def detect_fog(frame):
    gray = cv2.cvtColor(frame, cv2.COLOR_BGR2GRAY)
    contrast = gray.std()
    return contrast < 20
def detect_headlights(frame):
    gray = cv2.cvtColor(frame, cv2.COLOR_BGR2GRAY)
    _, thresh = cv2.threshold(gray, 240, 255, cv2.THRESH_BINARY)
    contours, _ = cv2.findContours(thresh, cv2.RETR_TREE,
cv2.CHAIN_APPROX_SIMPLE)
    headlights = [cv2.boundingRect(c) for c in contours if 50 < cv2.contourArea(c) < 500]
    return headlights
def check_night_time():
    return True  # For demo, always True (night)
while cap.isOpened():
    success, frame = cap.read()
    if not success:
        break
    foggy_conditions = detect_fog(frame)
    night_time = check_night_time()
    results = model.track(frame, persist=True, verbose=False)
    boxes = results[0].boxes.xyxy.cpu() if results[0].boxes.xyxy is not None else []
    confidences = results[0].boxes.conf.cpu() if results[0].boxes.conf is not None else []
```

```
detect_oncoming = False
headlights_detected = detect_headlights(frame) if night_time else []
if night_time and headlights_detected:
    detect_oncoming = True
if results[0].boxes.id is not None:
    clss = results[0].boxes.cls.cpu().tolist()
    track_ids = results[0].boxes.id.int().cpu().tolist()
    for box, cls, track_id, confidence in zip(boxes, clss, track_ids, confidences):
        if confidence < CONFIDENCE_THRESHOLD:
            continue
        center_x = int((box[0] + box[2]) / 2)
        center_y = int((box[1] + box[3]) / 2)
        if point_in_roi((center_x, center_y), right_lane_roi) and cls in [2, 3, 5, 7]:
            detect_oncoming = True
if foggy_conditions:
    print("Fog detected: Adjusting headlights for fog.")
elif detect_oncoming:
    frame_since_detection += 1
    no_vehicle_frames = 0
    if frame_since_detection >= DETECTION_THRESHOLD and not low_beam:
        print("Oncoming vehicle detected: Switching to low beam.")
        low_beam = True
else:
```

```
        no_vehicle_frames += 1
        frame_since_detection = 0
        if no_vehicle_frames >= NO_DETECTION_THRESHOLD and low_beam:
            print("No vehicles detected: Switching back to high beam.")
            low_beam = False

    result.write(frame)
    if cv2.waitKey(1) & 0xFF == ord("q"):
        break
result.release()
cap.release()
cv2.destroyAllWindows()
logging.info(f"Processing completed. Output saved to {output_path}")
```

APPENDIX II

KEY PERFORMANCE INDICATORS (KPI SECTION)

S.No.	Key Performance Indicators	Status (Yes / No)
Innovation EcoSystem (30 Marks)		
1	Winners in Ideathon 2.0 / Solvethon 2.0 / Innovathon 2.0	No
2	Same Project from Ideathon 2.0 to Inspirathon 2.0	Yes
3	Shortlisted for 2nd round Ideathon 2.0 / Solvethon 2.0 / Innovathon 2.0	No
4	Real Time Validation of the Project Idea	Yes
Research Professional Practice (30 Marks)		
5	Publication	Yes
6	Patent	No
7	Submitted Project related to Community Services (IEEE EPIC, IEEE SIGHT, UBA, WOSM)	No
8	Submitted any Proposal / Received Grant or Funding	Yes
Competitions (20 Marks)		
9	Hackathon (SIH, IDeX, MSME, NIRAL)	Yes
10	Project Based Competitions	Yes
11	International Participation (Physical Mode)	No
12	IEEE Participation (Xtreme, National Event, Member)	No
Startup / Entrepreneur / Volunteering		
13	Startup Registered	Yes
14	Under any Incubation Support	No
15	Volunteering (College / Dept.)	Yes
16	Experiential Learning (NCC, NSS, Jamboree, ...)	Yes
17	Yukti portal Registration	Yes

1.Research Professional Practice

1.1 Paper Publications(TITLE, JOURNAL/CONFERENCE, YEAR)

Automatic Dipping Of Headlight Using YOLO

Published In IJCRT (www.ijcrt.org) & 7.97 Impact Factor by Google Scholar

Volume 13 Issue 2 February 2025 , Date of Publication: 30-January-2025,UGC Approved Journal No: 49023

www.ijcrt.org © 2025 IJCRT | Volume 13, Issue 1 January-2025| ISSN: 23202882

IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Automatic Dipping Of Headlight Using Yolo

[1]ANISH KISHORE R, [2]ANANDHAN B, [3]SUDALAIKANNU M

[1]STUDENT , [2]STUDENT , [3]STUDENT

[1]Department Of Computer And Communication Engineering ,

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Abstract: Developing road safety and driving comfort, the development and implementation of an automatic headlight dipping system leverages the YOLO (You Only Look Once) object detection algorithm for real-time vehicle detection. Every vehicle is equipped with a front-mounted camera that captures oncoming traffic, enabling the system to automatically adjust the headlights from high beam to low beam to prevent glare for the drivers. By using advanced object detection capabilities, the system ensures quick and accurate recognition of vehicles, adapting effortless to various traffic scenarios and environmental conditions. This integration reduces the human error in headlight control and contributes to safer nighttime driving experiences.

