REVA UNIVERSITY
Bengaluru, India

SCHOOL OF ELECTRICAL AND ELECTRONICS ENGINEERING

A PROJECT REPORT
ON

"ROBO ASSISTANT WITH ARTIFICIAL INTELLIGENCE FOR UNIVERSITY APPLICATION"

Submitted in fulfillment of the requirements for the award of the Degree of

Bachelor of Technology
In
Electrical and Electronics Engineering

Submitted by

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DECLARATION

We, **Mr. Abhishek G Hatti(R16EE004), Mr. Abhishek N(R16EE005), Mr. Basavaraj A Sonnad(R16EE025), Mr. Harsha(R16EE061)** students of B. Tech, belongs to School of Electrical and Electronics Engineering, REVA University, declare that this Project Report entitled **"ROBO ASSISTANT WITH ARTIFICIAL INTELLIGENCE FOR UNIVERSITY APPLICATION"** is the result the of project work done by me under the supervision of **Prof. Raghu C N** School of Electrical and Electronics Engineering.

We are submitting this Project Report in partial fulfillment of the requirements for the award of the degree of Bachelor of Technology in Electrical and Electronics Engineering by the REVA University, Bengaluru during the academic year 2019-2020.

We declare that this project report has been tested for plagiarism, and has passed the plagiarism test with the similarity score less than 25% and it satisfies the academic requirements in respect of Project work prescribed for the said Degree.

We further declare that this project report or any part of it has not been submitted for award of any other Degree / Diploma of this University or any other University/ Institution.

(Signature of the Students)

Certified that this project work submitted by Abhishek G Hatti, Abhishek N, Basavaraj A Sonnad, Harsha has been carried out under my / our guidance and the declaration made by the candidate is true to the best of my knowledge.

Signature of Guide

Date ……..

Signature of Director

Date ……..

Official Seal of the School

SCHOOL OF ELECTRICAL AND ELECTRONICS ENGINEERING

CERTIFICATE

Certified that the project work entitled **"ROBO ASSISTANT WITH ARTIFICIAL INTELLIGENCE FOR UNIVERSITY APPLICATION"** carried out under my / our guidance by **ABHISHEK G HATTI(R16EE004), ABHISHEK N(R16EE005), BASAVARAJ A SONNAD(R16EE025), HARSHA(R16EE061)** are bonafide students of REVA University during the academic year 2019-20, are submitting the project report in partial fulfillment for the award of **Bachelor of Technology in Electrical and Electronics Engineering** during the academic year **2019–20**. The project report has been tested for plagiarism, and has passed the plagiarism test with the similarity score less than 25%. The project report has been approved as it satisfies the academic requirements in respect of Project work prescribed for the said Degree.

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1.

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ABSTRACT

The main aim of this project is to reduce human work on silly tasks and promote automation, the robot is wholly based on vision, unlike other automatic moving robots, it uses its main camera for movement, obstacle detection and corner detection. This is possible by analysing the camera data that is pixel data for the path detection, the lanes are identified using the image library of python that is OpenCV. The Robot also operates on tensor flow data and the precision in mobility is achieved using stepper motor. It is designed to take the tasks that require more time and man power off your hands. It is also really cool, and go a long way in making the academy smarter and on the cutting edge of technology.

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INTRODUCTION

1.1 History

The history of automation, despite a few bumps along the way, has seen a lot of success in a short period of time. It continues to grow and evolve today, providing us with more innovative solutions, interactive AI, and assistance in unravelling the secrets of the universe. It's impossible to know if Karel Capek and all the science fiction writers after him were right about a future robot rebellion. What's clear is that the future looks to be automated. As exciting as current and future tech is, we shouldn't forget the history of automation or the work that it has taken to get us where we are today. Over time, we've grown reliant on automated technology. It's found in almost every part of our lives, from automatic doors, to factory line robots, to business process automation. Nowadays, artificial intelligence is the talk of the town, and the dreaded robot takeover seems to be looming ever closer. We have chatbots handling customer service, AI in our back pockets, and increasingly 'smart' homes.

Our main intension in this project is to reduce the human effort for communication and make the student-department interaction automated. We will build a robot that can monitor and interact with the students based on the requirements of the university. The purpose behind the initiation of this project is to make the tasks of the department/university automated. Needs like Mass event registrations, Promotion of university brand, Student surveillance data etc., will be addressed once the robot has been implemented successfully.

1.2 Project overview

This overview tells the story of an ambitious, student led, robot initiative to plan, design and build a robot with artificial intelligence at REVA University in Bangalore. This project is a first of its kind in the university and was conceived, planned and progressed by 4th year students. The main motto behind this project is to build a robot helps you with day to day tasks of the university like monitoring the discipline and activities of the students, announcements regarding the university events- Circulars, Event registration etc. The robot can be used to promote the university brand through advertising.

CHAPTER 2

LITERATURE SURVEY

2.1 Introduction

As artificial intelligence (AI) and robots are increasingly taking place in practical service solutions, it is necessary to understand technology in value co-creation.

