Robotic Car for Cockroach Detection

BY

Nafiz Ahamed

ID: 152-15-5662

MD. Nazmul Hossain

ID: 152-15-5646

Sourav Biswas

ID: 151-15-5062

MD. Minul Hasan

ID: 151-15-5042

This report presented in partial fulfillment of the requirements for the Degree of Bachelor of Science in Computer Science and Engineering

Supervised By

Fahad Faisal

Assistant Professor

Department of CSE
Daffodil International University

Co-Supervised By

Md. Sazzadur Ahamed

Senior Lecturer

Department of CSE
Daffodil International University

DAFFODIL INTERNATIONAL UNIVERSITY
DHAKA, BANGLADESH
APRIL 2019

APPROVAL

This Project titled **"Robotic Car for Cockroach Detection"**, submitted by Nafiz Ahmed, ID No: 152-15-5662, MD. Nazmul Hossain, ID No: 152-15-5646, Sourav Biswas, ID No: 151-15-5062, MD. Minul Hasan, ID No: 151-15-5042 to the Department of Computer Science and Engineering, Daffodil International University has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of B.Sc. in Computer Science and Engineering and approved as to its style and contents. The presentation has been held on 2nd May, 2019.

BOARD OF EXAMINERS

Dr. Syed Akhter Hossain — **Chairman**
Professor and Head
Department of Computer Science and Engineering
Faculty of Science & Information Technology
Daffodil International University

Dr. Md. Ismail Jabiullah — **Internal Examiner**
Professor
Department of Computer Science and Engineering
Faculty of Science & Information Technology
Daffodil International University

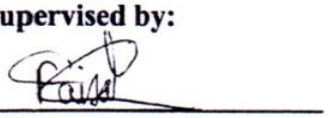
Dr. Sheak Rashed Haider Noori — **Internal Examiner**
Associate Professor & Associate Head
Department of Computer Science and Engineering
Faculty of Science & Information Technology
Daffodil International University

Dr. Md. Saddam Hossain Mukta — **External Examiner**
Assistant Professor
Department of Computer Science and Engineering
United International University

DECLARATION

We hereby declare that, this project has been done by us under the active supervision of **Fahad Faisal, Assistant Professor, Department of Computer Science** and Engineering, Daffodil International University. We also declare that neither this project nor any part of this project has been submitted elsewhere for award of any degree.

Supervised by:



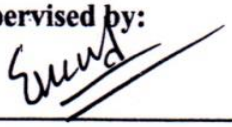
Fahad Faisal

Assistant Professor

Department of CSE

Daffodil International University

Co-Supervised by:



Md. Sazzadur Ahamed

Senior Lecturer

Department of CSE

Daffodil International University

Submitted by:

Nafiz Ahamed

Nafiz Ahamed

ID: 152-15-5662

Department of Computer Science and Engineering

Daffodil International University

Nazmul Hossain

MD. Nazmul Hossain

ID: 152-15-5646

Department of Computer Science and Engineering

Daffodil International University

Sourav Biswas

Sourav Biswas

ID: 151-15-5062

Department of Computer Science and Engineering

Daffodil International University

Md. Minul Hasan

MD. Minul Hasan

ID: 151-15-5042

Department of Computer Science and Engineering

Daffodil International University

ACKNOWLEDGEMENT

First we express our heartiest thanks and gratefulness to almighty Allah for His blessing for making this project successfully.

We are profoundly grateful to our supervisor **Fahad Faisal**,**Assistant Professor**, Department of Computer Science and Engineering for his expert guidance and continuous encouragement throughout this project completion.

We would like to express deepest appreciation towards **Md. Sazzadur Ahamed**, **Senior Lecturer**, Department of Computer Science and Engineering whose invaluable guidance supported us in completing this project.

We would like to express our heartiest gratitude to Dr. Akhter Hossain, Professor and Head, Department of Computer Science and Engineering for his suggested idea of this project.

We must express my sincere heartfelt gratitude to all the people who helped us directly or indirectly during this course of work.

Finally, we must acknowledge with due respect the constant support and patients of our parents.

ABSTRACT

Efficient and accurate object detection has been an important topic in the advancement of computer vision systems. With the advent of deep learning techniques, the accuracy for object detection has increased drastically. The project aims to incorporate neural networks technique for object detection with the goal of achieving high accuracy with a real-time performance. Robotic vision continues to be treated including different methods for processing, analyzing, and understanding. All these methods produce information that is translated into decisions for robots. From start to capture images and to the final decision of the robot, a wide range of technologies and algorithms are used like a committee of filtering and decisions. This report aims to design and implement the object detection and machine interfacing for cockroach detection. Here the working procedure has been divided into two parts hardware and software. In order for the system to be operational, Tensor flow, Arduino and Raspberry Pi microcontroller as well as camera module has been used. The projected algorithm has been used to train neural network model to detect cockroach from picture and real time image which is captured by camera module as input for finding accuracy. Finally, it is found that our project provides faster image detection process.

TABLE OF CONTENTS

LIST OF FIGURES

FIGURES **PAGES**

CHAPTER 1

INTRODUCTION

1.1 Introduction

The concept of machine able to see is not new. This stuff has been introduced in science fiction decades ago. But it was not possible for us back then. With the advancement of science it was possible for us to make robotic vision reality.

Our project aims to develop a device which will be able to move in different direction as the user pleases and it will be able to detect a certain kind of pest cockroach. Our project is divided into two parts hardware and software. Hardware part is divided into two parts first part is consisted of Arduino which is responsible for operating the robotic car and second part is consist of raspberry pi and camera module which will be able to detect cockroach image. In software part we have mainly used tensor flow to train our data model and many different software for many small requirements.

1.2 Motivation

- Cockroach generally thrive in warm environments that's why we find them in warm places and densely populated buildings of cities.
- Cockroach causes serious health problems like allergy and asthma because it contains a specific protein called allergen [1].
- Many different virus & bacteria are transported by cockroach that are through their body which is harmful for human
- To make cockroach mitigate people use different pesticide which causes serious problems for both human and our environment.
- Cockroach can contaminate food with their salvia which causes serious food poisoning.

1.3 Objective

- Our device reduces human effort to reduce cockroach.
- Our device can be modified to detect any object with help training.
- Our future works involves not only detect it but also eliminate it.
- Human can only detect cockroach when it is visible to eye but our device is able to move freely without any exhausted.
- Our device provides easy controlling system so that people of all ages can control it.

1.4 Expected outcomes

- Our device will be able to move in places which is difficult for human
- It will be able to detect cockroach in real time in any position
- Our device will be to provide clean environment
- Our device is easy to operate
- It will very much secure for human

1.5 Layout of the report

- Chapter 1 we discuss about our device, its objective, motivation and our expected outcome.
- Chapter 2 we discuss about ongoing work and related work, Challenges we faced and scope of problems.
- Chapter 3 we dealing with design requirements and our project development requirements
- Chapter 4 we are talking about our device design in detail and all requirements.
- Chapter 5 we are discussing about our device implementation and testing
- Chapter 6 is all about the summary of device, its result and future scope

CHAPTER 2

BACKGROUND

2.1 Introduction

Cockroach is among of the most common pest found in densely populated buildings in cities and homes. Cockroach has amazing ability to survive in very critical condition. Cockroach are pest because of their filthy habits. They search for food at night in kitchen, rubbish bin, sewer and drain etc. In addition it sometimes attack eyelash, hair and finger nails of sleeping human. It also causes serious problems for health.

In Bangladesh cockroach problem is not new. As it causes serious problems, people want to get rid of it as soon as possible. But it also have a negative effect. Since 1990 the use of chemical products and pesticide has increased doubled in numbers. It causes serious problem to environment. But cockroach generally dwell at night so it is impossible to human to always keep eye on their food supply and surroundings.

With the advancement of science and technology image processing application has gained much more scope. In industries, defense, surveillance and security image processing application with robotic vision has gained much more importance [2] [3]. Among those application objection detection has played an important role.

The main objective of this project is to build a device which will be able to detect cockroach in real time using image processing and this device will also be able to move freely in plain spaces.

This device will be controlled by a user and it will reduce human effort to keep eye on food storage and surroundings. It will help to build clean and safe environment for human.

2.2 Related Works

Our project aims to combine robotic vision and image processing. There are many ongoing projects are happening all around the world to combines robotic vision and image processing. But none of them are doing the exact work we tend to do. There is no mention of any system or device to detect pest in our country and the world.

Our project aims to design a device which will be able to move in places controlled by a user. It will be able to detect cockroach which will help people to ensure safe environment and health. This device will be easy to operate and control. As it is a small device so there will be no problem for shift it from one place to another.

However we find some projects that tends to combine image processing and robotic vision.

- Ball following robot
- Line following robot
- Finger gesture based steering control robot
- Virtual steering robot
- Motion Detection using DIP

All these projects are using image processing and robotic vision and many other techniques to achieve their goal for different means.

Even there is some cockroach inspired robots which mimics the amazing ability of cockroach

- CRAM- cockroach robot with articulated mechanism which will be able to go in places which is impossible for human and it will also be able to shrink it body size in half.
  This robot is developed by US Berkeley [4].
- HARM- Harvard Ambulatory Micro robot is developed by Harvard JOHN A PAULSON School of Engineering which can run very fast, shift change position, jump [5].

2.3 Comparative Studies

The purpose of our device is completely different from all the existing device. But the main concept and the process we followed is built our device is quiet same. Both our device and existing device have combined robotic vision and image processing to serve specific purpose.

- Line following robot – As the name define line following robot is an automated guided vehicle which follow an embedded line on floor which defines its path. With the help of image processing the robot is able to recognize its path.

- Ball following robot - This project was developed to track down ball. The robot uses camera module to take frames of the ball and use image processing track the ball as its training data defines balls size, shape and color as its features.

- Finger gesture based steering control robot – This project is divided into three parts.
  First part uses sensor to transmit signal of the finger gesture
  Second part uses receiver to receive the transmitted signal
  Last part uses image processing to decode the signal and helps to make decision.

- Virtual steering robot – It is one kind of self-driving car which uses different sensor to understand its surroundings and with the help of image processing it knows when to stop
  And use training data to drive.

- Motion Detection using DIP – It is one of the critical projects of computer vision. There are lot of techniques to acquire motion detection along with image processing by analyzing the difference in background and foreground it possible to detect motion.

2.4 Scope of the problem

The idea of our device is very much unique but as it a developing there are 3 major problems we are dealing with in this project

First the problem is in dark background and in low light our device sometimes does not produce accurate result. Moreover, sometimes reflection from surface can cause false objection. Various lighting conditions lead to false objection.

Second problem is the power usage as there is no visual way for user to check the battery is running low it might create from for user to when the device shuts down.

Third problem is our device is not trained to avoid obstacle or liquid surface to it can causes problem.

Some more feature can be added to improve performance.

