A METHOD FOR OBJECT DETECTION TO HELP BLIND PEOPLE USING MACHINE LEARNING

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This Report Presented in Partial Fulfillment of the Requirements for the

Degree of Bachelor of Science in Computer Science and Engineering

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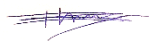**DAFFODIL INTERNATIONAL UNIVERSITY**

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APPROVAL

This Project titled " **A Method For Object Detection To Help Blind People Using Machine Learning**", submitted by *Md. Mahamudul Hasan*, *Faysal Ahmmed* and *Md. Hasanul Haque* 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 *28 January 2021*.
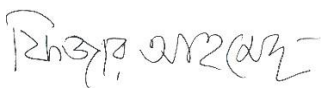
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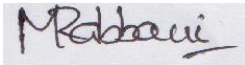Daffodil International University

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DECLARATION

We hereby declare that, this project has been done by us under the supervision of **Masud Rabbani,** Lecturer**, Department of CSE** 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 or diploma.

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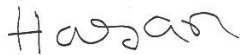ID: 171-15-9334
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Finally, we must acknowledge with due respect the constant support and patients of our parents.

ABSTRACT

The proposed project is made for blind people for detecting object in outdoor and indoor both. There are huge numbers of blind people on the world. According to World Health Organization (WHO) there are about 285 million visually impaired people in the world, In these people around 39 million are blind. 82% people are blind whose age are 50 years and older [1]. It changed the visual world to the visually impaired people groups and give the data about the object around them just as the area of those objects can distinguish any items from picture, video or live stream. The blind people are facing many difficulties daily for not detecting object. Our project will help them to improve their daily life. It can detect the objects that we face in our daily life.

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CHAPTER 1
INTRODUCTION

1.1 Introduction

As of now, object detection is one of the well-known stages in entire the world. Many useful projects are based on object detection. It is most important to know the accurate object of machine because uses technology related to automation in most of the sectors. Using object detection many works are done nowadays. The project is based on Deep Neural Network (DNN). A list of objects dataset is attached in the project. From that objects are detected by applying DNN. The ssd_mobilenet_v3 model has used in the project. It is a Single-Shot multibox Detection (SSD) network used to detect object. The Common Objects in Context (COCO) image dataset has used for training the model [2].

1.2 Motivation

One day we were crossing a road on Gulistan Mazar. Suddenly, we saw a blind people was standing there to cross the road. He was unable to cross the road because of heavy traffic on the road. Then we helped the man to cross the road. Another story have to add on this paper for clear our motivation. One of our friend's uncle was faced a car accident. But unfortunately he lost his eye sight. He was unable to detect objects and human around him. That time a thought has come to our mind that if we could make a device that can help blind people like him to detect objects around them, that will be very helpful for them. Then we decided to make this project. There are 0.8 million blind people in Bangladesh which is 0.72% of total population. The estimated number of blind people is 39 million in the world. They face many difficulties everyday for their movement. Without someone's help they can't move properly. So we are trying to make a device that can help them to reduce their efforts and provide efficiency by detect objects through our device.

1.3 Rationale of the Study

This research paper will make easy and efficient of Blind peoples lives and society. Not only for blind person but also in many working place this machine learning research will help. This research can also used in tracking objects by improving it's process and algorithm future, For tracking movement of a cricket bat, or tracking a footballer or racer or tracking a ball during a football match.

1.4 Research Questions

- Does detection effectively work on machine learning?
- Can we detect and identify our objects properly?
- Will it helpful for blind people?
- How will it help blind people?

1.5 Expected Output

- A machine that will help blind people to find specific object in his specific region.
- We want to gain accuracy near 100%. If a blind people can detect his expected object or recognize his closed people through our device that will give us satisfaction.
- Vehicle detection
- Human detection.

1.6 Project Management and Finance

There are nothing to worry about financial issues. There are no complex issue with the project management. It is very easy to manage the project. In future it can be a business model.