Technology has become an integral part of our lives. Smartphones wake us up and automatic toasters prepare our breakfast. Increasingly, the machines that we employ mimic cognitive functions of humans and can be programmed to carry out a complex set of actions automatically (robots). By accessing one's calendar, analysis of sleep and learning from prior morning routines, technology knows when it is a good time for technology to start preparing breakfast. As service functions based on AI and robots become more common in markets and everyday lives, they are likely to change the way value is co-created and experienced.

2.2 Literature Review

Hanson Robotics' most advanced human-like robot, Sophia, personifies our dreams for the future of AI. As a unique combination of science, engineering, and artistry, Sophia is simultaneously a human-crafted science fiction character depicting the future of AI and robotics, and a platform for advanced robotics and AI research.

Pepper is a semi-humanoid robot manufactured by SoftBank Robotics (formerly Aldebaran Robotics), designed with the ability to read emotions. It was introduced in a conference on 5 June 2014, and was showcased in Softbank mobile phone stores in Japan beginning the next day. Pepper's ability to detect emotion comes from the ability to analyze expressions and voice tones.

ASIMO is a bipedal humanoid robot Honda has been developing with a goal to develop robots that will coexist with and be useful to people since its first introduction in 2000. In 2011, the latest version was introduced with world's first autonomous behavior control technology.

Honda has developed a new system that is a fundamental technology for advanced intelligence, which comprehensively evaluates inputs from multiple sensors that are equivalent to the visual, auditory, and tactile senses of a human being, then estimates the situation of the surrounding environment and determines the corresponding behavior of the robot.

ASIMO became capable of responding to the movement of people and the surrounding situations. For instance, ASIMO will stop its current action and change its behavior to accommodate the intention of the other party.

CHAPTER 3

PROPOSED WORK

3.1 Introduction to Artificial Intelligence

In computer science, **Artificial Intelligence** (**AI**), sometimes called **Machine Intelligence**, is intelligence demonstrated by machines, in contrast to the **Natural Intelligence** displayed by humans. Leading AI textbooks define the field as the study of "intelligent agents": any device that perceives its environment and takes actions that maximize its chance of successfully achieving its goals. Colloquially, the term "artificial intelligence" is often used to describe machines (or computers) that mimic "cognitive" functions that humans associate with the human mind, such as "learning" and "problem solving".

Computer science defines AI research as the study of "intelligent agents": any device that perceives its environment and takes actions that maximize its chance of successfully achieving its goals. A more elaborate definition characterizes AI as “a system’s ability to correctly interpret external data, to learn from such data, and to use those learnings to achieve specific goals and tasks through flexible adaptation.”

In the twenty-first century, AI techniques have experienced a resurgence following concurrent advances in computer power, large amounts of data, and theoretical understanding; and AI techniques have become an essential part of the technology industry, helping to solve many challenging problems in computer science, software engineering and operations research.

Why AI?

AI would have a low error rate compared to humans, if coded properly. They would have incredible precision, accuracy, and speed. They won't be affected by hostile environments, thus able to complete dangerous tasks, explore in space, and endure problems that would injure or kill us. This can even mean mining and digging fuels that would otherwise be hostile for humans. Replace humans in repetitive, tedious tasks and in many laborious places of work. Predict what a user will type, ask, search, and do. They can easily act as assistants and recommend or direct various actions. An example of this can be found in the smartphone. Can detect fraud in card-based systems, and possibly other systems in the future. Organized and manages records. Interact with humans for entertainment or a task as avatars or robots. An example of this is AI for playing many videogames. Robotic pets can interact with humans. Can help w/ depression and inactivity. Can fulfill sexual pleasure. They can think logically without emotions, making rational decisions with less or no mistakes. Can assess people. This can be for medical purposes, such as health risks and emotional state. Can simulate medical procedures and give info on side effects. Robotic radiosurgery, and other types of surgery in the future, can achieve precision that humans can't. They don't need to sleep, rest, take breaks, or get entertained, as they don't get bored or tired.

3.2 Introduction to Machine Learning

Explained

Machine learning is the practice of helping software perform a task without explicit programming or rules. With traditional computer programming, a programmer specifies rules that the computer should use. ML requires a different mindset, though. Real-world ML focuses far more on data analysis than coding. Programmers provide a set of examples and the computer learns patterns from the data. You can think of machine learning as "programming with data".

Steps to solving an ML problem

Figure No: 3.2.1 – Steps to solve ML (*Source: https://www.tensorflow.org/)

Anatomy of a neural network

A neural network is a type of model that can be trained to recognize patterns. It is composed of layers, including input and output layers, and at least one hidden layer. Neurons in each layer learn increasingly abstract representations of the data. For example, in this visual diagram we see neurons detecting lines, shapes, and textures. These representations (or learned features) make it possible to classify the data.

