



A Project Synopsis

On

**“LANE FOLLOWING MOBILE ROBOT”**

Submitted in partial fulfillment of the requirement of

University of Mumbai for the Degree of

**Bachelor of Engineering**

In

**Electronics Engineering Department**

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# CERTIFICATE

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## **ABSTRACT**

*Lane Following is one of the most important aspects of robotics. A Lane Following Mobile Robot is an autonomous robot which is able to follow a lane that is drawn on the surface consisting of a contrasting color. It is designed to move automatically and follow the lane. The robot uses Raspberry Pi Camera to identify the lane and thus assisting the robot to stay on the track. The robot is driven by DC gear motors to control the movement of the wheels. The Arduino Uno interface is used to perform and implement algorithms to control the speed of the motors and to control steering of the robot to travel along the lane. This project aims to implement the algorithm and control the movement of the robot by proper control parameters and thus achieving better performance. We will be applying a learned perspective transformation in addition to the fixed “birds-eye view” transformation. This ensures robust lane fitting even if the road plane changes. It can be used industrial automated equipment carriers, small household applications, tour guides in museums.*

**Keywords:** *Raspberry Pi, Arduino Uno, Image Processing.*

# **1. Introduction**

This project Lane Following Mobile Robot uses camera sensors and modules to determine the lane and follow the path. Lane following robot is a machine that can follow a path. The path can be visible like a white line on a surface. Detecting the lane and maneuvering the robot to stay on course, while constantly correcting wrong moves forms a simple yet effective system. Camera- based lane detection is what is used to detect the lanes and position the robot in between the lanes properly and prevent the lane departure.

## **1.1 Background**

In the industries, carriers are required to carry products from one point to another point which are usually in separate buildings or blocks. Conventionally, carts or trucks were used with human drivers. Unreliability and inefficiency in this part of the assembly line formed the weakest link. This project is to automate this sector, using carts to follow a lane instead of team of workers.

## **1.2 Motivation**

How ants always travel in a line, following an invisible route in search of food, or back home. Ever thought about a robot which follows lane? The purpose of this project is to recreate in terms of machines what one see around to solve a problem or fulfill a requirement.

The area will be benefitted from the project:

- Industrial automated equipment carriers.
- Entertainment and small household applications.
- Tour guides in museums and other similar applications.

## **2. The Problem Definition**

### **2.1 Problem Statement**

The task is to build an autonomous car that can basically control or change the course of direction without any human input. One of the use cases are in industries where certain goods are being placed in from one area to another and using this system we can properly reduce manpower and time delay.

In the industries, carriers are required to carry products from one point to another point which are usually in separate buildings or blocks. Conventionally, carts or trucks were used with human drivers. Unreliability and inefficiency in this part of the assembly line formed the weakest link. Our task is to build an autonomous car that can basically control or change the course of direction without any human input and using this system, we can properly reduce manpower and time delay.



### 3. Literature Survey

SN	Paper	Advantages and Disadvantages
1.	Yeongcheol Cho Published: <b>2017</b>	Advantages: <ul style="list-style-type: none"><li>• It has reduced computation complexity.</li><li>• Gaussian filter is applied for removing the noise in image data.</li></ul> Limitations: <ul style="list-style-type: none"><li>• Cost increases because there is the use of 2 sensors.</li></ul>
2.	Jiyoung Jung ID and Sung-Ho Bae Published: <b>2018</b>	Advantages: <ul style="list-style-type: none"><li>• Using 3D Lidar point cloud, we categorized the points of the drivable region and distinguished the points of the road signs on the ground.</li></ul> Limitations: <ul style="list-style-type: none"><li>• Roads with drastic slopes and severe curvatures in mountainous areas could be challenging.</li></ul>
3.	Jong-Ho Han and Hyun-Woo Kim Published: <b>2021</b>	Advantages: <ul style="list-style-type: none"><li>• Ensures safe driving under unfavorable road conditions such as fog.</li></ul> Limitations: <ul style="list-style-type: none"><li>• It is difficult to detect the road lines beneath the parked cars on the side.</li></ul>

## **4. Proposed System**

### **4.1 Overview**

First the image is captured using raspberry pi camera. Every image that is being processed in in BGR format and for open cv to work, the image is then converted in RGB format. With this RGB format, region of interest is processed.

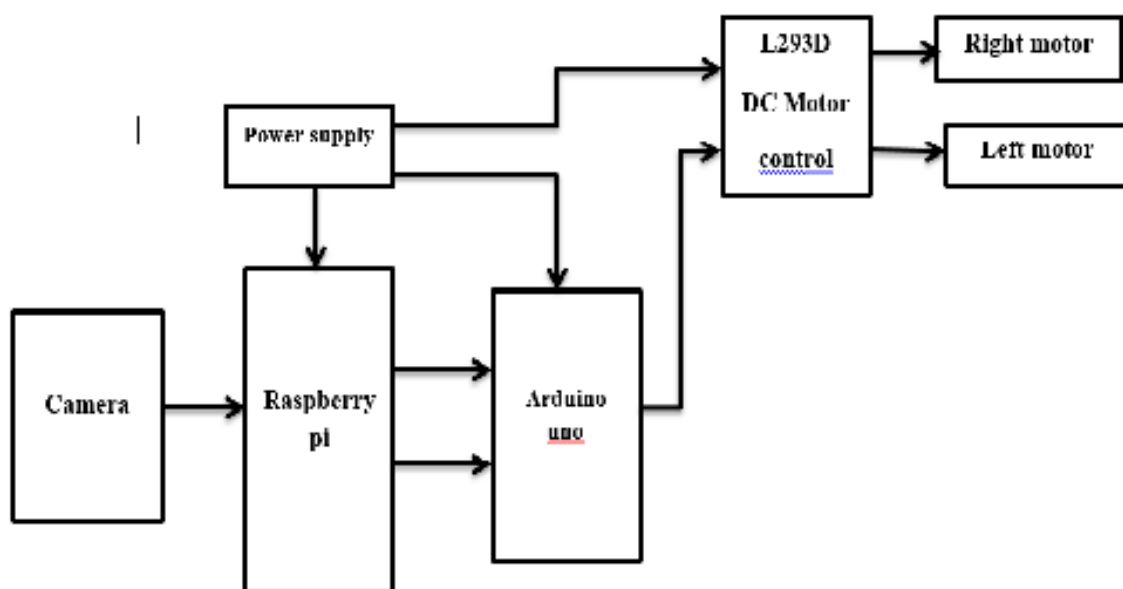
Using region of interest, a perspective view is determined. The frame is then converted to grayscale image for detecting the edges and processing the two lines in the lane. Finally using the center of width of frame, the car follows with respective to the center and lines of frame.

