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A MAJOR PROJECT PROPOSAL ON

AUTOMATED DRIVING LICENSE TEST

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Submitted to:

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ABSTRACT

During a driving test, the authorities have to be present and monitor every candidate individually and mark them which is time and human resource intensive. In our system, the monitoring is done by using Raspberry Pi and Open Cv through line detection, object detection and color detection.By using image processing, the aim is to automate this process for quicker and more reliable distribution of driving license and lower the human error probabilities.

Keywords *– Driving test automation,object detection, image processing*

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CHAPTER 1
INTRODUCTION

1.1 Background

Nowadays getting a driving license is an important thing in every adult's life. The transport management office issues the license to a trainee provided the trainee passes the prescribed test. These tests should challenge the capability of the trainee in every way possible. The aspirant must be perfect and confident in driving. In the end, the trainee has to earn the license. Road safety is an issue of national concern as it impacts on the economy, public health and general welfare of the people. More than 85 percent of traffic is carried out by road transport because of easy availability of roads, adaptability to individual needs and cost savings. The survey conducted by International Finance Corporation implies that most of the road accidents are happening because of improper knowledge about how to drive the vehicle. The other survey conducted shows that 54 percent of the license holders do not have the proper knowledge of driving the vehicle.

We are presenting an automated driving license test capable of testing the knowledge and mental awareness of the person while driving a vehicle so as to improve the standard of license issuing mechanism in order to improve road safety in a country. This automated system is done by interfacing raspberry pi and open cv with other sensors ,these sensors are kept on the test track to identify the errors of the candidate while he is taking the test. Arduino UNO microcontroller reads the data collected by sensors, processes them and send the result information to the candidate and authorities of transport management office.

1.2 Problem Definition

Driving has become an essential part of the modern lifestyle but the process of obtaining a driving license has been the same for decades. The current process is very time and human resource consuming as more than a dozen people are engaged full-time for this purpose and also involves a level of imperfection due to human error and judgment.

1.3 Objectives

The primary objectives of this projects are as follows:

1. To automate driving test using image processing
2. To reduce human errors during the driving test procedure
3. To reduce corruption during the driving test procedure

1.4 Project Features

The project will be able to accomplish following:

- Remote monitoring
- Driving test automation
- object detection
- Line detection

1.5 Project Application

- Monitoring system driving license test center
- As a training platform

1.6 System Requirement

1.6.1 Software Requirements

The software requirements are as follows:

1. Windows/Linux/Mac
2. Rasbian OS
3. Arduino IDE

1.6.2 Hardware Requirements

The hardware requirements are as follows:

1. Raspberry Pi
2. Pi camera/USB camera
3. Arduino Nano
4. DC motor
5. Motor mount
6. Wheel
7. Motor Driver
8. Bluetooth module
9. Wire

1.7 Project Feasibility

The feasibility analysis of the system has been done from various aspects such as technical, operational and economical viewpoint.

The present technology is sufficient to meet the requirements of the system, the required algorithm exists and the device to input the data to the system is also present. The system is believed to work well when developed and installed. The requirements for the project have been accounted for and the system is built on available resources to meet the requirements. The detailed feasibility study is as follows

1.7.1 Technical Feasibility

Our project satisfies technical feasibility needs. The existing network protocols and operating system services of various operating systems would allow for feasible implementation of this application. As this service satisfies technological hardware and software capabilities of present day available personal devices, the proposed project was decided to be technically feasible.

1.7.2 Operational Feasibility

The operation of the system requires only a modern computer, the user interface will be simple and intuitive. The solution proposed for the project is operationally workable

and user-friendly to end users.

1.7.3 Economic Feasibility

Economic feasibility analysis is the most commonly used method for determining the efficiency of a project. It is also known as cost analysis. It helps in identifying profit against investment expected from a project. Cost and time are the most essential factors involved in this field of study. Developed system is economically feasible. It can be developed on a simple PC which can be available at an affordable cost. System is built on open-source language, so development is free of cost. All the references and resources are freely available on the internet. So, we can say that the developed system is economically feasible.

CHAPTER 2
LITERATURE REVIEW

2.1 Previous Works

In the last few years with the rise in affordable compute power and abundance of data various machine learning algorithms are being used to solve problems in everyday life which previously were thought to be immensely difficult in the field of computer science.

Computer vision is an interdisciplinary scientific field that deals with how computers can gain high-level understanding from digital images or videos. Computer vision tasks include methods for acquiring, processing, analyzing and understanding digital images, and extraction of high-dimensional data from the real world in order to produce numerical or symbolic information.