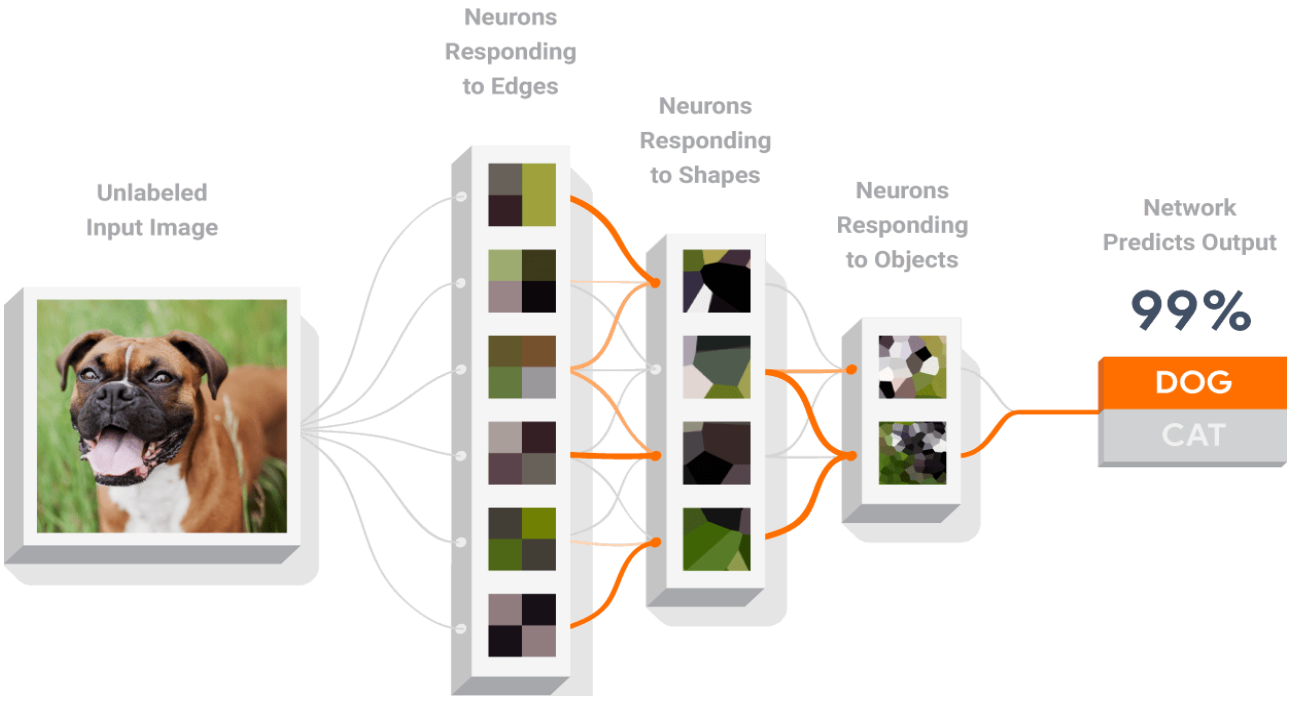


Figure No: 3.2.2 – Anatomy of Neural Network (*Source: https://www.tensorflow.org/)

Training a neural network

Neural networks are trained by gradient descent. The weights in each layer begin with random values, and these are iteratively improved over time to make the network more accurate. A loss function is used to quantify how inaccurate the network is, and a procedure called backpropagation is used to determine whether each weight should be increased, or decreased, to reduce the loss.

Figure No: 3.2.3 – Training of Neural network (*Source: https://www.tensorflow.org/)