## 5. Methodology

### 5.1 System Design

The basic operation of lane follower are:

- Camera is mounted in the front of the robot to capture the lane image. This will detect the lane by finding lane marks.
- Raspberry pi is the master device of our system and Arduino is slave device. Arduino is used to perform and implement the control the speed of the motor and to control steering of the robot so that it can travel along the lane.



### 5.2 System Component Selection

#### HARDWARE REQUIREMENTS:

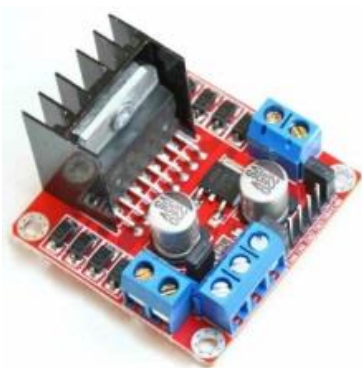
1. **Raspberry pi**: raspberry pi is small computer that easily connect to interface with lot os hardware and it is support multiple languages.



2. **Arduino UNO:** Our project is power intensive, then you need a slave device to reduce an overhead from your main controller. So that's why we use Arduino UNO as slave device so that you can establish a communication link between main microcontroller and slave device. According to the image processing done using raspberry pi, the data is sent to Arduino and which would in turn control the motor driver to move in a particular direction. For eg: using left () method would be executed to turn the vehicle in left direction.



3. **DC Motors drive:** used for control the motor.

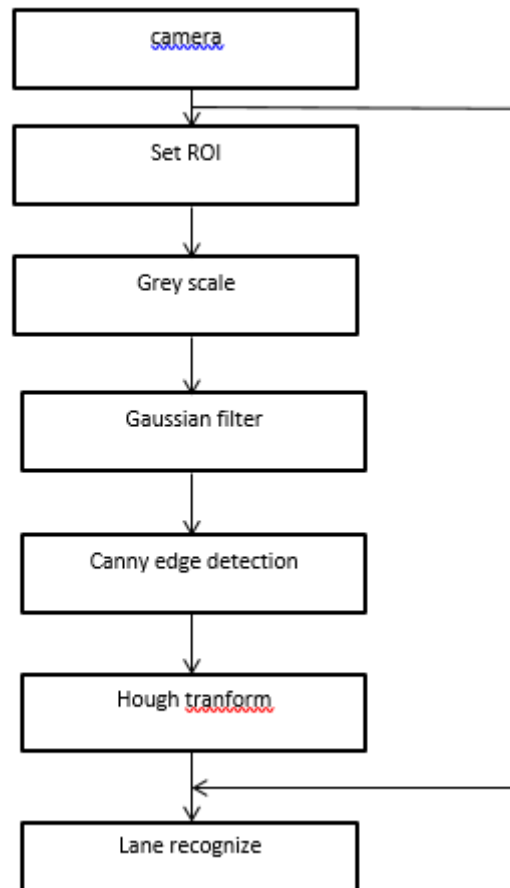


4. **Mono camera:** used for capturing images.



**SOFTWARES USED: C++.**

### 5.3 Implementation



Lane recognize [1]

## **6 Applications**

- i. Industrial automated equipment carriers.
- ii. Entertainment and small household applications.
- iii. Tour guides in museums and other similar applications.

## **7 Conclusion**

This paper proposed a very cost-efficient autonomous robot where we used Perspective Transformation and Canny Edge Detection Algorithms to detect lane. The position information was fed from the Raspberry Pi to Arduino, which controlled the motors speed and turns.

## **SUMMARY**

The system is completed in to the three division i.e is the Input system, Processing System and Output system. Input system is camera. It captures the surrounding images, to determine lane and obstacles on the lane. Processing system is done by raspberry pi and Arduino Uno. Raspberry pi instructs Arduino Uno to control the moment of the robot. Arduino Uno interface consisting microcontroller Atmega328P which works on the basic of the logic of the program burn to it. Output system consist combination of L298 Motor Driver and DC gear-motors.

## LITERATURE CITED

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Author: Yeongcheol Cho  
Published: 2017
2. *Real-Time Road Lane Detection in Urban Areas Using LiDAR Data*  
Author: Jiyoung Jung ID and Sung-Ho Bae  
Published: 2018
3. *Lane Detection Algorithm Using LRF for Autonomous Navigation of Mobile Robot*  
Author: Jong-Ho Han and Hyun-Woo Kim  
Published: 2021



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*Author: Mr. Nihal A Shetty*  
*Published: 2019*
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