The task of automating driving license test can be accomplished in two different ways. A hardware based driving license test by interfacing Arduino UNO board with number of sensors can be implement at low cost. This automated system is done by interfacing Arduino UNO board with number of sensors, these sensors are kept on the test track to identify the errors of the candidate while he is taking the test. Arduino UNO microcontroller reads the data collected by sensors, processes them and send the result information to the candidate and authorities of Regional Transport Office (RTO) whether he/she is passed or failed to get a driving license.[1] Main drawback of using a hardware based automation system is the need to align sensor every time a tester fails the test by colliding with the sensor.

The problems of hardware implementation can be solved by implementing a software based testing system. Pole mounted camera along the entire length of test track can be deployed to determine the position of vehicle. A smartphone mounted on the front windscreen can be deployed to use its camera and sensors to determine the position of vehicle. HAMS, in its general incarnation, uses the smartphone's front and rear cameras, and other sensors, to monitor the driver (for instance, their gaze) and the road scene in front (for instance, the distance to the vehicle in front), simultaneously. It employs advanced Artificial Intelligence (AI) models, which the team has developed for

efficient and robust operation.[2]

2.2 Related Theory

2.2.1 Artificial Neural Network(ANN)

Artificial neural networks (ANN) are computing systems vaguely inspired by the biological neural networks that constitute animal brains. Such systems ”learn” to perform tasks by considering examples, generally without being programmed with task-specific rules.[3]

Neurons

ANNs are composed of artificial neurons which retain the biological concept of neurons, which receive input, combine the input with their internal state (activation) and an optional threshold using an activation function, and produce output using an output function. The important characteristic of the activation function is that it provides a smooth transition as input values change, i.e., a small change in input produces a small change in output.[4]

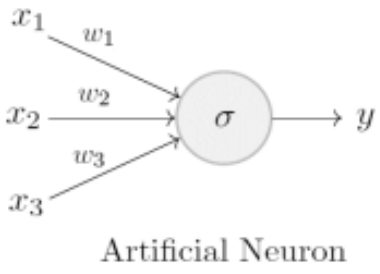

Figure 2.1: Artificial Neuron

The network consists of connections, each connection providing the output of one neuron as an input to another neuron. Each connection is assigned a weight that represents its relative importance. A given neuron can have multiple input and output connections. The neurons are typically organized into multiple layers, especially in deep learning.

Neurons of one layer connect only to neurons of the immediately preceding and immediately following layers. The layer that receives external data is the input layer. The layer that produces the ultimate result is the output layer. In between them are zero or more hidden layers.

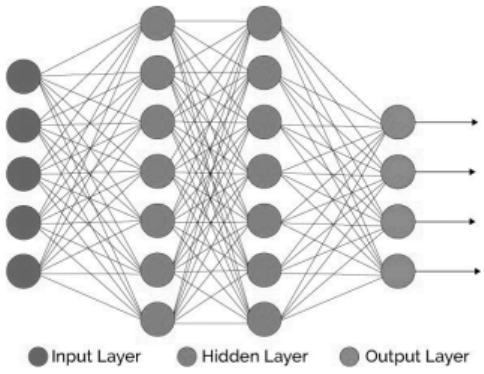

Figure 2.2: Structure of Neural Network

2.2.2 Convolutional Neural Network(CNN)

CNN is a kind of neural network, its weight sharing network structure makes it more similar to the biological neural network, reduces the complexity of the network model and the number of weights [5].CNNs were inspired by biological processes. The name "convolutional neural network" indicates that the network employs a mathematical operation called convolution. Convolution is a specialized kind of linear operation. They use convolution in place of general matrix multiplication in at least one of their layers.

Design

A convolutional neural network consists of an input and an output layer, as well as multiple hidden layers. The hidden layers of a CNN typically consist of a series of convolutional layers that convolve with a multiplication or other dot product.