3.3 Robot Design

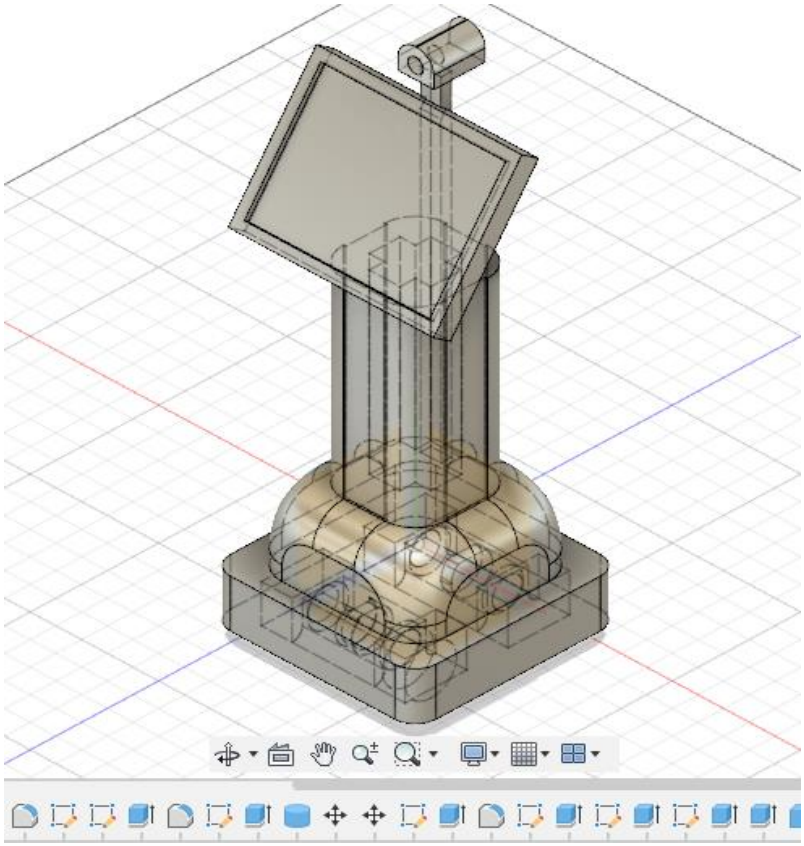


Figure 3.3.1- Complete view of the robot

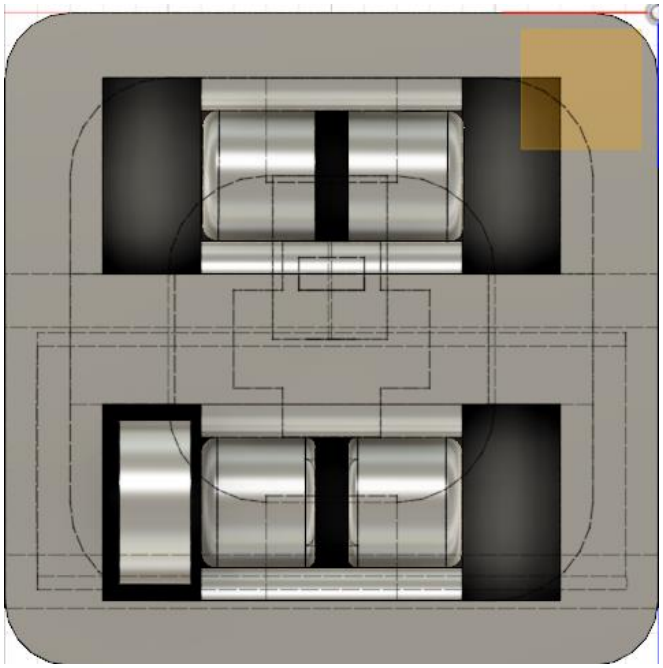


Figure 3.3.2- Bottom view of the motors and wheel

Figure 3.3.3- Behind view of the Robot

3.4 Proposed Block Diagram

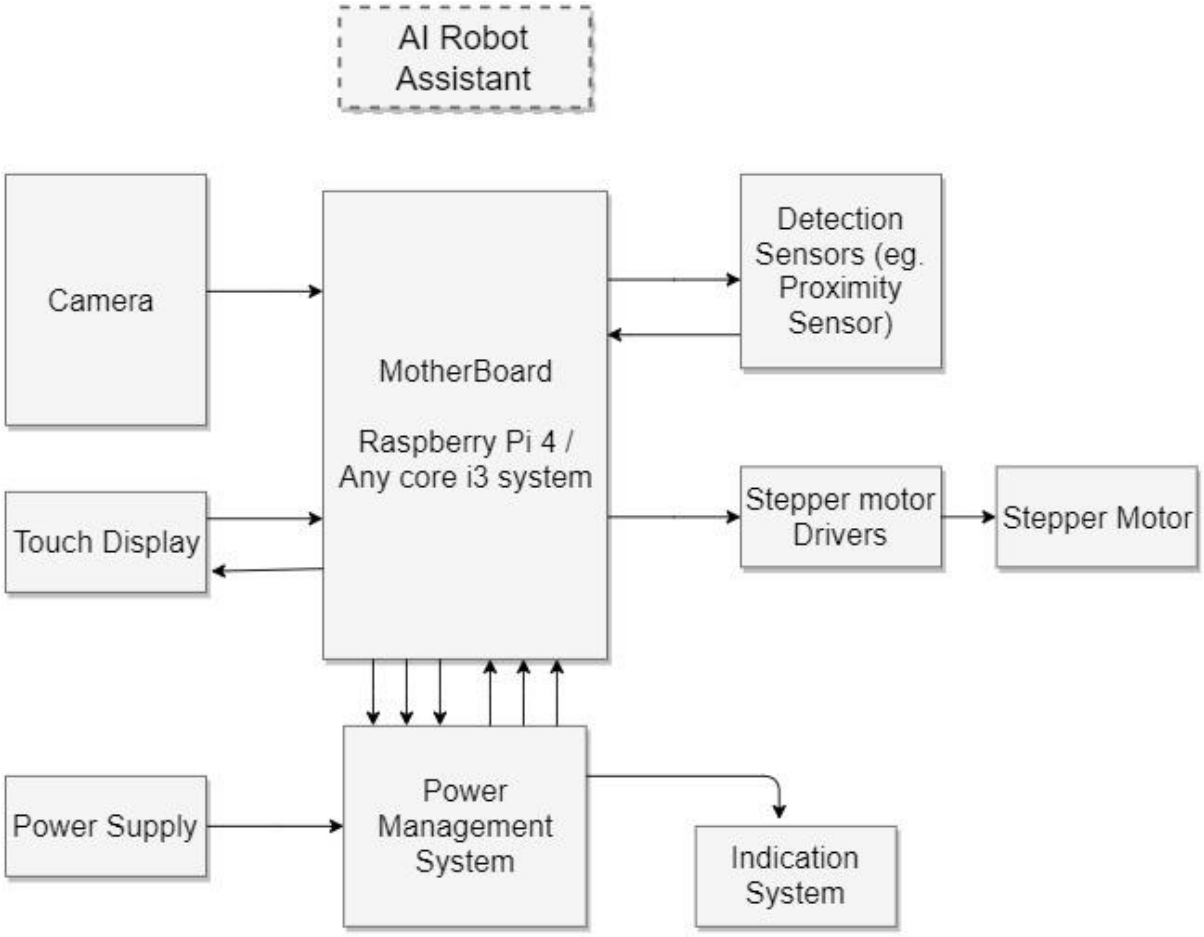


Figure No: 3.4.1 - Block diagram of Robo Assistant

3.5 Software Platforms

1. Autodesk Fusion 360

So, what is Fusion 360? The answer is 3D CAD reinvented to become the next generation Product Innovation Platform incorporating CAD/CAM/CAE tool for collaborative product development.

Autodesk Fusion 360 is a fundamental departure from our current desktop bound CAD software, so let's have a deeper dive and get a high-level overview of what really sets it apart from the competition, why the platform is such a compelling offering and how it helps ends users and businesses meet the requirements, challenges and technological changes facing the design and manufacturing sectors.

Features-

3D Designing

Autodesk Fusion 360 brings true 'Top-down' design to your workflow, with a single model environment in which all unique parts and assemblies can be created. Existing library files can be

linked into your current design, allowing for 'change it here – change it everywhere' control of your standard parts.

It incorporates both direct and parametric modelling, allowing you to start with an existing design from any other CAD system, or create your own designs from scratch.

Prototyping and Fabrication

Prepare your designs for 3D printing as a prototype or as a final part within Fusion 360's integrated 3D print preparation environment.

Once the final design is agreed, programme your part for 2, 2.5 or 3 axis CAM directly inside F360 and write out your post for any one of the many supported NC code post processors. Traditional drawings have not been left out and can be created directly inside the platform. 3D Print models, CAM paths and Drawings are all directly linked to your 3D CAD model. When your model updates – everything else will too! Late design changes need not be a problem inside Fusion 360's integrated Product Innovation Environment.

Integrated Simulation

The closer you can get your 3D CAD model to real life, the more information can be generated for Simulation and verification of your design. Minimise the number of physical prototypes you need to make, reduce costs and reduce time to market.

Fusion 360 includes integrated Assembly modelling, Motion studies, Rendering and FEA tools to help you analyse your design before you make it. Generate Static stress, Modal Frequencies, Thermal, Thermal Stress, and Structural Buckling, Non liner Stress, Event simulation and Shape optimisation studies for a fraction of the price of dedicated simulation software.