1.7 Report Layout

The report is divided into six chapters to present the study. For easier understanding there are some sections under each of the chapter. Chapter 1: Introduction, is the beginning chapter. This chapter has been divided into 7 sub sections. This chapter includes the motivation of the work, expected outcome, research question,. The chapter will help to know what we will analyses throughout the research. In Chapter 2: Background, existing works outcomes were discussed associated with current study. The chapter displays the origin of our research. Differences between related work and present work are also discussed. This chapter has 5 subsections. In Chapter 3: Research Methodology, contains data collection, research subject. The chapter shows the method of work. It displays how data is pre-processed and after that what is the statistical measurement. This section has 5 subsections. It shows the model setup, results and result analysis in Chapter 4: Experimental Results and Discussion. The chapter has 3 subsections. It is about the effect of the study on environment, how its helps society and its sustainability in Chapter 5: Impact on Society, Environment and Sustainability. The chapter includes 4 subsections. The last chapter is Chapter 6: Summary, Conclusion, Recommendation and Implication for Future Research. The chapter is discussed about the ending of the study, summary, our limitations and what will be done with the project in future is discussed. The chapter has 3 sub-sections. At the conclusion of this paper References and Appendices are included that will be helpful for studying the paper more easily and effectively.

CHAPTER 2
BACKGROUND

2.1 Terminologies

Detecting object is new trend in machine learning. It is connected to image processing and computer vision.

2.2 Related works

Object detection is not a new technique today. Many works has been done with object detection before. Some works with object detection are "Improving shadow suppression in moving object detection with HSV color information" [3]. "Region-based Segmentation and Object Detection" [4]. "Object detection based on an adaptive attention mechanism" [5]. "From images to shape models for object detection" [6]. "Salient Object Detection: A Benchmark" [7].

2.3 Comparative Analysis and Summary

There are many projects based on object detection. But our project is different from those. Some projects used Fast R-CNN model, Histogram of Oriented Gradients (HOG), Spatial Pyramid Pooling (SPP-net), YOLO. But we use ssd_mobilenet_v3 model. That is different from others. Here we used 91 objects to detects and the result is so impressive. In YOLO model GPU needs to use. But in our project we didn't need to use GPU because of our ssd_mobilenet_v3 model.

2.4 Scope of the Problem

In our project there is nothing to worry about scope. We used to follow different projects. We also trying to us separate models in our projects to gain more accuracy. But finally the model we are using in this project is much better than others. It gives higher accuracy in low time and it is also easy to train.

2.5 Challenges

There are some challenges in object detection. Sometimes background of image is complex. There are similarities between several types of object like human and doll. It recognize sometimes doll as human. So, it not only founded on single feature like shape, color, size etc. Same species object will be changed because of size, color, viewpoint, shape etc. sometimes.

CHAPTER 3
RESEARCH METHODOLOGY

3.1 Research Subject and Instrumentation

Machine learning is our research subject. We detected object using machine learning tools. Different machine learning API and algorithm are used in object detection. In our project we are detecting various types of object. Preliminary we are detecting 91 types of object. They are –

Table 3.1: The objects which are used in the project

Number	Object	Number	Object	Number	Object	Number	Object
1	person	11	fire hydrant	21	bear	31	elephant
2	bicycle	12	street sign	22	zebra	32	bear
3	car	13	stop sign	23	shoe	33	zebra
4	motorcycle	14	parking meter	24	handbag	34	shoe
5	airplane	15	bench	25	bottle	35	skis
6	bus	16	bird	26	plate	36	snowboard
7	train	17	cat	27	cup	37	sports ball
8	truck	18	sheep	28	fork	38	kite
9	boat	19	cow	29	sheep	39	baseball bat
10	traffic light	20	elephant	30	cow	40	Baseball glove