2.5 Challenges

It is very much difficult to develop a project we doesn't exists at all. We faced many challenges and complexities during this project. But we tried our best to develop this project which can help society to overcome problems. Challenges we faced so far

- Lack of resource – As this project unique from existing project we faced a lot of problems for collecting resource and confusion if it is useful for our device.
- Economic problem – As we are students it was very difficult for us to arrange money for this device hardware and we faced lot of problems as the latest hardware is very costly. So, we had to use cheap hardware's which we could afford.
- Lack of professionalism – As we are not professional and we have previous real experience to work with professional. Our device lacks in professionalism.
- Poor Workstation – The demand of our project was highly configured PC but with our limited resource and poor workstation we had to waste a lot of time in creating classifier and training data.

CHAPTER 3

Requirement Specification

3.1 Hardware and Software Requirement

In this chapter we will discuss about the hardware and software that have been used to develop this project. We will also discuss about which software we will use to interface with Raspberry pi and Arduino micro controller.

In this project we have 2 types of requirement

1. Hardware requirement
2. Software requirement

Which we will discuss briefly

Hardware Requirement

- Raspberry Pi 3b+
- Raspberry Pi 5MP camera module
- Arduino Uno
- Motor Driver L298N
- DC Motor
- Bluetooth Driver HC-05
- Battery 12V
- Car Chassis
- Wheel

Software Requirement

- Tensor Flow API
- Python
- Arduino IDE
- Label IMG
- Photo Editor
- Linux Operating System
- Arduino Car Control Application

3.1.1 Hardware Requirement

Raspberry Pi 3b+ - This model is one of the most popular and latest raspberry pi computer. It has 1.4 GHZ 64 bit quad core processor. It has 1 GB RAM. On Board Wireless Lan dual band 802.11 and On Board Bluetooth 4.2 HS. 300 MB/s Ethernet.

Camera interface and display interface. This micro controller will help us to detect cockroach in this project as it has 1 GB RAM and we have used 16 GB external memory in which we have used our trained data to perform object detection.

Raspberry Pi 5MP camera module – It is an image sensor which is used to capture video feed.

Arduino Uno - It is a micro controller board which supports ATmega328 and provide many advantage using ATmega328.

.

Motor Driver L298N – It is a dual H-bridge motor driver which allows to control the speed and direction of two DC motors. It will help our device wheel speed and direction.

DC Motor - This class of motors helps to convert direct current into mechanical energy. It will supply our device wheel the power.

Bluetooth Driver HC-05 – It is a module which helps to provide wireless serial connection and also easy to access by a controller or PC. It will help our device to connect with controller

Battery 12V - It provides 12 voltage power to device.

Car Chassis – It provides convenient space to setup our device.

Wheel – It helps our device to move in places.

3.1.2 Software Requirement

Tensor Flow API – Tensor Flow is an open source machine learning framework. It was developed by Google. It is used for dataflow programming across a range of tasks.

Python – It is high level programming language developed for general purpose.

Arduino IDE – It is an open source software which helps to write & upload code in Arduino.

Label IMG – It is an image annotation tool develop by using python which saves image annotation as XML files.

Photo Editor – It is free software which helps to do different operations with image and photos without reducing its quality.

Linux Operating System – It is an open source operating system based on Linux kernel which is convenient to use for development projects.

Arduino Car Control Application – It is an android app which provides user friendly environment to control our device

3.2 Logical Data Model

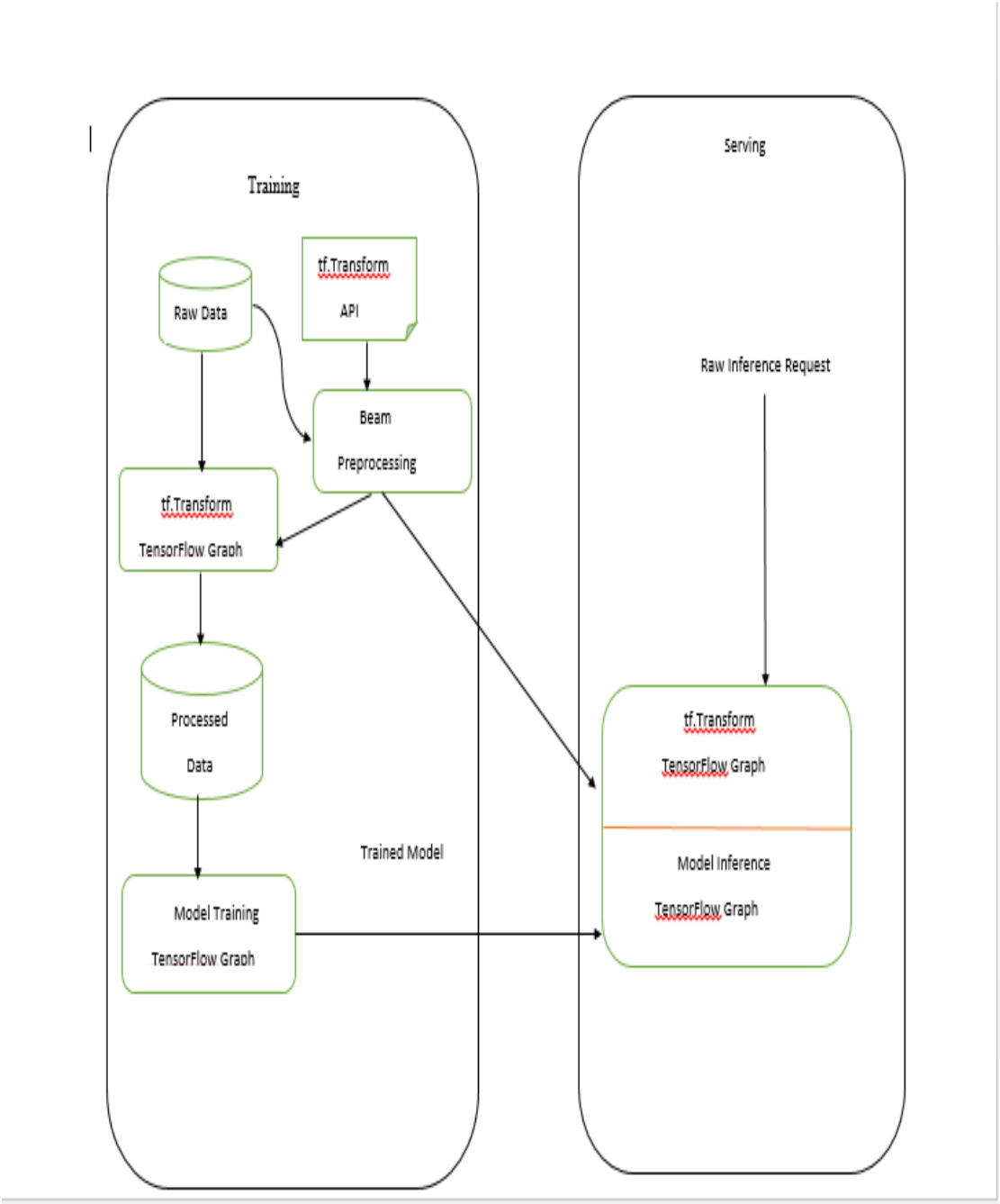


Figure 3.2.1: - Logical Data Model

3.3 Design Requirements

To develop this project we have considered different aspect which should be considered for making this device effective and convenient. We are going to briefly discuss about them.

Performance – First thing that we have considered is performance. It is the most important thing in any scenario cause without performance it will be like work done in waste. In this project we have used to different micro controller so that the device can be able perform at its maximum and able provide user a great experience.

Simple and Flexible - The device design is very simple and flexible. We tried to avoid all kind of complexity so the user may find difficult to use. Our design is simple and flexible to meet our user needs.

Reliability - Our device is trained to the degree to which the result of computation, calculation and detection to be accurate. This device is pretty much accurate to satisfy our user expectation.

Security - Security is one of most important thing that we have considered to develop this project. We tried our best to ensure the safety of our user. We assured that our device is harmless and is free from all potential threat.

Efficiency – Our device provide a standard and easy user interface to control our device. Moreover, it uses less power so power consumption is not a problem at all.

Portability – Our device is portable. User can use it if he has a Bluetooth device and smart phone in any place.

Usability – Our device doesn't need any information about user or doesn't require sign in or registration. A simple app has to install in order to control the device. So, there is no extra hassle a user has to go through. It fulfils the user context of use.

CHAPTER 4

Design Specification

4.1 Front-end Design

In our project we build a Robotic Car that can detect Cockroach. As it is a robotic device so our device design is complex. But we tried to make it as simple as considering the performance, efficiency and security.

It is a moving car that has three wheels. Two wheels are controlled by the Motor driver and Motor Driver will be controlled by the Arduino. The car will controlled by a user through an third party android application named “Circuits Ninja”. A Bluetooth module is placed to the circuit for receiving instructions from user. The car will move with those instructions. Car can move by Forward, Reverse, Right and Left.

The target of this device is to detect a Cockroach in real time. So we needed another device named Raspberry Pi which is a mini computer to process the data. The pi placed on the top of the device. A camera module is also placed with pi to capture real time data. The pi computer receive data and process the data to give the output. The whole device will powered by a 12V battery.

Front end Design figure follows:

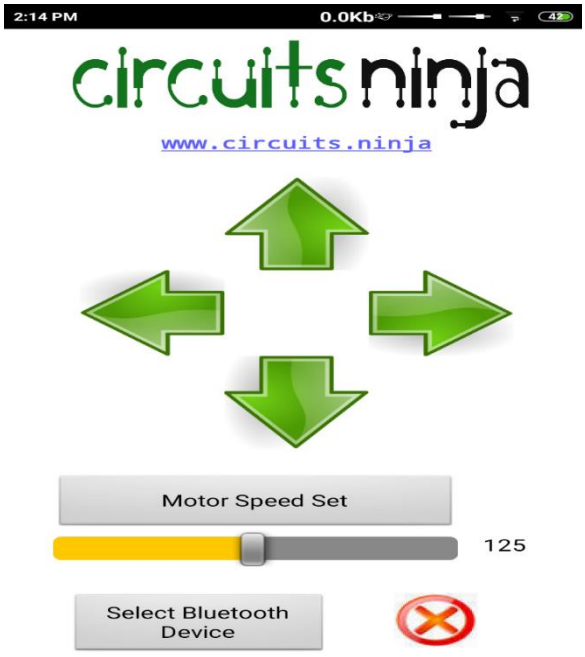


Figure 4.1.1: - Circuit Ninja application

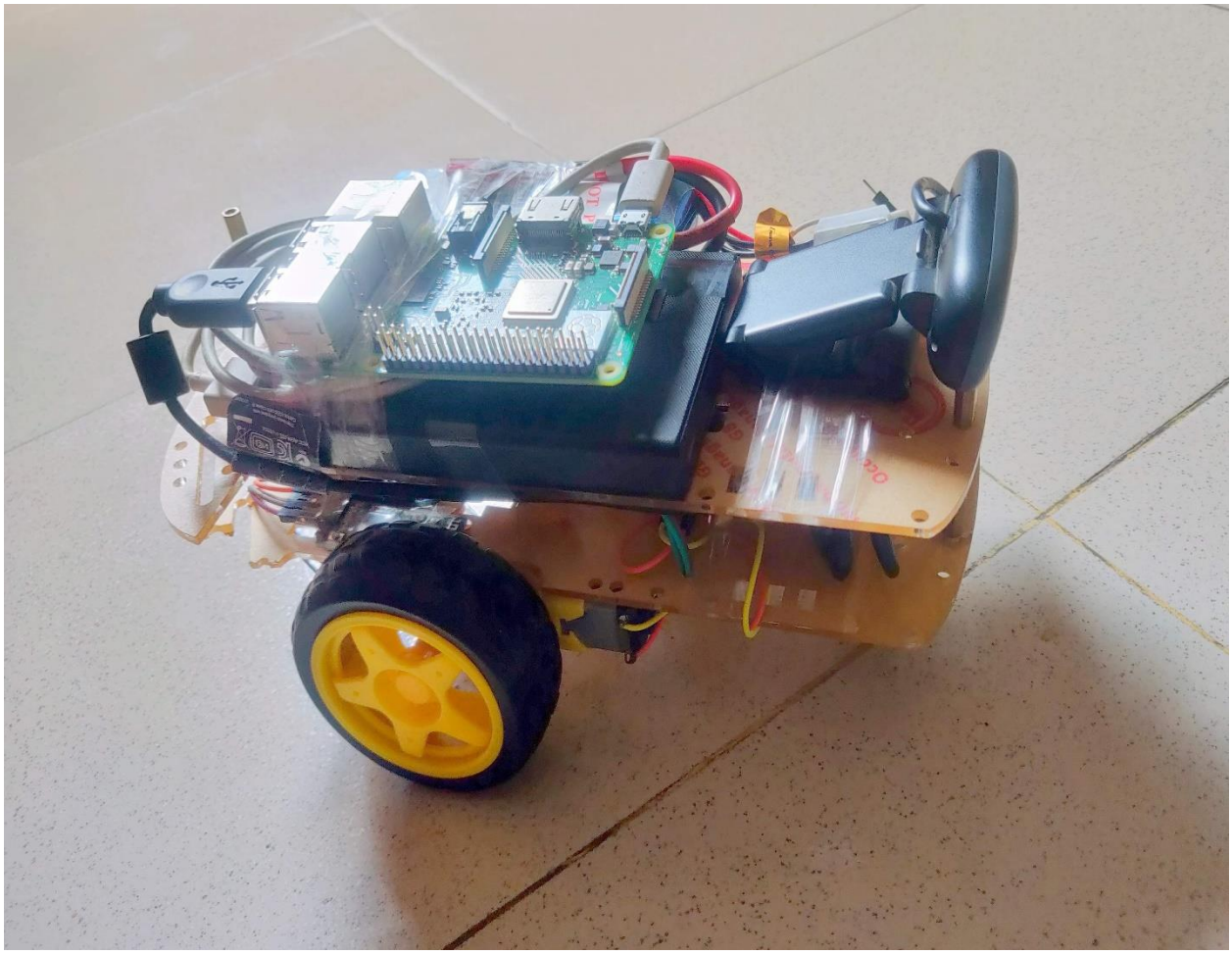


Figure 4.1.2: - Car Device

4.2 Back end Design

This part contains a lot of complex coding connections with hardware sensors. In this part of our project development where sensors receive instructions from raspberry pi and Arduino to meet with its purpose. To perform its purposes we needed to set up few things. First we trained our object classifier. The classifier will detect Cockroach. Classifier trained by Tensorflow API. All the back end works briefly described below.

First we installed Tensorflow on our Linux Operating System. A python3.6 version installed also with all dependent libraries

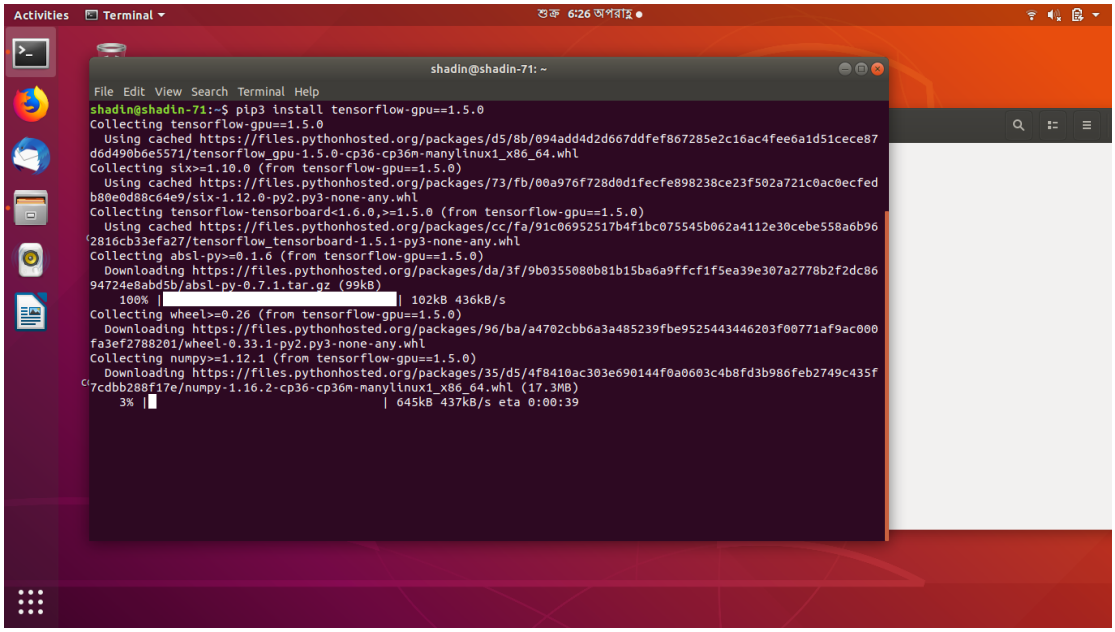


Figure 4.2.1: - Installing Tensor Flow & Python Libraries

Tensorflow API Model contains large number of collections of model implemented by Tensorflow researchers. To train our classifier we needed our targeted object images. There will be two types of images as Test images and Train images. Test images will be 20% of the total images and remaining 80% of images will be in Train images. These two types of images will be kept in “model-> research->object_detection->images” folder.

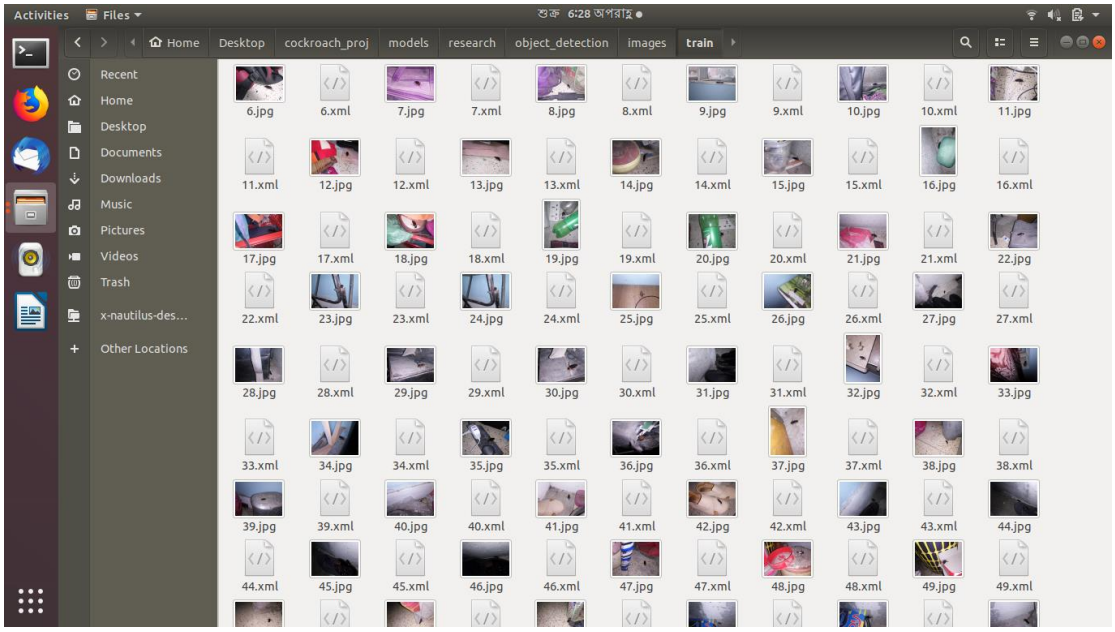


Figure 4.2.2: - Images & XML file for training

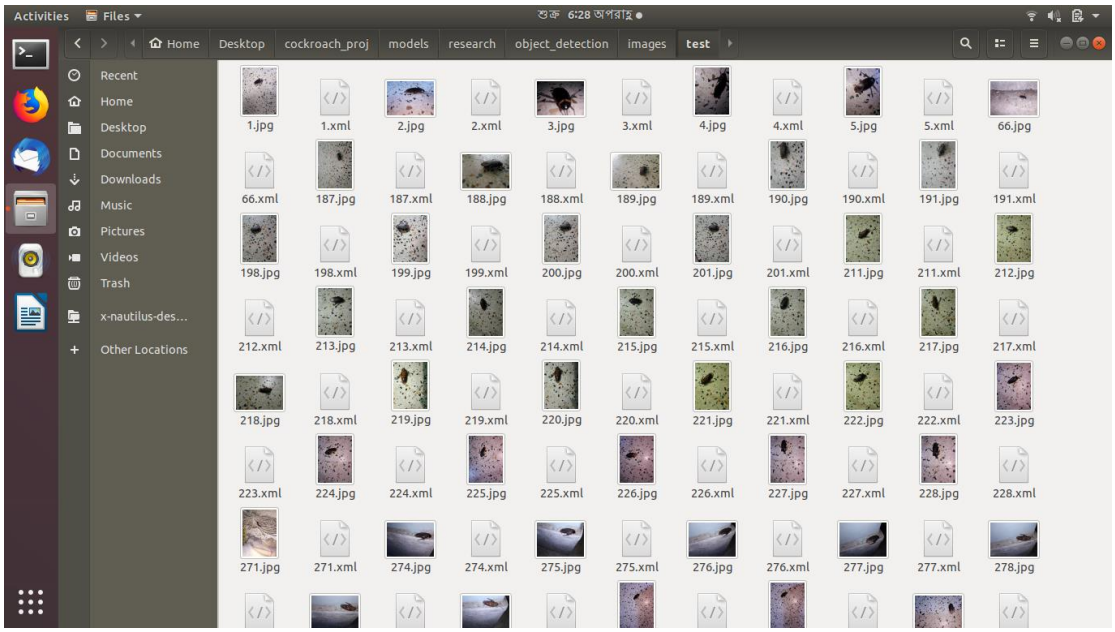


Figure 4.2.3: - Images & XML file for testing

Then we need to generate TF Record as extension (.records). To generate TF Record we have done two more steps. First we needed to label our test and train images. So there is a program call “Label Image” which will generate the coordinate value of the selected object in xml format.