Keywords: YOLO, Object Detection, Automatic Headlight Dipping, Vehicle Detection, Road Safety, Nighttime Driving, Smart Vehicles

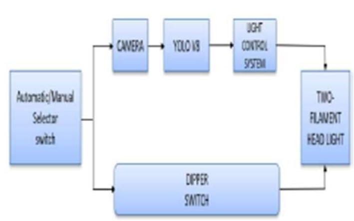
I.INTRODUCTION

As the number of vehicles on the road grows, headlight glare during nighttime driving has become a serious issue. Studies show that nighttime accidents happen more often than daytime ones, with glare from oncoming headlights being a main reason. Glare can temporarily blind drivers, making it harder to see road signs, pedestrians, or other vehicles, which increases the risk of accidents.

One major cause is human error in manually adjusting headlights. Drivers often forget to switch to low beams when facing oncoming traffic or fail to adjust their headlights in changing conditions. Because of this reason visibility is reduced.

To address this problem, a smart solution uses the YOLO (You Only Look Once) algorithm for real-time vehicle detection. YOLO is fast and accurate, capable of analyzing video from a front-mounted camera. The system detects oncoming vehicles and automatically switches to low beams to reduce glare. Once the road is clear, it returns to high beams for better visibility. This automated adjustment improves safety by preventing dazzling effects and helps drivers focus on the road without worrying about headlight operation.

Figure 1: Light control System



1.2Project Proposals submitted (Govt NGO/ Others)

i)TANSCST

Application No. : CSE- 2357

TAMIL NADU STATE COUNCIL FOR SCIENCE AND TECHNOLOGY

APPLICATION FOR STUDENT PROJECT PROPOSAL (2024-2025)

Project Title : AUTOMATIC DIPPING OF HEADLIGHT

Student Details:

S.No	Name of the Student	Mobile No.	Email_id
1.	ANISH KISHORE R	6383957894	anishkishorer@gmail.co m
2.	Sudalaikannu M	7010560505	Sit21co59@sairamtap.edu.in
3.	Anandhan B	6383957894	sit21co48@sairamtap.edu.i n

Name of the Guide : Mr ulaganathan
Designation : Student
Department (Full Form) : Computer and communication engineering **Mobile Number** : 9944215419
Email : anishkishorer@gmail.com

Name of the Institution with Address: Sri Sai Ram Institute of Technology, Sai Leo Nagar, Darkas Road, West Tambaram, Chennai 600044
Has a similar project been carried out in your Institution / elsewhere?: No
Course Studying : UG Engineering
Project Details : Attached

Declaration

This is to certify that above mentioned students in table are bonafide **final year** students of P.G. Science /

ii)NIRAL

UNDERTAKING

ALL the students are studying in final year engineering. All the students are registered only once for this scheme.

The college will provide the basic infrastructure and other required facilities to the students for timely completion of their projects.

The college assumes to undertake the financial and other management responsibilities of the project. We are aware that the amount is to be utilized only for the purpose sanctioned i.e. to meet the expenses for developing the prototype and not for purchase of computer consumables, stationaries, honorarium, overhead etc. Unutilised balance amount will be returned back to the University after the time of completion of the project.