Number	Object	Number	Object	Number	Object	Number	Object
41	Skateboard	54	sandwich	67	dining table	80	toaster
42	surfboard	55	orange	68	window	81	sink
43	tennis racket	56	broccoli	69	desk	82	refrigerator
44	bottle	57	carrot	70	toilet	83	blender
45	plate	58	hot dog	71	door	84	book
46	wine glass	59	pizza	72	tv	85	clock
47	cup	60	donut	73	laptop	86	vase
48	fork	61	cake	74	mouse	87	scissors
49	knife	62	chair	75	remote	88	teddy bear
50	spoon	63	couch	76	keyboard	89	hair drier
51	bowl	64	potted plant	77	cell phone	90	toothbrush
52	banana	65	bed	78	Microwave	91	hair brush
53	apple	66	mirror	79	oven		

For detecting these objects, we had used some equipment. Using these equipment, we have completed our project. These equipments are:

❖ Devices:
    i.   Smartphone
    ii.   Laptop

❖ Software:
    i.   Anaconda 3
    ii.   Jupyter notebook

❖ Model:
    i.   Ssd_mobilenet_v3. coco

❖ Packages

i. Jupyter

ii. OpenCV- python

3.2 Data Collection Procedure

The most important things of any project is data. If the quality of data is good, the train will be good. The accuracy of result will be more when we will use more data to train. By two way we collect data for our project. They are -

- Capture Image: Most of our data were collected by capturing on our smartphone. There are three sources to collect our data. They are -

  a. From Road

  b. From Market

  c. From House

- Download Image: We have also collected some data from internet.

We went to Highway road to collect our data. There we take some pictures of vehicles that will help to research in future. After that we went to different market to collect data. After returning home we took more picture of our selected objects. And in the last we collect some data from internet. We downloaded some data from facebook and google image.

3.3 Statistical Analysis

First of all, we plan to build a model that detect every type of objects in our country. But it was very difficult for us. Finally, we collected 500 image of objects which contains 91 class. To build our dataset more efficient we preprocessed our data until it removes inconsistence and inappropriate data. After processed we have finally got 273 data. Every class has same number of data that means 3 data for each class.

3.4 Applied Mechanism

It takes 7 steps to train up the model with our dataset. The steps are:

- Collecting Images.
- Setting up the environment.
- Install required Packages.
- Preprocessing data
- Download ssd_ mobilenet_v3 model.
- Training the model
- Export the model

Collecting Image :

We have collected the images from different fields by using smartphone's camera and downloading from internet.

Setting Up The Environment:

We use jupyter notebook for our environment. For setting up environment it takes some steps.

- ➢ Create a new Notebook.
- ➢ Rename the file.
- ➢ Start the Kernel

Install Required Package:

Jupyter notebook has most of the package like Python, Pandas, Numpy etc. are pre-installed. But some packages are not installed and those are installed by running.

Preprocessing Image:

There were different shape of images in our collection. We make the image in same format and size. To build our dataset more efficient we preprocessed our data until it removes inconsistence and inappropriate data.

Download ssd_ mobilenet_v3 model:

In 2017 an object detector was released called MobileNet as an effective CNN architecture build for computer vision and mobile application. Proven depth-wise separable convolutions was used by the architecture to build lightweight deep neural networks [8]. Then v2 and after that v3 was built. We use v3.

Training the model

In this part which have some line of code to write.

> - model main. ipynb which runs the training process.

> - configpath to config the model
> - weightsPath = path to training

Export the trained Model:

After few seconds training model was saved and the model was provide to detect objects.