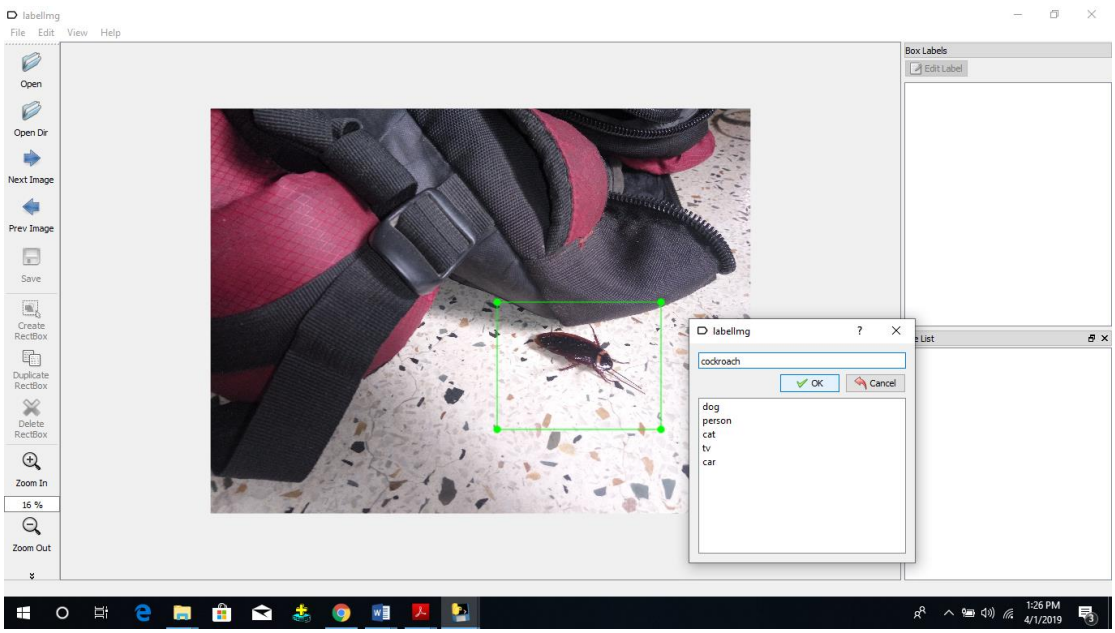


Figure 4.2.4: - Image labeling using LabelImg Software

Then a python script call “xml_to_csv” that generate xml coordinate data to csv format.

Now we created label map and configure training pipeline. Label map will tell the trainer what each object is by defining a mapping of class names and id numbers. The label map will be a (.pbtx) extension named.

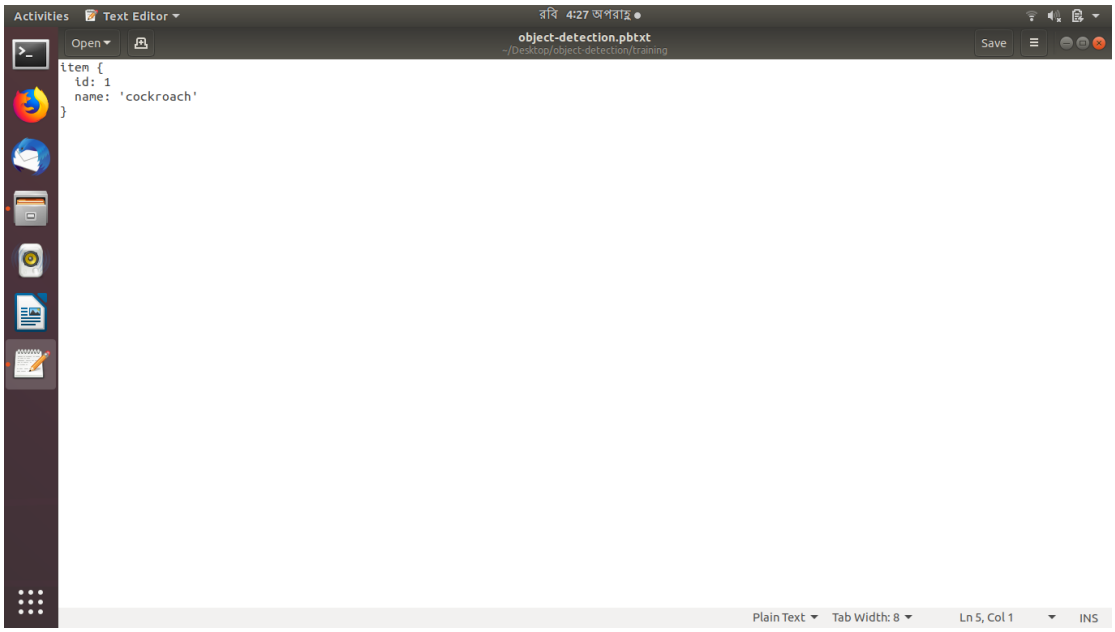


Figure 4.2.5: - Configure File

To configure training we used "ssd_mobilenet_v1_pets.config". This configuration file is used to define which parameters will be used for training.

After setting up the environment we started our train process.

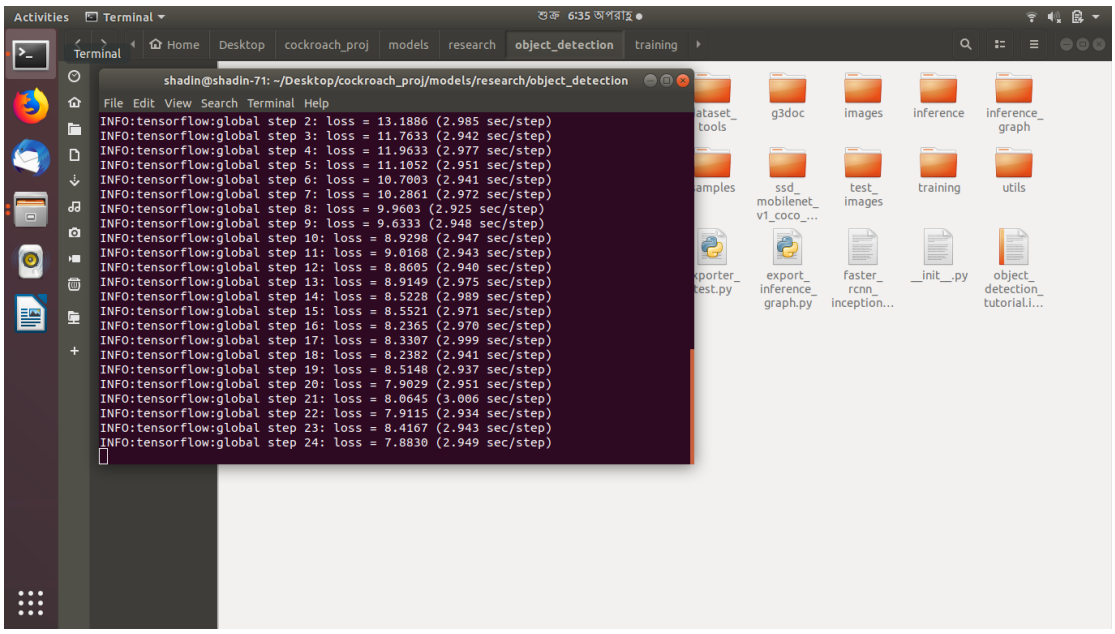


Figure 4.2.6: - Training process

Learning rate at step 3012 at middle of process

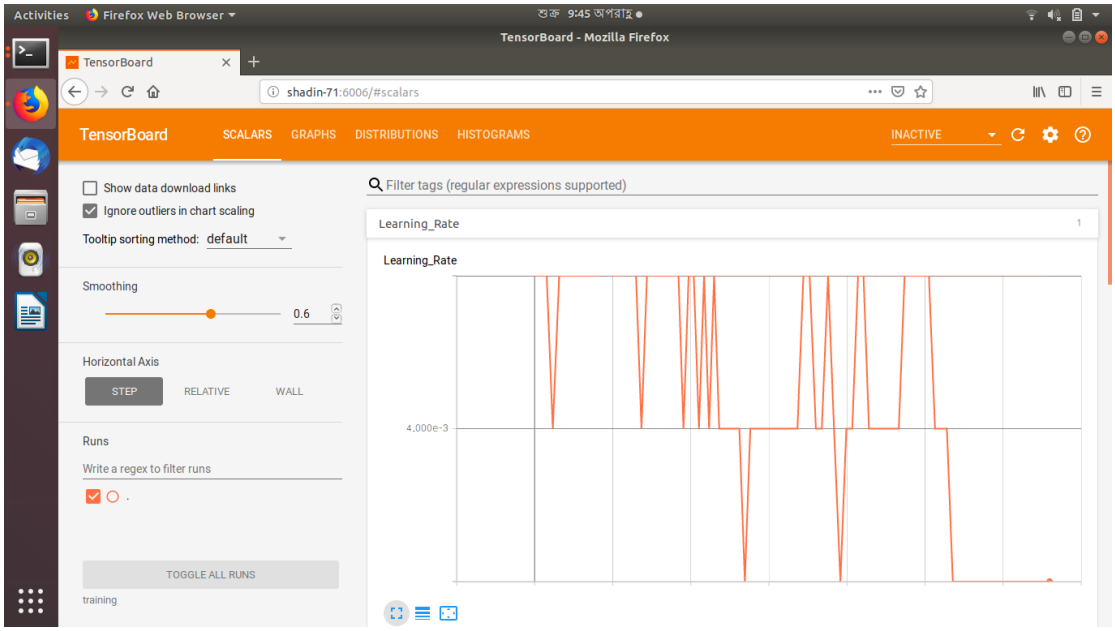


Figure 4.2.7: - Graph of Learning

Learning rate defines how our classifier is being learning. At this step our graph is showing that our classifier is still leaning. So we continued our learning process.

Loss at strep 3012 at middle of process

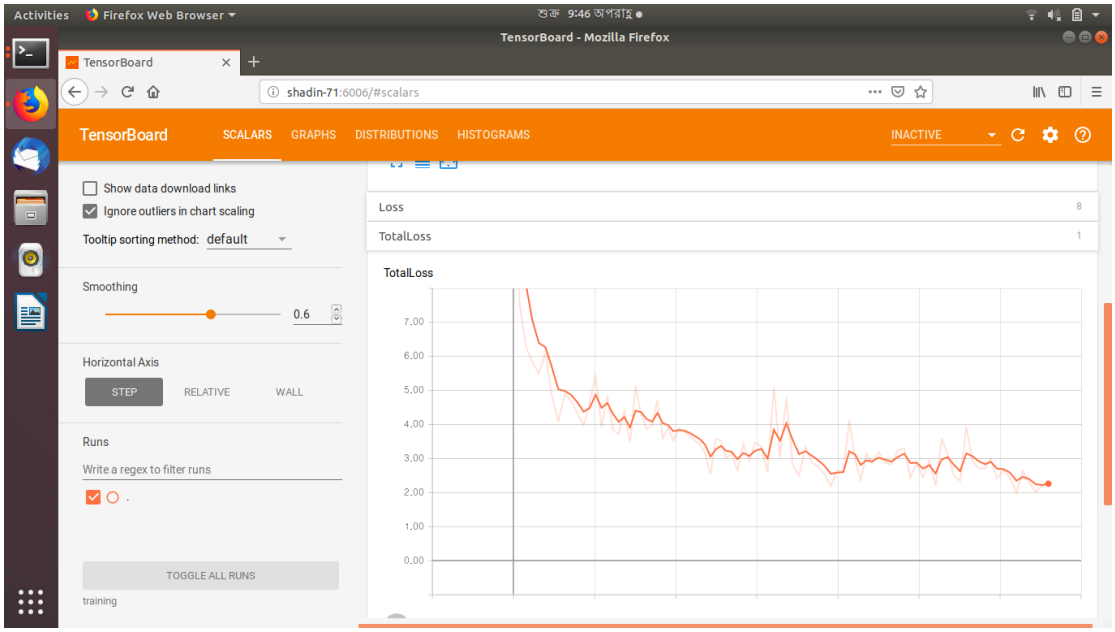


Figure 4.2.8: - Graph of Loss

Loss is the target function that the optimization algorithm will try to minimize. Lower the loss value will be good for classifier. Our target to get the loss value of average bellow 2.