2. Tensor Flow

An end-to-end open source machine learning platform.

TensorFlow is an end-to-end open source platform for machine learning. It has a comprehensive, flexible ecosystem of tools, libraries and community resources that lets researchers push the state-of-the-art in ML and developers easily build and deploy ML powered applications.

Easy model building

TensorFlow offers multiple levels of abstraction so you can choose the right one for your needs. Build and train models by using the high-level Keras API, which makes getting started with TensorFlow and machine learning easy.

If you need more flexibility, eager execution allows for immediate iteration and intuitive debugging. For large ML training tasks, use the Distribution Strategy API for distributed training on different hardware configurations without changing the model definition.

Robust ML production anywhere

TensorFlow has always provided a direct path to production. Whether it's on servers, edge devices, or the web, TensorFlow lets you train and deploy your model easily, no matter what language or platform you use.

Use TensorFlow Extended (TFX) if you need a full production ML pipeline. For running inference on mobile and edge devices, use TensorFlow Lite. Train and deploy models in JavaScript environments using TensorFlow.js.

Build and train ML models easily using intuitive high-level APIs like Keras with eager execution, which makes for immediate model iteration and easy debugging. Easily train and deploy models in the cloud, on-prem, in the browser, or on-device no matter what language you use. A simple and flexible architecture to take new ideas from concept to code, to state-of-the-art models, and to publication faster.

3. OpenCV

OpenCV (Open Source Computer Vision Library) is an open source computer vision and machine learning software library. OpenCV was built to provide a common infrastructure for computer vision applications and to accelerate the use of machine perception in the commercial products.

The library has more than 2500 optimized algorithms, which includes a comprehensive set of both classic and state-of-the-art computer vision and machine learning algorithms. These algorithms can be used to detect and recognize faces, identify objects, classify human actions in videos, track camera movements, track moving objects, extract 3D models of objects, produce 3D point clouds from stereo cameras, stitch images together to produce a high resolution image of an entire scene, find similar images from an image database, remove red eyes from images taken using flash, follow eye movements, recognize scenery and establish markers to overlay it with augmented reality, etc.