3.5 Implementation Requirements

For implementing our project we needed some requirements. Without the requirements the implementation of the project was so hard. The main execution requirements are:

> - Device and Software
>   1. Python v3.9
>   2. Jupyter Notebook
>   3. Anaconda
> - Knowledge
>   1. Basics of Machine Learning
>   2. Python Programming
>   3. Basics of neural Networks

CHAPTER 4

EXPERIMENTAL RESULTS AND DISCUSSION
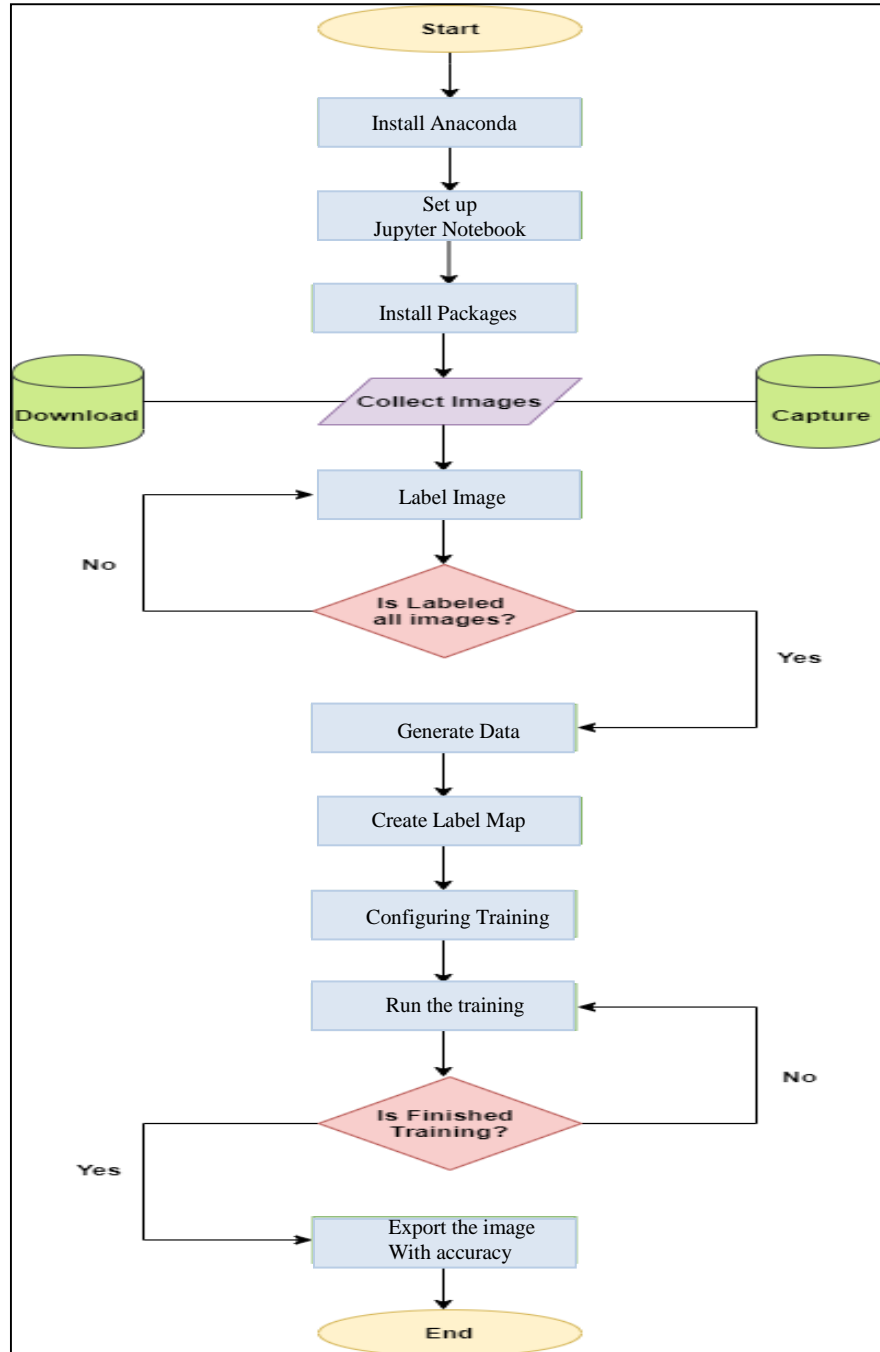
4.1 Experimental Setup