Learning rate at 6012 which is a final step

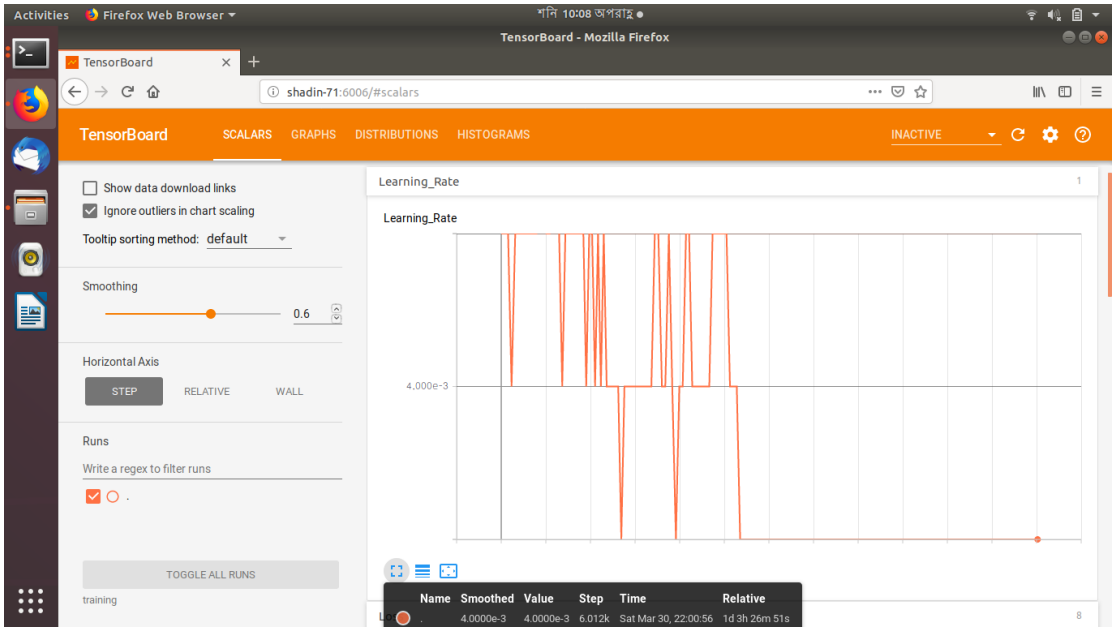


Figure 4.2.9: - Constant Graph

In this graph our learning is constant. We can declare our classifier is enough trained. So we stopped at this step to train our model.

Total loss at step 6012 which is a final step

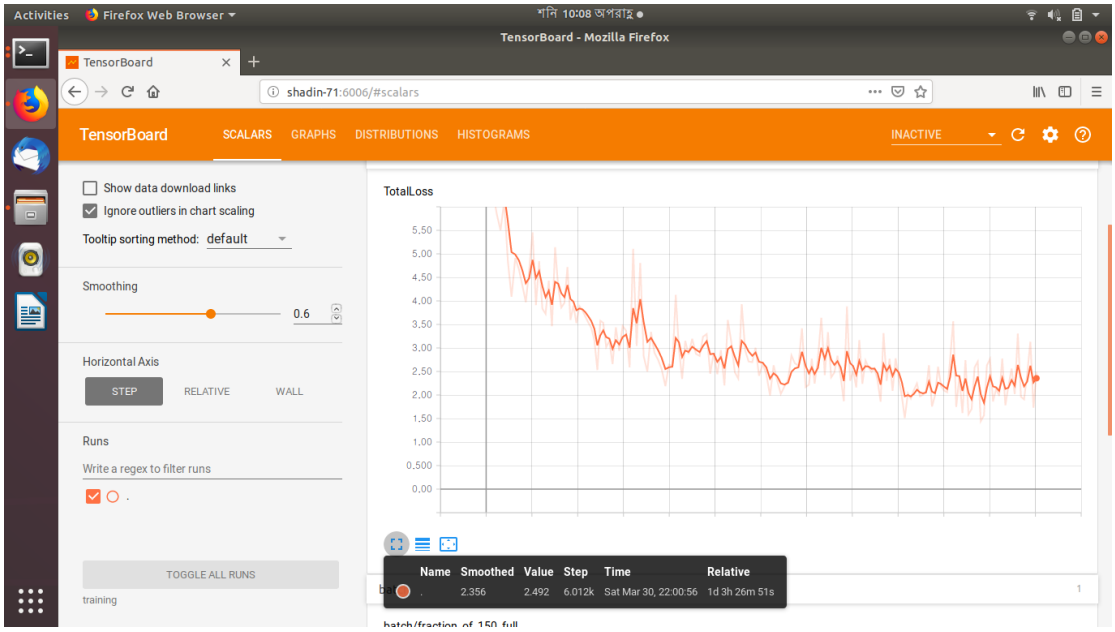


Figure 4.2.10: - Total Loss

Our targeted loss value below 2 but in our case our classifier is being trained at loss value of 2.492. So we decided to stop at this position.

After completing training we generate our classifier in “inference graph” folder. We set this classifier to the raspberry pi to get the desired output.

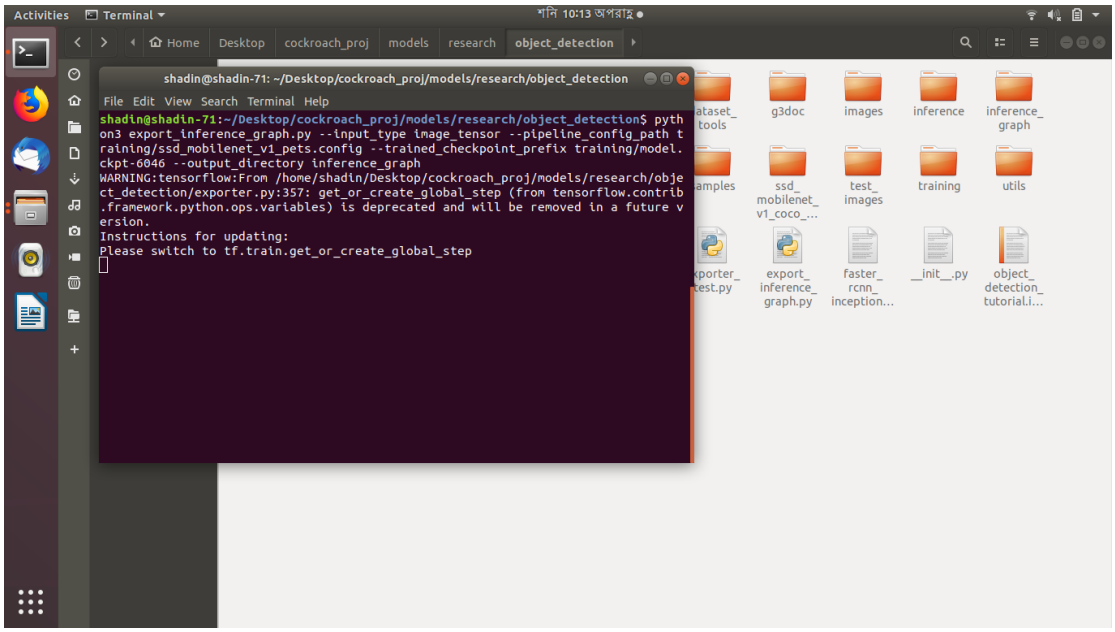


Figure 4.2.11: - Generating Inference Graph

We have Arduino code that will be set on Arduino microcontroller to receive instruction from user through Bluetooth module and output as a moving car

Figure 4.2.12: - Arduino Code

4.3 Interaction design and UX

Design is a compulsory element of any project to interact with the environment. So as ours, we tried to keep our device simple so that users can use the device easily. We designed our device that will be controlled through an android application by user and it will pass the captured video feed of environment through camera to the user. User can move the car by visualizing from the real time video feed.

In real time video feed a Cockroach will be detected and user will be able to see the detected object with an accuracy.

UX design is the elementary process of a project that enhance user satisfaction by improving usability, accessibility and pleasure. Our project's UX design is the android application design which is given below.

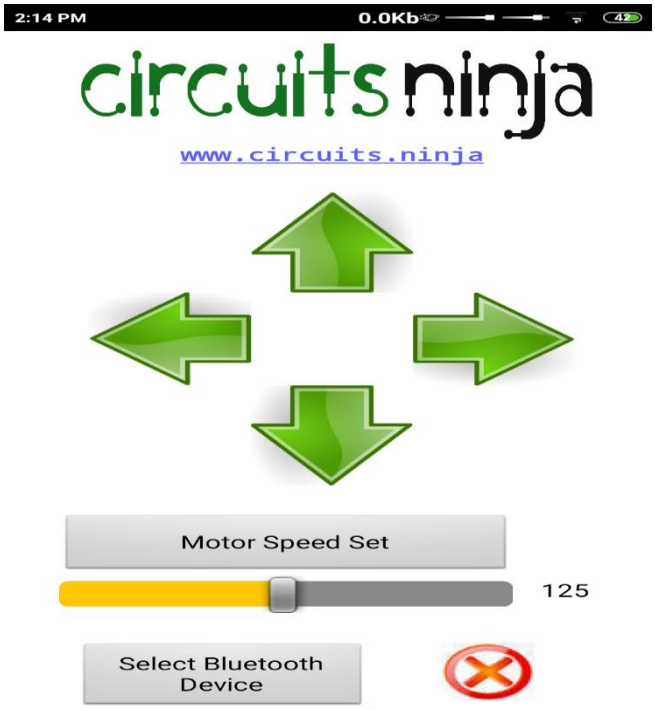


Figure 4.3.1: - UX Design

4.4 Implementation Requirements

Raspberry Pi 3b+ - This device is used to run the whole object detection model. A python script will be run by this device. It connected with the camera to get the video feed of the environment and process the feed to give a desire output.

Raspberry Pi 5MP camera module – This a camera module that we use to capture real time view.

Arduino Uno - In our project we have used this micro controller to provide instruction for our car.

Motor Driver L298N – we use this driver to control our motor speed and the direction of our motor to go Forward, Backward, Left and Right.

DC Motor – Motor is used to move the car in different manner.

Bluetooth Driver HC-05 –It is used in our device to connect with controller and send instruction to Arduino from user.

Battery 12V - 12 voltage is used to powering up our device.

Car Chassis – We used a chassis kit for our project build.

Wheel – It is used for movement.