Along with well-established companies like Google, Yahoo, Microsoft, Intel, IBM, Sony, Honda, Toyota that employ the library, there are many startups such as Applied Minds, VideoSurf, and Zeitera, that make extensive use of OpenCV. OpenCV's deployed uses span the range from stitching streetview images together, detecting intrusions in surveillance video in Israel, monitoring mine equipment in China, helping robots navigate and pick up objects at Willow Garage, detection of swimming pool drowning accidents in Europe, running interactive art in Spain and New York, checking runways for debris in Turkey, inspecting labels on products in factories around the world on to rapid face detection in Japan.

It has C++, Python, Java and MATLAB interfaces and supports Windows, Linux, Android and Mac OS. OpenCV leans mostly towards real-time vision applications and takes advantage of MMX and SSE instructions when available. A full-featured CUDA and OpenCL interfaces are being actively developed right now. There are over 500 algorithms and about 10 times as many functions that compose or support those algorithms. OpenCV is written natively in C++ and has a templated interface that works seamlessly with STL containers.

CHAPTER 4

RESULT ANALYSIS

4.1 Building the Algorithm

Steps followed to detect lanes and mark them are-

1. Importing image
2. Applying colour filters (to convert RGB to HSV)
3. Converting to Grayscale (for easier edge detection)
4. Applying Gaussian Blur (for smoothing edges)
5. Applying mask algorithm (to black out unwanted objects)
6. Applying Canny algorithm (to detect edges)
7. Restricting vision strictly to lanes
8. Applying Rough transform (to detect continuous lines)
9. Importing image- Getting video frames one by one.

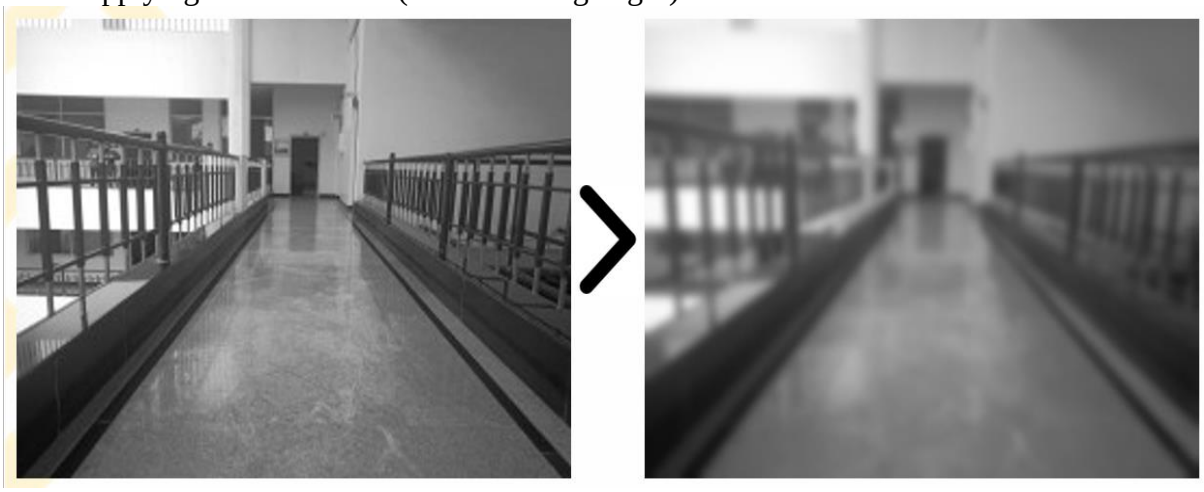
Steps Explained-

1. Importing image from Input.

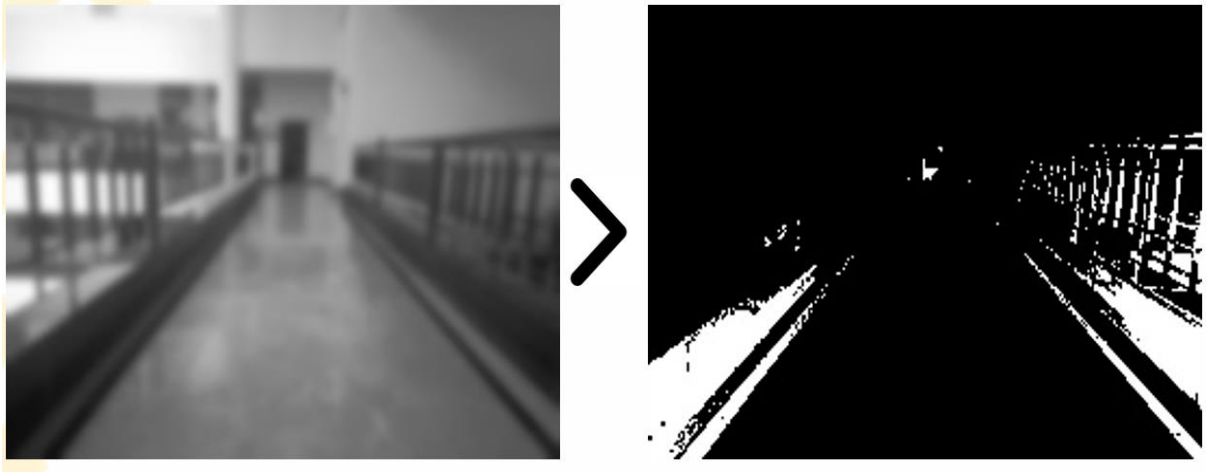
2. Applying colour filters (to convert RGB to HSV)- OpenCV works on HSV colour standards.

