# HYBRID MODEL FOR LASSITUDE DETECTION SYSTEM IN DRIVERS USING DEEP LEARNING AND AUTOMATIC BRAKING SYSTEM AND LI-FI COMMUNICATION SYSTEM


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## INTRODUCTION

- Lassitude refers to a condition of low alertness and cognitive impairment. Exorbitant brain pursuit and stimulation can make a person feel cognitively worn out, and this feeling is analogous to physical fatigue.
- People may lose their attention due to lassitude, and this may cause severe injuries analogous to accident caused while driving vehicle.

## AIM

The aim of the project is Real time lassitude detection in drivers for giving better approach to reduce accidents with the use of deep learning and Li-Fi communication.

## PROJECT OBJECTIVES

**MODULE 1:**

1.1 Preprocessing the eye data acquired from MRL eye dataset for training and testing.

1.2 Training and performance analysis of the acquired data by using different CNN architecture (Vgg-16, inceptionV3, MobileNetV2).

**MODULE 2:**

Real time detection for capturing most relevant visual trait from the cropped Region Of Interest (ROI) using Haar- Cascade Classifier.

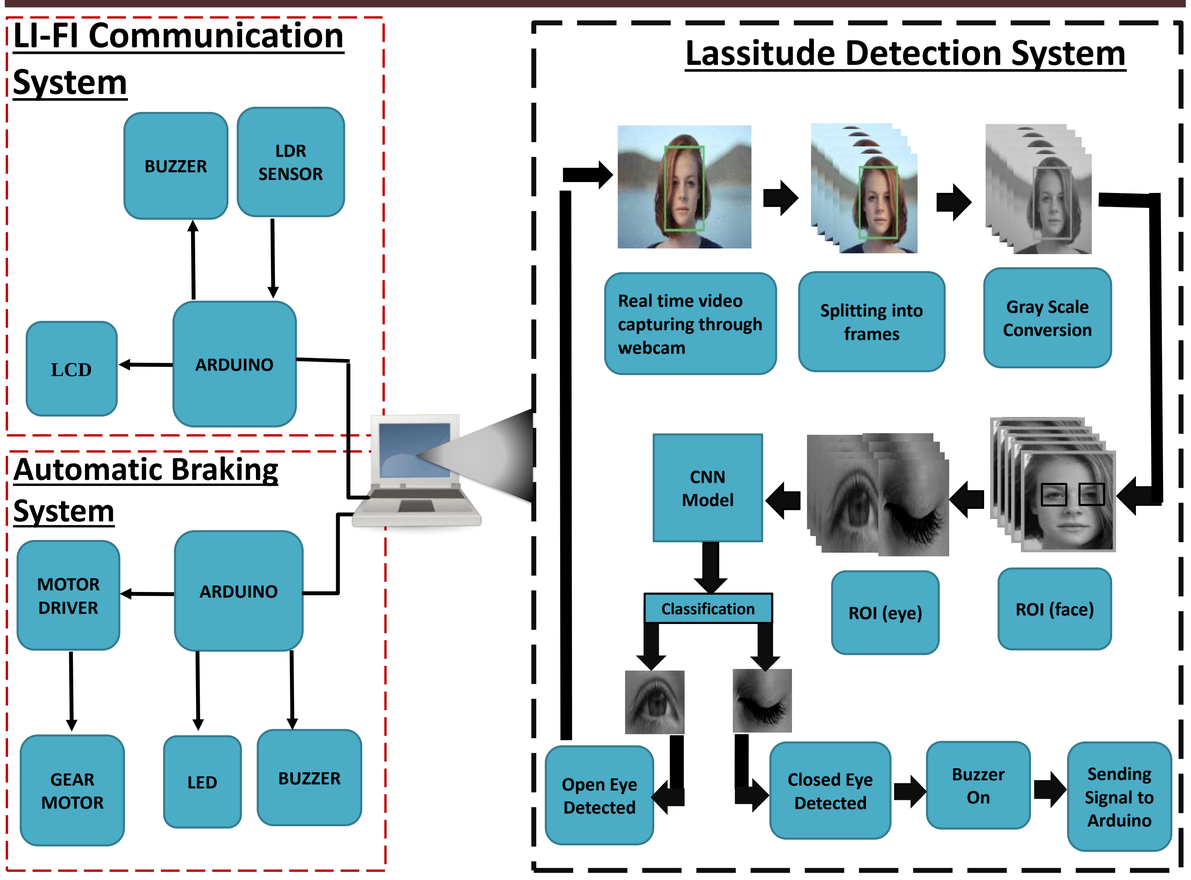
**MODULE 3:**

Implementation of hardware(vehicle) prototype with Automatic Braking System.

**MODULE 4:**

Developing transmitter receiver circuit on the front-end and back-end of vehicle prototype respectively for data transmission through LI-FI Communication System.

## BLOCK DIAGRAM




## COMPARISON OF CLASSIFIERS

| CNN CLASSIFIER | ACCURACY | LOSS |
|---|---|---|
| INCEPTION V3 | 95.12 | 12.09 |
| MOBILENETV2 | 91.89 | 18.23 |
| VGG-16 | 89.68 | 22.67 |

## REFERENCES


I. A. Altameem, A. Kumar, R. C. Poonia, S. Kumar and A. K. J. Saudagar, "Early Identification and Detection of Driver Drowsiness by Hybrid Machine Learning," *IEEE Access*, vol. 9, pp. 162805-162819,November 2021.

II. R. Tamanani, R. Muresan and A. Al-Dweik, "Estimation of Driver Vigilance Status Using Real-Time Facial Expression and Deep Learning," *IEEE Sensors Letters*, vol. 5, no. 5, pp. 1-4, May 2021.