TensorFlow API –In this project we have trained our classifier through this TensorFlow model.

Python –We have used python to run various script.

Arduino IDE –We have used Arduino IDE to compile and upload the code to the Arduino.

Label IMG – We have used this software to label our image in XML format from which later we train our classifier.

Photo Editor – We have used this is software to customize our data image.

Linux Operating System – It is used to make a compatible environment to develop our project.

Ninja Circuit (Android Application) – It is used to send user command to the Arduino for movement of the car.

CHAPTER 5

Implementation and Testing

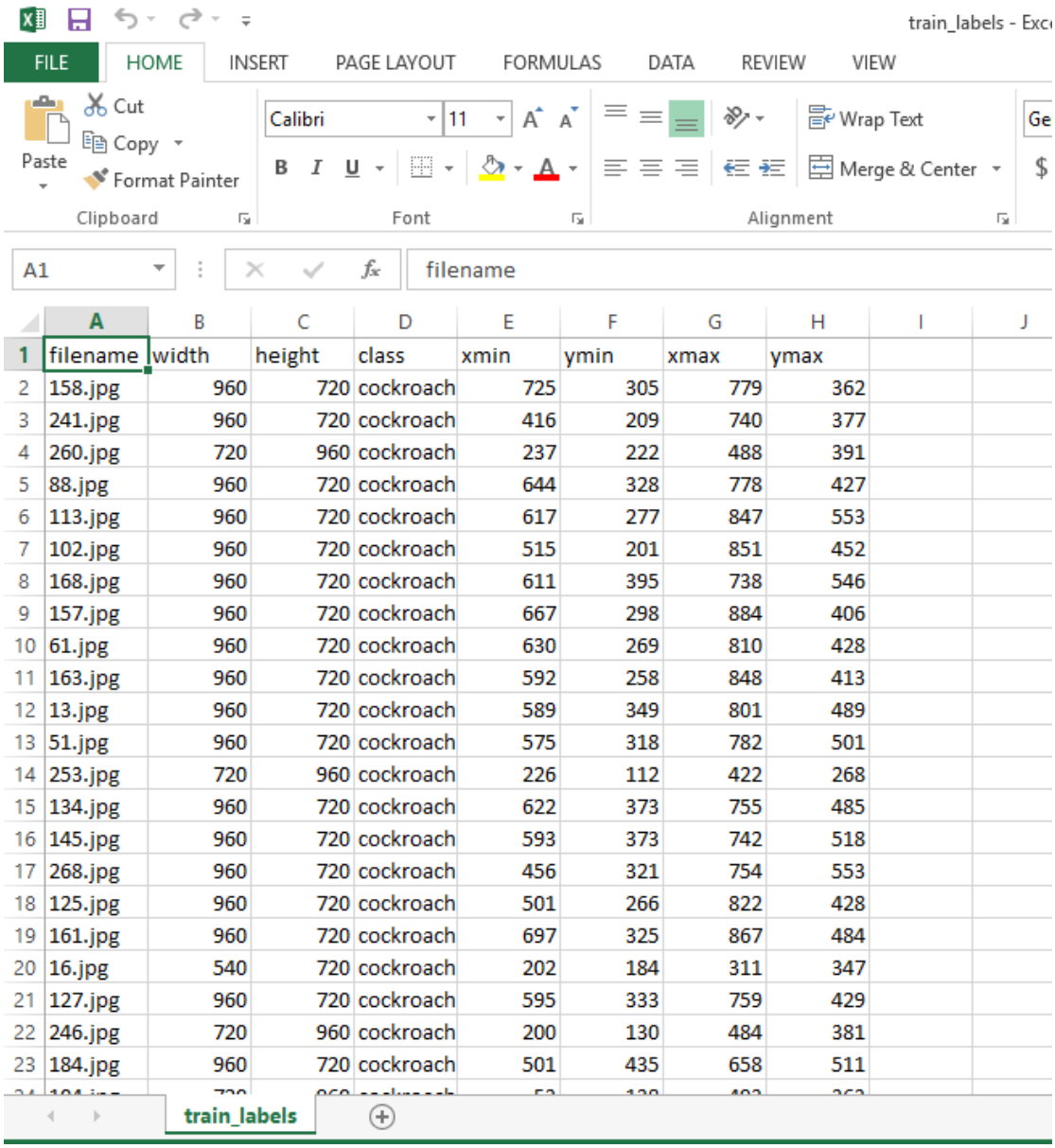
5.1 Implementation of Database

A1 | filename

	A	B	C	D	E	F	G	H	I	J	K
1	filename	width	height	class	xmin	ymin	xmax	ymax			
2	3.jpg	960	720	cockroach	8	94	874	720			
3	187.jpg	720	960	cockroach	335	209	535	471			
4	304.jpg	720	960	cockroach	246	163	509	563			
5	200.jpg	720	960	cockroach	165	125	607	387			
6	199.jpg	720	960	cockroach	15	127	396	381			
7	212.jpg	720	960	cockroach	98	165	569	450			
8	217.jpg	720	960	cockroach	141	135	466	534			
9	4.jpg	540	720	cockroach	213	1	538	478			
10	294.jpg	720	960	cockroach	75	212	503	380			
11	221.jpg	720	960	cockroach	18	135	513	568			
12	219.jpg	720	960	cockroach	93	9	413	528			
13	224.jpg	720	960	cockroach	53	162	525	525			
14	287.jpg	960	720	cockroach	567	90	855	430			
15	291.jpg	720	960	cockroach	135	162	565	325			
16	215.jpg	720	960	cockroach	116	143	548	415			
17	216.jpg	720	960	cockroach	135	90	456	566			
18	301.jpg	720	960	cockroach	60	72	347	381			
19	201.jpg	720	960	cockroach	185	160	585	405			
20	191.jpg	720	960	cockroach	271	56	547	468			
21	299.jpg	720	960	cockroach	51	62	341	387			
22	223.jpg	720	960	cockroach	143	205	588	525			
23	295.jpg	720	960	cockroach	281	156	482	560			

test_labels

Figure 5.1.1: - Test Labels Data



train_labels - Exc

FILE HOME INSERT PAGE LAYOUT FORMULAS DATA REVIEW VIEW

Cut Copy Format Painter Paste Clipboard

Calibri 11 Font

Wrap Text Merge & Center Alignment

A1 filename

	A	B	C	D	E	F	G	H	I	J
1	filename	width	height	class	xmin	ymin	xmax	ymax		
2	158.jpg	960	720	cockroach	725	305	779	362		
3	241.jpg	960	720	cockroach	416	209	740	377		
4	260.jpg	720	960	cockroach	237	222	488	391		
5	88.jpg	960	720	cockroach	644	328	778	427		
6	113.jpg	960	720	cockroach	617	277	847	553		
7	102.jpg	960	720	cockroach	515	201	851	452		
8	168.jpg	960	720	cockroach	611	395	738	546		
9	157.jpg	960	720	cockroach	667	298	884	406		
10	61.jpg	960	720	cockroach	630	269	810	428		
11	163.jpg	960	720	cockroach	592	258	848	413		
12	13.jpg	960	720	cockroach	589	349	801	489		
13	51.jpg	960	720	cockroach	575	318	782	501		
14	253.jpg	720	960	cockroach	226	112	422	268		
15	134.jpg	960	720	cockroach	622	373	755	485		
16	145.jpg	960	720	cockroach	593	373	742	518		
17	268.jpg	960	720	cockroach	456	321	754	553		
18	125.jpg	960	720	cockroach	501	266	822	428		
19	161.jpg	960	720	cockroach	697	325	867	484		
20	16.jpg	540	720	cockroach	202	184	311	347		
21	127.jpg	960	720	cockroach	595	333	759	429		
22	246.jpg	720	960	cockroach	200	130	484	381		
23	184.jpg	960	720	cockroach	501	435	658	511		

train_labels

Figure 5.1.2: - Train Labels Data

In above train labels data and test labels data we have shown you the csv file which has been created after running python script XML to CSV from XML file which was generated from picture running through LabelImg software. This CSV file is very important to generate TF record.

5.2 Implementation of Front-end Design

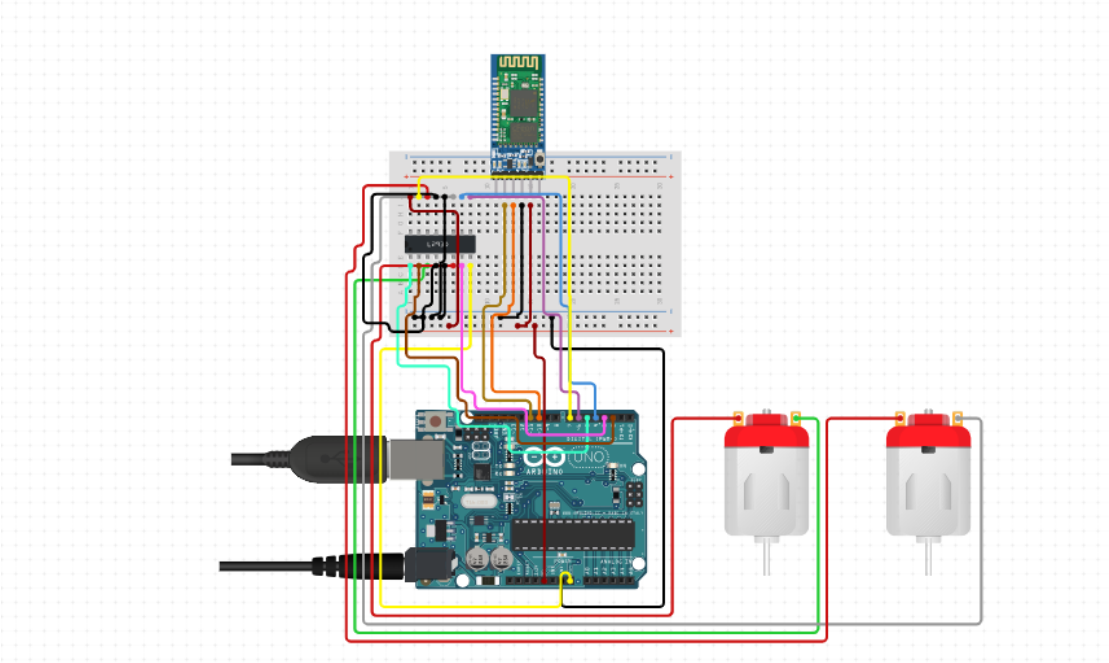


Figure 5.2.1: - Circuit Diagram of Arduino with HC-05 and L293D

In above picture we have shown you the circuit diagram of Arduino with HC-05 and L293D which is the main architecture of our vehicle design.