3. Converting to Grayscale (for easier edge detection)

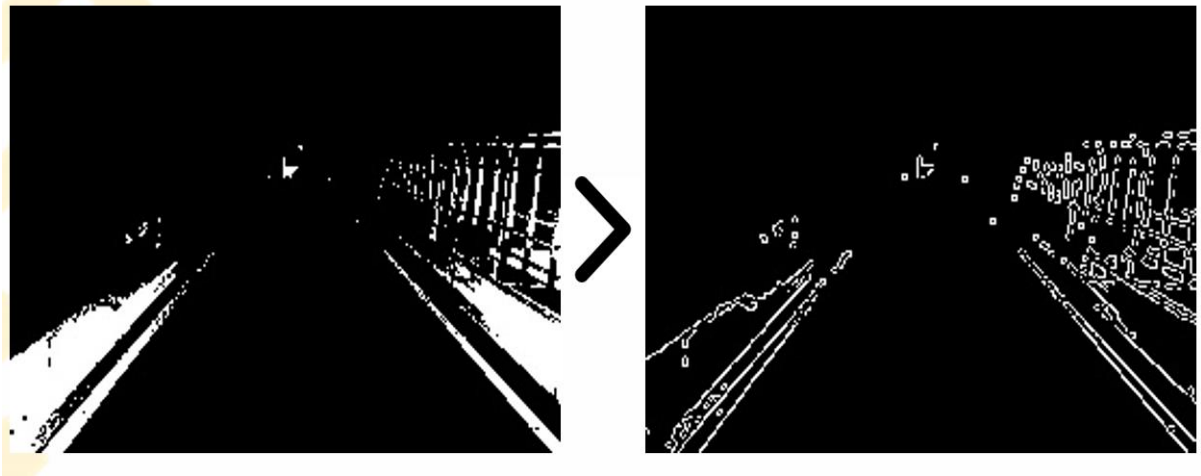
4. Applying Gaussian Blur (for smoothing edges)



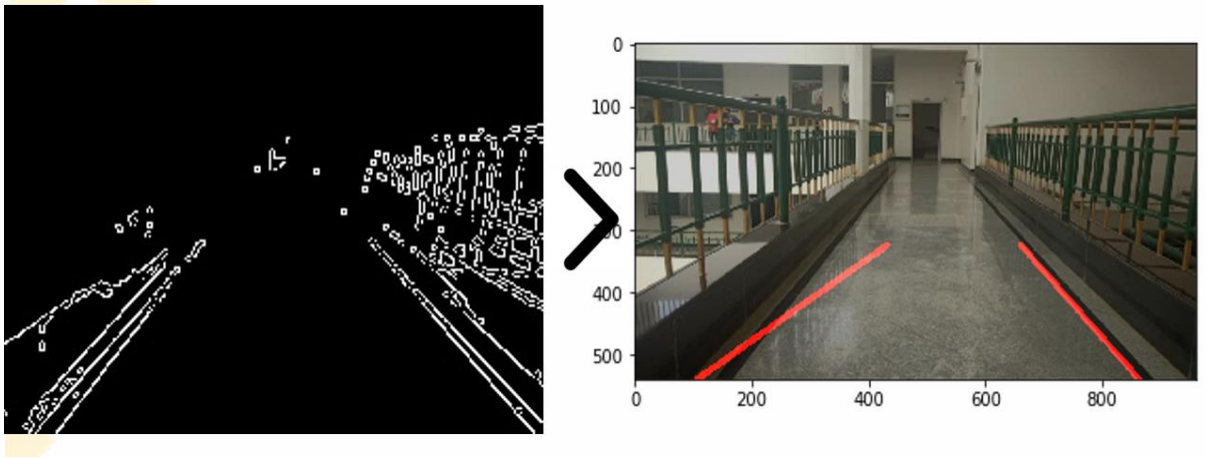
5. Applying mask algorithm (to black out unwanted objects)



6. Applying Canny algorithm (to detect edges)



7. Applying Rough transform (to detect continuous lines)



4.2 Intelligent Steering

Steering is completely based on distance between the lanes. After the robot recognizes lanes, a centre line is drawn exactly in middle referencing the width of the image (green line), a python script is then written where distance is pre-loaded, whenever the centre line is closer than usual, the script throws 'Turn left' and 'Turn right'. Below are the steps:

STEP 1: Calculate distance between left lane and right lane with respect to centre lane.

STEP 2: Check whether the conditions satisfy of being centre.

STEP 3: Indicate Left if the centre line tilts to right and indicate right if the centre line tilts to left. These indications are given as pulse to stepper motor driver.