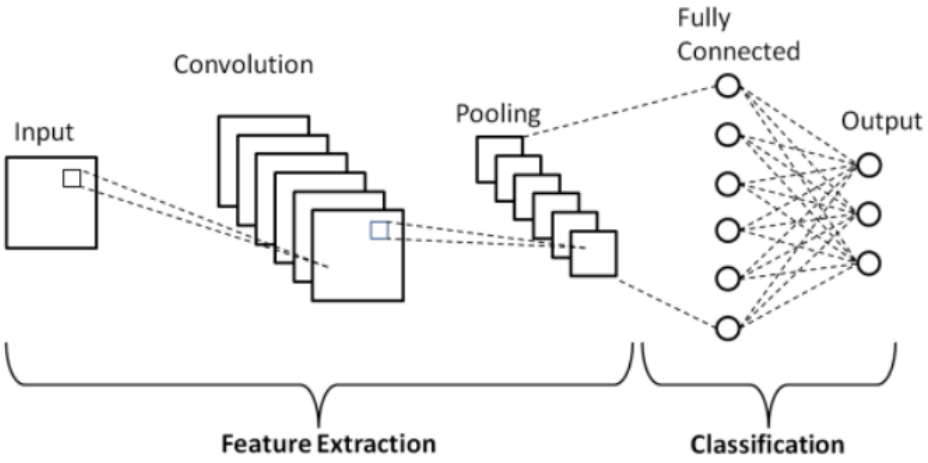

Figure 2.3: Basic schematic of Convolutional Neural Network(CNN)

A CNN typically has three layers:

- Convolutional layer:This layer performs a dot product between two matrices, where one matrix is the set of learnable parameters otherwise known as a kernel, and the other matrix is the restricted portion of the receptive field. The kernel is spatially smaller than an image but is more in-depth. This means that, if the image is composed of three (RGB) channels, the kernel height and width will be spatially small, but the depth extends up to all three channels.During the forward pass, the kernel slides across the height and width of the image-producing the image representation of that receptive region. This produces a two-dimensional representation of the image known as an activation map that gives the response of the kernel at each spatial position of the image. The sliding size of the kernel is called a stride.

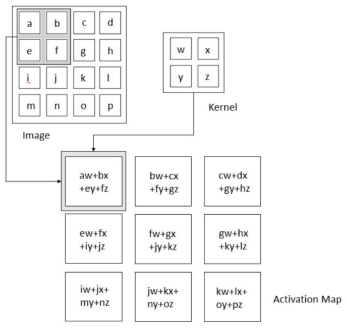

Figure 2.4: Activation Map

- Pooling layer: The pooling layer replaces the output of the network at certain locations by deriving a summary statistic of the nearby outputs. This helps in reducing the spatial size of the representation, which decreases the required amount of computation and weights. The pooling operation is processed on every slice of the representation individually.

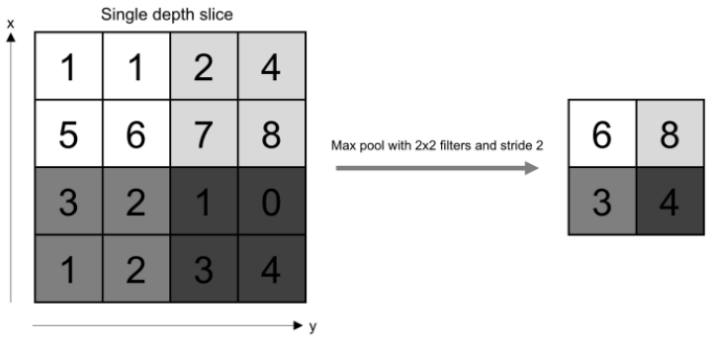

Figure 2.5: Pooling Operation

- Fully connected layer: Neurons in this layer have full connectivity with all neurons in the preceding and succeeding layer as seen in regular Forward Convolutional Neural Network(FCNN). This is why it can be computed as usual by a matrix multiplication followed by a bias effect.

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CHAPTER 3
METHODOLOGY

Automatic driving license consists of two parts. Object detection and lane detection. Object detection will be used to determine the position of vehicle and the position obtained will be compared with lane. If the position of vehicle is determined to be touching the lane then test will be automatically stopped prompting a message.