5.3 Implementation of Interactions

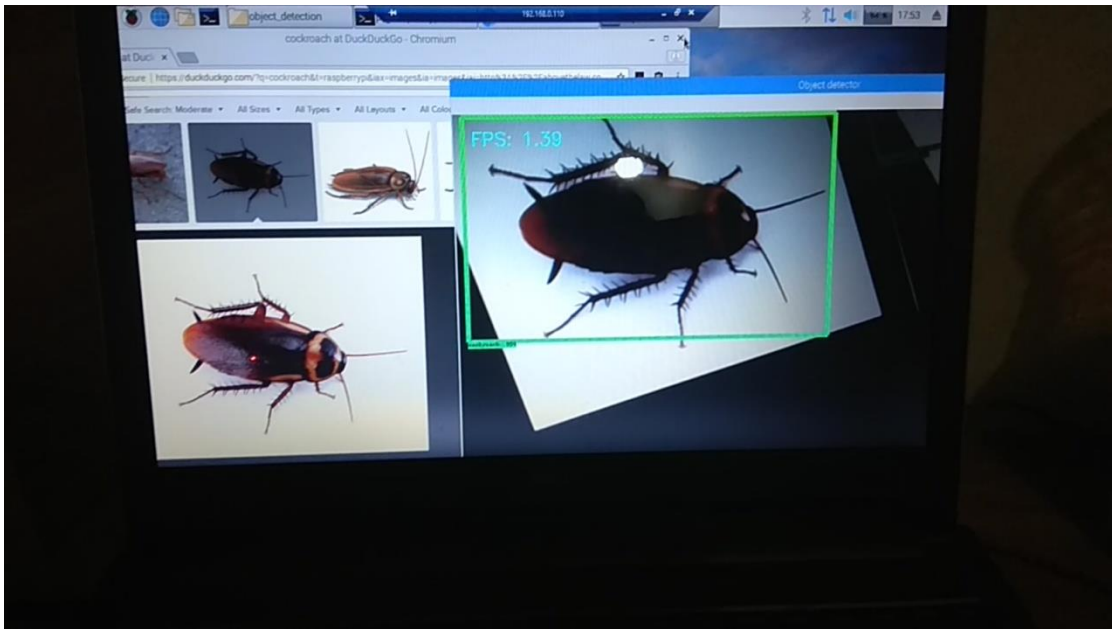


Figure 5.3.1: - Cockroach Detection

In the above figure we have shown the successful complementation of cockroach through pi camera module.

5.4 Testing Implementation

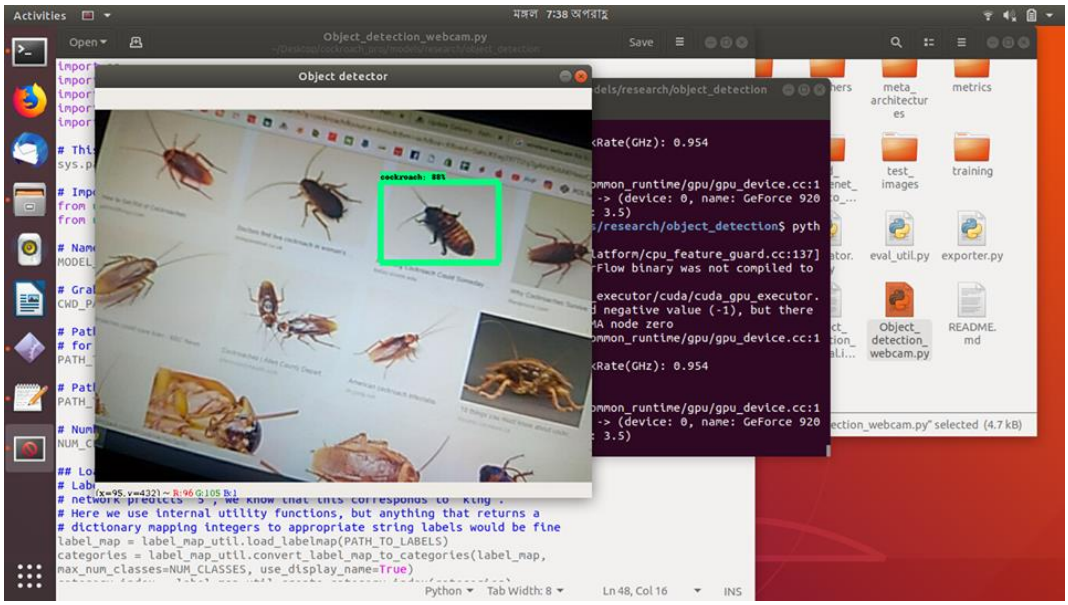


Figure 5.4.1: - Testing with random cockroach image a

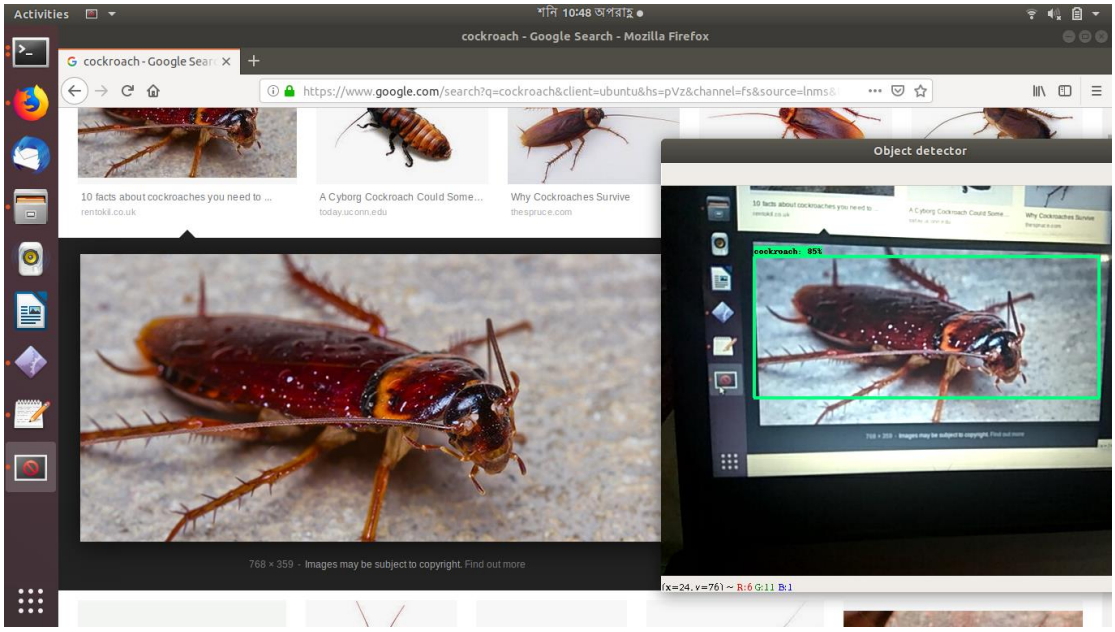


Figure 5.4.2: - Testing with random cockroach image b

We have used random image if our trained model can detect image that we haven't used and it successfully detect any cockroach image.

5.5 Test Results and Reports

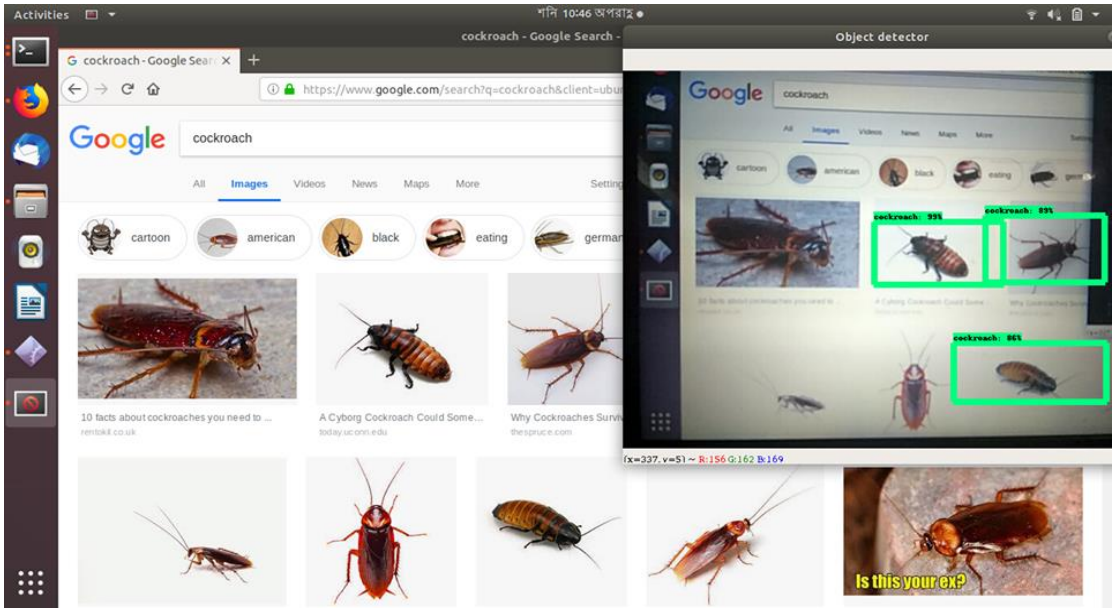


Figure 5.5.1: - Cockroach image with highest accuracy

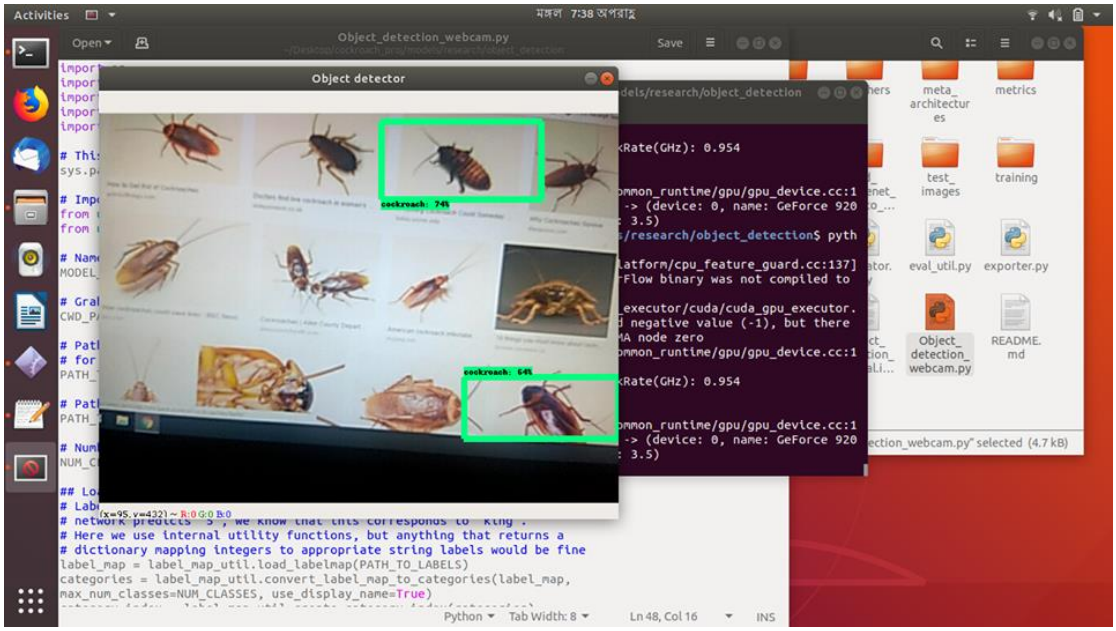


Figure 5.5.2: - Cockroach image with lowest accuracy

In above figure we have showed image with highest and lowest accuracy. Highest accuracy we have got 99% and lowest accuracy we have got 74%. Our image processing is accuracy is 70%.