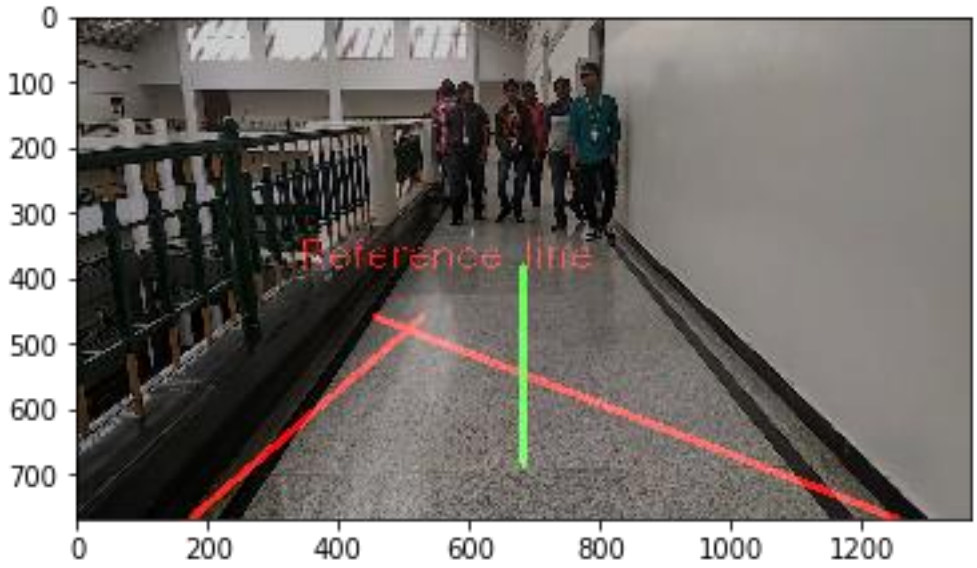


Figure 4.2.1 – This image shows the reference line exactly at centre.

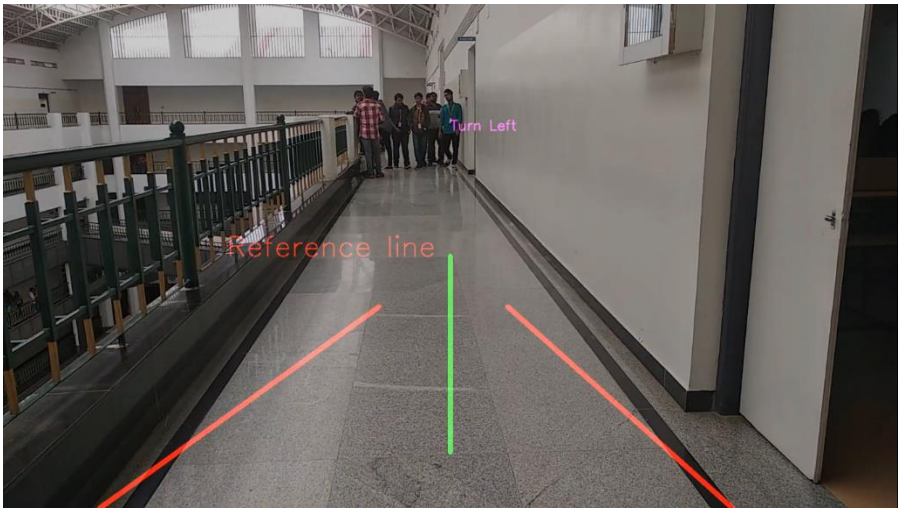


Figure 4.2.2 – This image shows the reference line slightly at right side.

Figure 4.2.3 – This image shows the reference line slightly at left side.

CHAPTER 5

CONCLUSION AND FUTURE SCOPE

5.1 Conclusion

This autonomous surveillance robot is a cutting-edge robot which is smart, interactive and remarkably mobile. The robot perceives questions and changes with the individual preferences and on a particular's requirements, which changes to individual inclinations and its audio and visual effects and the illustrations and development are made for an intuitive learning background. The robot is developed so as it can move in the work space to render improvised lifestyle.

The application of this robot makes it more interesting and appealing. It is a smart announcer which is preferably to reduce the human effort or any physical efforts. Any announcements can be transferred to the mass by the controller using this application or robot. It has an audio video correspondence which will provide us with the monitor to monitor video conference in the absence of the individual. The database can be stored in this system which can help in future evaluation and also the database management of all the monitored data.

The major application is of the smart navigation which takes an individual towards an more secure condition, this will be an good application for the visually challenged individuals so as to navigate themselves to a particular destination in the workplace.

5.2 Future Scope

AI is going to permeate every job sector in the future. It can create new career paths in the field of Machine learning, Data mining, and analysis, AI software development, program management, and testing. The demand for AI certified professionals will grow along with the developments in AI. And also with machine learning on the rise, it is only natural that the medium gets a face on it robots! The sophistication of machine learning is not a 'small wonder' if you know what I mean. Multi-agent learning, robot vision, self-supervised learning all will be accomplished through robotization. Our robot can be upgraded to be used in wide variety of sectors like Education, Marketing, Security Services etc.,

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