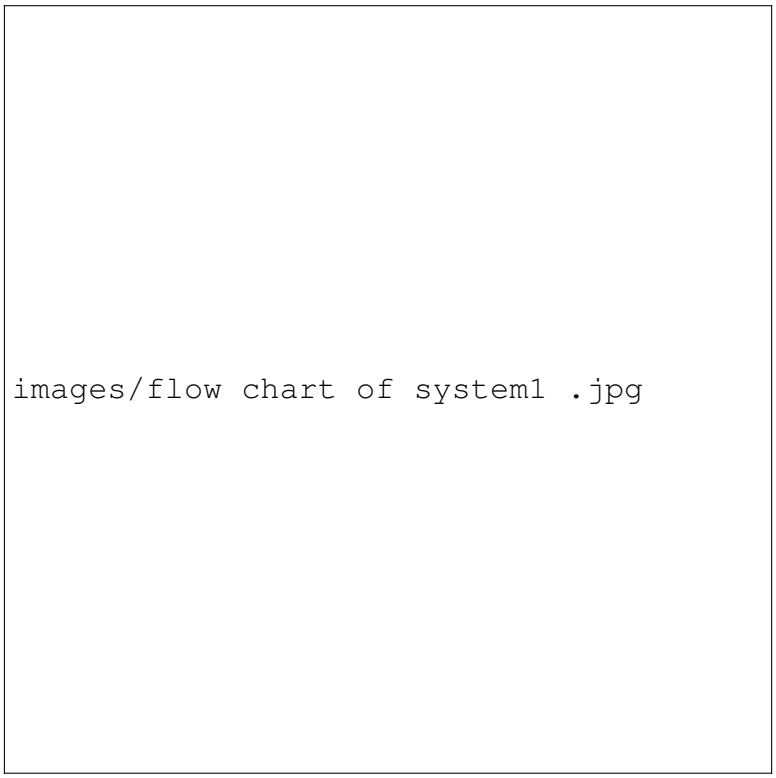

Figure 3.1: Flow chart of System

3.1 Object Detection

The Object Detection part focuses on detecting the car body precisely using You Only Look Once(YOLO) algorithm.

You Only Look Once(YOLO) algorithm works using the following three techniques:

- Residual blocks:First, the image is divided into various grids. Each grid has a dimension of S x S.Every grid cell will detect objects that appear within them.

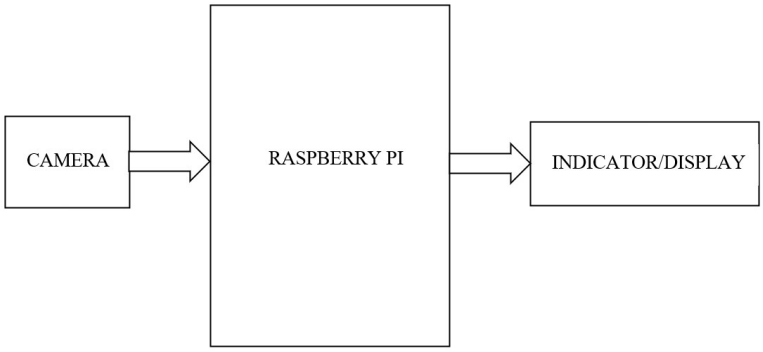

Figure 3.2: Block Diagram of System

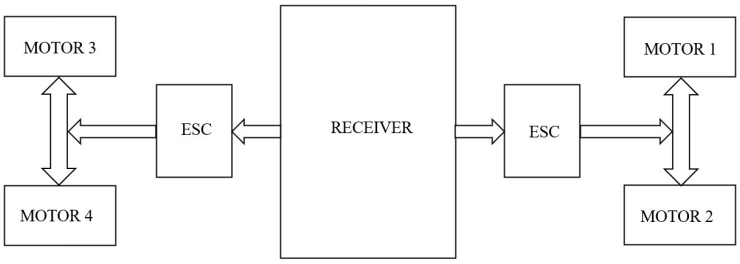

Figure 3.3: Block Diagram of Car

- Bounding box regression: A bounding box is an outline that highlights an object in an image.Every bounding box in the image consists of the attributes, width (bw), height (bh), class, bounding box center (bx,by).
- Intersection Over Union (IOU):Intersection over union (IOU) is a phenomenon in object detection that describes how boxes overlap. YOLO uses IOU to provide an output box that surrounds the objects perfectly.