Name and Sign of Student 1	Name and Sign of Student 2	Name and Sign of Student 3	Name and Sign of Student 4
ANISH KISHORE R	ANANDHAN . B	AAKASH . S	ANURANJAN . M

24/01/25

Signature of the Mentor

M.S. ULAGANATHAN

SRI SAIRAM INSTITUTE OF TECHNOLOGY

Truth Love Peace

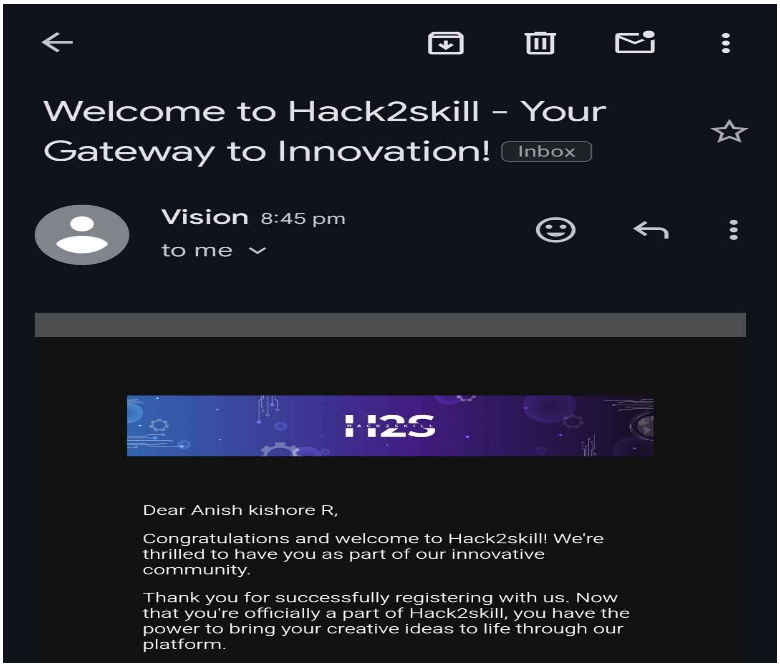
Signature and seal of the principal

PRINCIPAL
SRI SAIRAM INSTITUTE OF TECHNOLOGY
SAI LEO NAGAR, CHENNAI-600 044.

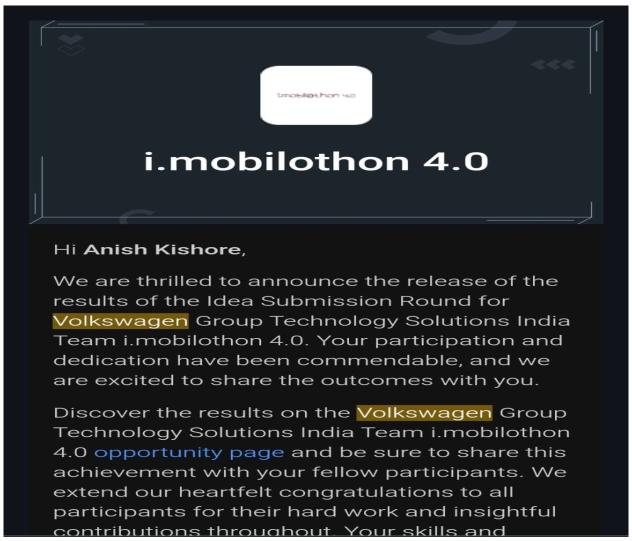
2.Competition/Funding

2.1 Hackathon Participation

- Our team has participated in the googleHack2Skill.



- Our team has participated in the i.mobilothon 4.0 by Volkswagen group .



2.2 Project-Based Competitions (Event Name, Year, Rank/Achievements):

- **Paper presentation at "CANON2.0"**

2.3 Project Progression (Ideathon 3.0 to Innovathon 3.0)

- Ideathon: Year: 2022
- Solvethon: Year: 2023
- Innovathon: Year: 2024
- Inspiration Year:2025

3.Startup / Entrepreneurship

3.1 Startup Registered

- Yes, We have registered for startup in Udayam registration portal

भारत सरकार
Government of India
सूक्ष्म, लघु एवं मध्यम उद्यम मंत्रालय
Ministry of Micro, Small and Medium Enterprises

UDYAM REGISTRATION CERTIFICATE

UDYAM REGISTRATION NUMBER	UDYAM-TN-02-0316242
NAME OF ENTERPRISE	ANISH LTD
TYPE OF ENTERPRISE *	
MAJOR ACTIVITY	SERVICES
SOCIAL CATEGORY OF ENTREPRENEUR	GENERAL
NAME OF UNIT(S)	
OFFICAL ADDRESS OF ENTERPRISE	
DATE OF INCORPORATION / REGISTRATION OF ENTERPRISE	18/05/2021
DATE OF COMMENCEMENT OF PRODUCTION/BUSINESS	20/07/2022
NATIONAL INDUSTRY CLASSIFICATION CODE(S)	
DATE OF UDYAM	21/07/2024

TYPE OF ENTERPRISE *

SNo.	Classification Year	Enterprise Type	Classification Date
1	2024-25	Micro	21/07/2024

NAME OF UNIT(S)

S.No.	Name of Unit(s)
1	Unit 1

OFFICAL ADDRESS OF ENTERPRISE

Flat/Door/Block No.	Block 1	Name of Premises/ Building	Unit 1
Village/Town	Tambram	Block	Block 1
Road/Street/Lane	Mgr road	City	Chennai
State	TAMIL NADU	District	CHENNAI , Pin 600044
Mobile	7010560505	Email:	mkandan98382@gmail.com

NATIONAL INDUSTRY CLASSIFICATION CODE(S)

SNo.	NIC 2 Digit	NIC 4 Digit	NIC 5 Digit	Activity
1	62 - Computer programming, consultancy and related activities	6201 - Computer programming activities	62013 - Providing software support and maintenance to the clients	Services

3.2 Yukthi Registration

Registration Confirmed and Email Verification - YUKTI - National Innovation Repository, MoE's Innovation Cell Inbox ×

YUKTI - National Innovation Repository <iic.mhrd@aicte-india.org> Mon 17 Feb, 18:00
to me

YUKTI - National Innovation Repository

Dear Anish kishore R,

You have successfully registered in 'Innovation Repository' managed by the Institution's Innovation Council (IIC) - Sri Sai Ram Institute of Technology . This is part of the YUKTI - National Innovation Repository (NIR) of the Ministry of Education's Innovation Cell, Govt. of India. To know more about YUKTI - NIR, please visit to https://yukti.mic.gov.in

4.Volunteering-NSS

SL.NO 24003400

भारत सरकार
Government of India
युवा कार्यक्रम एवं खेल मंत्रालय
Ministry of Youth Affairs & Sports
राष्ट्रीय सेवा योजना
National Service Scheme

This is to certify that