CHAPTER 6

Conclusion and Future Scope

Discussion and Conclusion

The aim of this project is to create a device which will be portable and it will be able detect object with the help of image processing. It will help to meet society with safe and healthy surroundings. The image detection process was created with the help of tensor flow. Tensor flow uses different neural networking model and algorithms of deep learning and machine learning to provide accurate object detection.

Our device is very easy to use. It combines application from image processing and robotic vision which will create new boundary in technological field.

Scope for Further Developments

- We want to make the device embedded so that it can move as its own decision.
- We want to reduce its size so it can go in compact places.
- We want to add more features so it will not only detect cockroach but also another pest
- We want to add some features so it will be able to eliminate pets.
- We want to develop feature so that it can track a cockroach when it is not in front of camera
- We want to detect cockroach without light and in dark places

Appendix A: Current Situation for our device in our country & Code for Object detection

In current situation there is no permanent solution of pest control and any kind of device in our country. It's because we are not thinking about the problem seriously. When we face any kind of health issue we go to doctor or take medicine. But we forgot a simple thing prevention is better than cure. This kind of device will not only help in pest control but also in many fields.

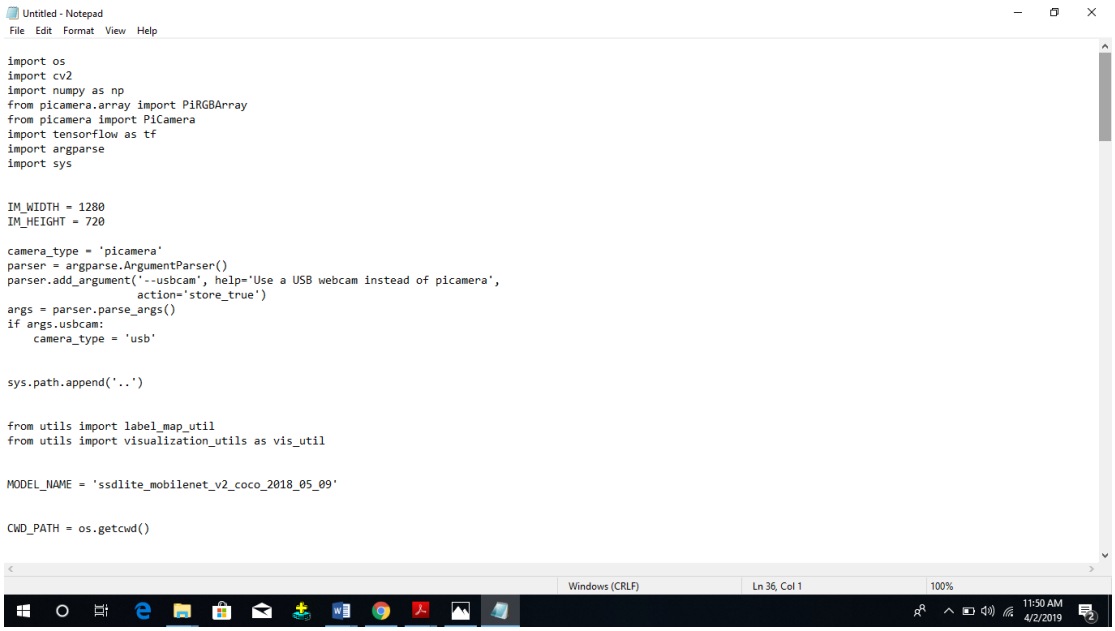


Figure A: - Code for image detection

REFERENCES

[1] Learn about Cockroaches and HealthDr. Jorge Parada<https://www.pestworld.org>last accessed on 01-04-2019 at 3:00pm.

[2] J. Kramer and M. Scheutz, "Development environments for autonomous mobile robots: A survey," Autonomous Robots, vol. 22.

[3] Luo, R.C. Chou, Y.T. Liao, C.T. Lai, C.C. Tsai, A.C. ,Nat. Chung Cheng Univ., Min-Hsiung, "NCCU Security Warrior: An Intelligent Security Robot System", IEEE IECON, p2960, Nov. 2007.

[4] Learn about cram available at <<https://www.evolving-science.com/>>last accessed on 21-03-2019 at 12:00pm.

[5] Learn about harm available at<<https://www.seas.harvard.edu/>>last accessed on 24-03-2019 at 2:00am.

[6]Learn about tensorflow available at

<<https://github.com/EdjeElectronics/TensorFlow-Object-Detection-on-the-Raspberry-Pi/blob/master/Object_detection_picamera.py?fbclid=IwAR1IvqmRABGvEQCq1LWpBgM__nKmvirli1jrdrGLfSuTmhgA_d_SzzWGVTg >>last accessed on 01-02-2019 at 2:00pm.

[7]Learn about intelligent car available at

<<https://www.academia.edu/6861884/A_Project_Report_On_INTELLIGENT_CAR_USING_IMAGE_PROCESSING >>last accessed on 01-04-2019 at 3:00pm.

[8] Learn about tensor flow and its algorithm available at

<<https://www.infoworld.com/article/3278008/what-is-tensorflow-the-machine-learning-library-explained.html>>last accessed on 01-04-2019 at 3:00pm.

Document Viewer

Turnitin Originality Report

Processed on: 02-Apr-2019 14:31 +06
ID: 1104382531
Word Count: 4111
Submitted: 1

Robotic Car for Cockroach Detection By Nafiz Ahamed

Similarity Index	Similarity by Source	
6%	Internet Sources:	2%
	Publications:	1%
	Student Papers:	6%

include quoted | exclude bibliography | exclude small matches | download | refresh | print | mode: quickview (classic) report

3% match (student papers from 09-Apr-2018)
Submitted to Daffodil International University on 2018-04-09

1% match (publications)
Rahul Vijay Soans, Ranjith, Abhilash Hegde, Chandra Singh, Adithya Kumar, "Object tracking robot using adaptive color thresholding", 2017 2nd International Conference on Communication and Electronics Systems (ICCES), 2017

<1% match (student papers from 26-Dec-2018)
Submitted to Universiti Teknologi MARA on 2018-12-26

<1% match (Internet from 15-Feb-2019)
https://mytectutor.com/category/arduino/

<1% match (Submitted to Colorado State University)
Submitted to Colorado State University

<1% match (student papers from 21-Feb-2019)
Submitted to Harrisburg University of Science and Technology on 2019-02-21

<1% match (student papers from 28-Apr-2018)
Submitted to University of Greenwich on 2018-04-28

<1% match (Internet from 31-Mar-2019)
https://lightninginabox.co/product/btcpi-no-case/

<1% match (Internet from 02-Aug-2014)
http://latestandroidversion.com

CHAPTER ONE INTRODUCTION 1.1 Introduction The concept of machine able to see is not new. This stuff has been introduced in science fiction decades ago. But it was not possible for us back then. With the advancement of science it was possible for us to make robotic vision reality. Our project aims to develop a device which will be able to move in different direction as the user pleases and it will be able to detect a certain kind of pest cockroach. Our project is divided into two parts hardware and software. Hardware part is divided into two parts first part is consisted of Arduino which is responsible for operating the robotic car and second part is consist of raspberry pi and camera module which will be able to detect cockroach image. In software part we have mainly used tensor flow to train our data model and many different software for many small requirements. 1.2 Motivation ? Cockroach generally thrive in warm environments that's why we find them in warm places and densely populated buildings of cities. ? Cockroach causes serious health problems like allergy and asthma because it contains a specific protein called allergen [1]. ? Many different virus & bacteria are transported by cockroach that are through their body which is harmful for human ? To make cockroach mitigate people use different pesticide which causes serious problems for both human and our environment. ? Cockroach can contaminate food with their salvia which causes serious food poisoning. ? ? ? ? ? 1.3 Objective Our device reduces human effort to reduce cockroach. Our device can be modified to detect any object with help training. Our future works involves not only detect it but also eliminate it. Human can only detect cockroach when it is visible to eye but our device is able to move freely without any exhausted. Our device provides easy controlling system so that people of all ages can control it. 1.4 Expected outcomes ? Our device will be able to move in places which is difficult for human ? It will be able to detect cockroach in real time in any position ? Our device will be to provide clean environment ? Our device is easy to operate ? It will very much secure for human ? ? ? ? ? ? 1.5 Layout of the report Chapter 1 we discuss about our device, its objective, motivation and our expected outcome. Chapter 2 we discuss about ongoing work and related work, Challenges we faced and scope of problems. Chapter 3 we dealing with design requirements and our project development requirements Chapter 4 we are talking about our device design in detail and all requirements. Chapter 5 we are discussing about our device implementation and testing Chapter 6 is all about the summary of device, its result and future scope CHAPTER TWO BACKGROUNG 2.1 Introduction Cockroach is among of the most common pest found in densely populated buildings in cities and homes. Cockroach has amazing ability to survive in very critical condition. Cockroach are pest because of their filthy habits. They search for food at night in kitchen, rubbish bin, sewer and drain etc. In addition it sometimes attack eyelash, hair and finger nails of sleeping human. It also causes serious problems for health. In Bangladesh cockroach problem is not new. As it causes serious problems, people want to get rid of it as soon as possible. But it also have a negative effect. Since 1990 the use of chemical products and pesticide has increased doubled in numbers. It causes serious problem to environment. But cockroach generally dwell at night so it is impossible to human to always keep eye on their food supply and surroundings. With the advancement of science and technology image processing application has gained much more scope. In industries, defense, surveillance and security image processing application with robotic vision has gained much more importance [2] [3]. Among those application objection detection has played an important role. The main objective of this project is to build a device which will be able to detect cockroach in real time using image processing and this device will also be able to move freely in plain spaces. This device will be controlled by a user and it will reduce human effort to keep eye on food storage and surroundings. It will help to build clean and safe environment for human. 2.2 Related Works Our project aims to combine robotic vision and image processing. There are many ongoing projects are happening all around the world to combines robotic vision and image processing. But none of them are doing the exact work we tend to do. There is no mention of any system or device to detect pest in our country and the world. Our project aims to design a device which will be able to move in places controlled by a user. It will be able to detect cockroach which will help people to ensure safe environment and health. This device will be easy to operate and control. As it is a small device so there will be no problem for shift it from one place to another. However we find some projects that tends to combine image processing and robotic vision. ? Ball following robot ? Line following robot ? Finger gesture based steering control robot ? Virtual steering robot ? Motion Detection using DIP All these projects are using image processing and robotic vision and many other techniques to achieve their goal for different means. Even there is some cockroach inspired robots which mimics the amazing ability of cockroach ? CRAM- cockroach robot with articulated mechanism which will be able to go in places which is impossible for human and it will also be able to shrink it body size in half. This robot is developed by US Berkeley [4]. ? HARM- Harvard Ambulatory Micro robot is developed by Harvard JOHN A PAULSON School of Engineering which can run very fast, shift change position, jump [5]. 2.3 Comparative Studies The purpose of our device is completely different from all the existing device. But the main concept and the process we followed is built our device is quiet same. Both our device and existing device have combined robotic vision and image processing to