3.2 Lane Detection

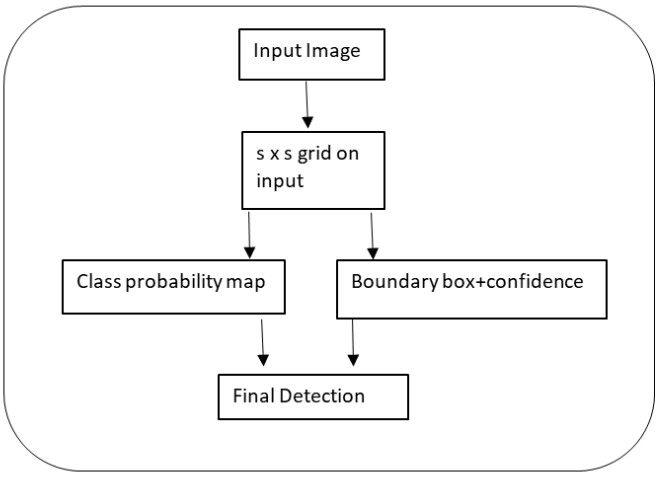

Figure 3.4: Object detection using YOLO

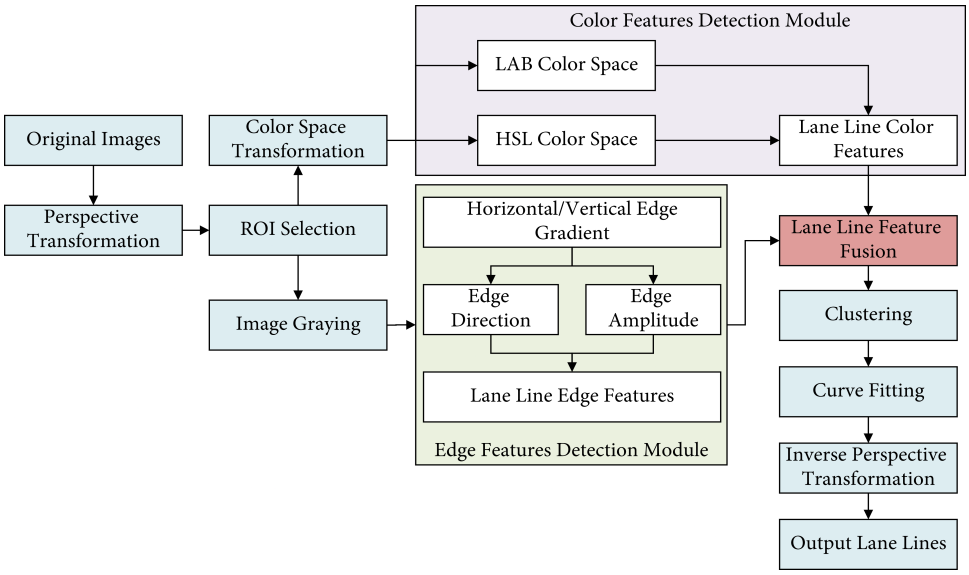

Figure 3.5: Lane Detection using feature selection

CHAPTER 4
EPILOGUE

4.1 Expected Output

The finalized project is expected to detect if a driver fails or passes the driving license exam.

4.2 Work Scheduled

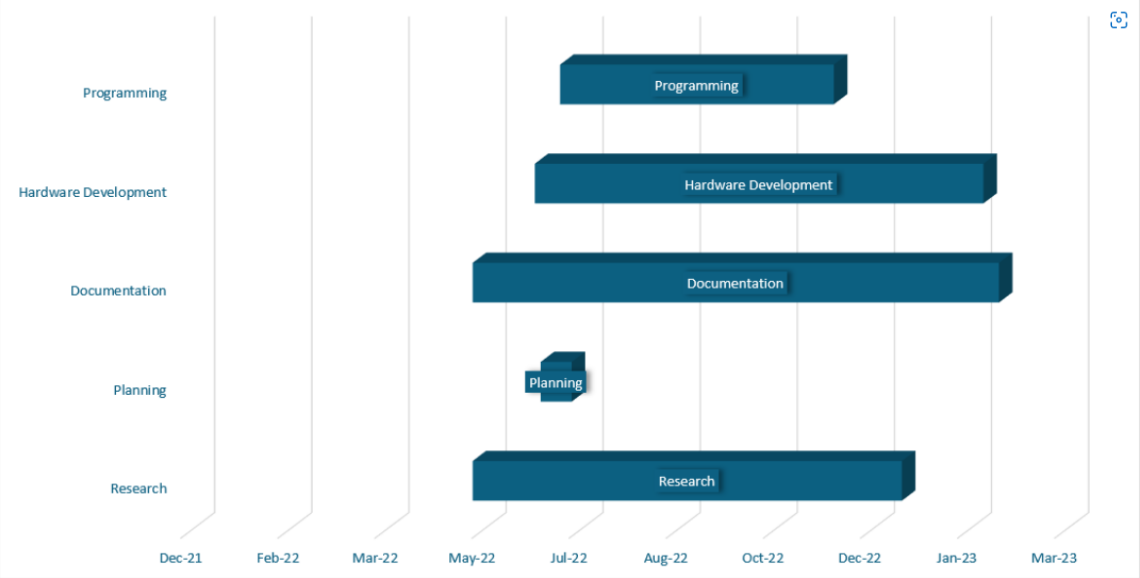

Figure 4.1: Gantt Chart

4.3 Cost Estimation

Items	No. of Item	Unit Price(Rs)	Total Price(Rs.)
Raspberry Pi 4	2	4,500/-	9,000/-
200 rpm metal gear dc motor	4	1000/-	4000/-
Arduino Nano	1	800/-	800/-
Motor Driver Module	2	1000/-	2000/-
RTC module	1	200/-	200/-
Pi camera/ USB camera	2	1500/-	3000/-
Bluetooth Module	1	800/-	800/-
Total			21,000/-

Table 4.1: Cost Estimation

REFERENCES