III. P. Krishnan, "Design of Collision Detection System for Smart Car Using Li-Fi and Ultrasonic Sensor," *IEEE Transactions on Vehicular Technology*, vol. 67, no. 12, pp. 11420-11426, December 2018.


## PERFORMANCE ANALYSIS OF INCEPTION V3 ARCHITECTURE

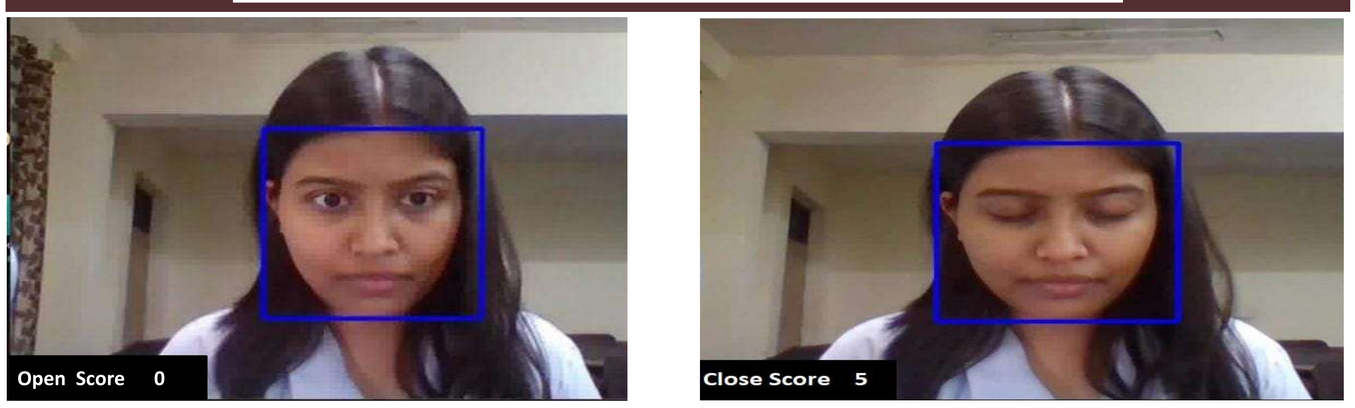

| | |
|---|---|
| Accuracy | 0.9512 |
| Loss | 0.1209 |
| Validation Loss | 0.1578 |
| Validation Accuracy | 0.9442 |

| | | |
|---|---|---|
| ACCURACY | $\frac{(TP+TN)}{(FP+FN+TP+TN)}$ | Where,<br>TP= TRUE POSITIVE<br>TN= TRUE NEGATIVE<br>FP= FALSE POSITIVE<br>FN= FALSE NEGATIVE |
| LOSS | $\sum_{k=1}^{n} (U - \hat{U})$ | Where,<br>U = ACTUAL VALUE<br>Û = PREDICTED VALUE<br>k = BATCH SIZE |

## MODEL CHECKPOINTS

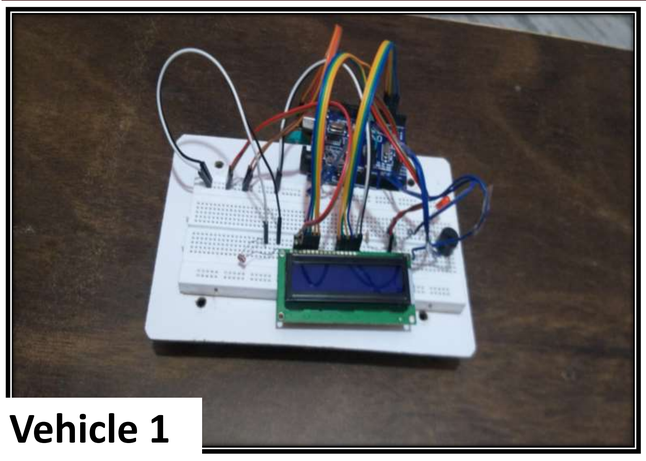
| | |
|---|---|
| checkpoint | monitor='val_loss', save_best_only=True verbose=3 |
| earlystop | monitor = 'val_loss', patience=7, verbose = 3, restore_best_weights=True |
| learning_rate | monitor = 'val_loss', patience=3,verbose=3 |
| callbacks | checkpoint, early stop, learning rate |
| epoch | 20 (randomly chosen) |

## SOFTWARE IMPLEMENTATION

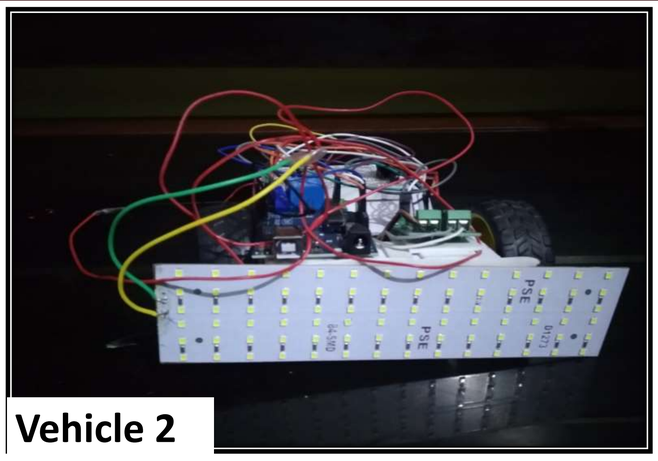



- Score will increase to 25 and buzzer will beep.

## HARDWARE IMPLEMENTATION



Vehicle 1



Vehicle 2

## CONCLUSION

- The proposed system is used to avoid various road accidents caused by lassitude.
- Using CNN architecture with transfer learning gave higher accuracy of 95.12.
- This model achieves highly accurate and reliable detection of lassitude and also preventing the accident by applying automatic brakes and sending warning signal to vehicle behind it.