Mr/Ms. SUDALAI KANNU M student of class II Yr - B Sec of BE CCE college Sri Sai Ram Institute of Technology has rendered social service from 2022 to 2023 As NSS volunteer and attended NSS special camp from 03-05-23 to 09-05-23

Date | Head of Institution | Programme Coordinator NSS | Regional Director NSS | Vice Chancellor

SL.NO. 24003494

भारत सरकार
Government of India
युवा कार्यक्रम एवं खेल मंत्रालय
Ministry of Youth Affairs & Sports
राष्ट्रीय सेवा योजना
National Service Scheme

This is to certify that

Mr/Ms. SUDALAI KANNU M student of class III YEAR - B of BE CCE college SRI SAI RAM INSTITUTE OF TECHNOLOGY has rendered social service from 2023 to 2024 as NSS volunteer and attended NSS special camp from 27:04:24 to 03:05:24

Date | Head of Institution | Programme Coordinator NSS | Regional Director NSS | Vice Chancellor

APPENDIX III

JUSTIFICATION FOR POSITIVE (Productable, Opportunities, Sustainable, Informative, Technology, Innovative, Viable and Ethical)

S.No	PARAMETERS	JUSTIFICATION	RATING (1 to 5)
1.	Productable	Currently effective in testing but not yet market-ready	3
2.	Opportunities	Strong market potential and readiness for future adoption.	4
3.	Sustainable	In development with sustainability goals in mind.	3
4.	Informative	Provides basic insights, with full functionality under development.	3
5.	Technology	Advanced tech stack ready for market deployment with ongoing refinements.	4
6.	Innovative	Unique approach nearing completion, with room for further differentiation.	4
7.	Viable	Technically feasible, but scalability and real-time use still in progress.	3
8.	Ethical	Ethical principles are incorporated during development, with evaluation pending deployment.	3

Imagine the Future and

Make it happen!

1 NO POVERTY
2 ZERO HUNGER
3 GOOD HEALTH AND WELL-BEING
4 QUALITY EDUCATION
5 GENDER EQUALITY
6 CLEAN WATER AND SANITATION
7 AFFORDABLE AND CLEAN ENERGY
8 DECENT WORK AND ECONOMIC GROWTH
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE
10 REDUCED INEQUALITIES
11 SUSTAINABLE CITIES AND COMMUNITIES
12 RESPONSIBLE CONSUMPTION AND PRODUCTION
13 CLIMATE ACTION
14 LIFE BELOW WATER
15 LIFE ON LAND
16 PEACE, JUSTICE AND STRONG INSTITUTIONS
17 PARTNERSHIPS FOR THE GOALS

Sairam SDG ACTION PROGRAM

Together let's build a better world where there is NO POVERTY and ZERO HUNGER. We have GOOD HEALTH AND WELL BEING, QUALITY EDUCATION and full GENDER EQUALITY everywhere. There is CLEAN WATER AND SANITATION for everyone. AFFORDABLE AND CLEAN ENERGY which will help to create DECENT WORK AND ECONOMIC GROWTH. Our prosperity shall be fuelled by investments in INDUSTRY, INNOVATION AND INFRASTRUCTURE that will help us to REDUCE INEQUALITIES by all means. We will live in SUSTAINABLE CITIES AND COMMUNITIES. RESPONSIBLE CONSUMPTION AND PRODUCTION will help in healing our planet. CLIMATE ACTION will reduce global warming and we will have abundant, flourishing LIFE BELOW WATER, rich and diverse LIFE ON LAND. We will enjoy PEACE AND JUSTICE through STRONG INSTITUTIONS and will build long term PARTNERSHIPS FOR THE GOALS.

For the goals to be reached, everyone needs to do their part: governments, the private sector, civil society and **People like you.**

Together we can...

Chairman & CEO - Sairam Institutions