Figure 4.1: Experimental Setup

4.2 Experimental Results

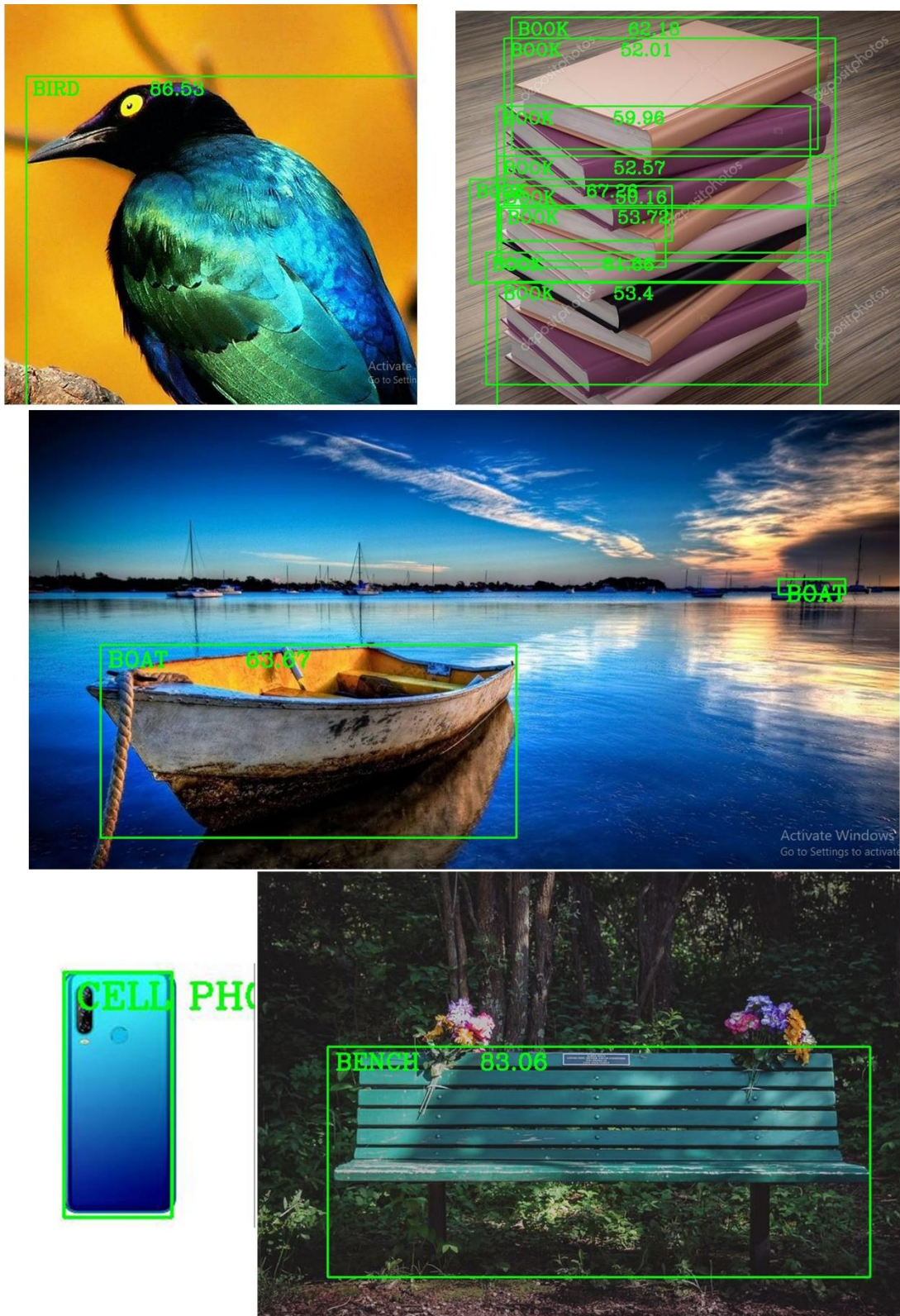Figure 4.2.A : Object Detection Results

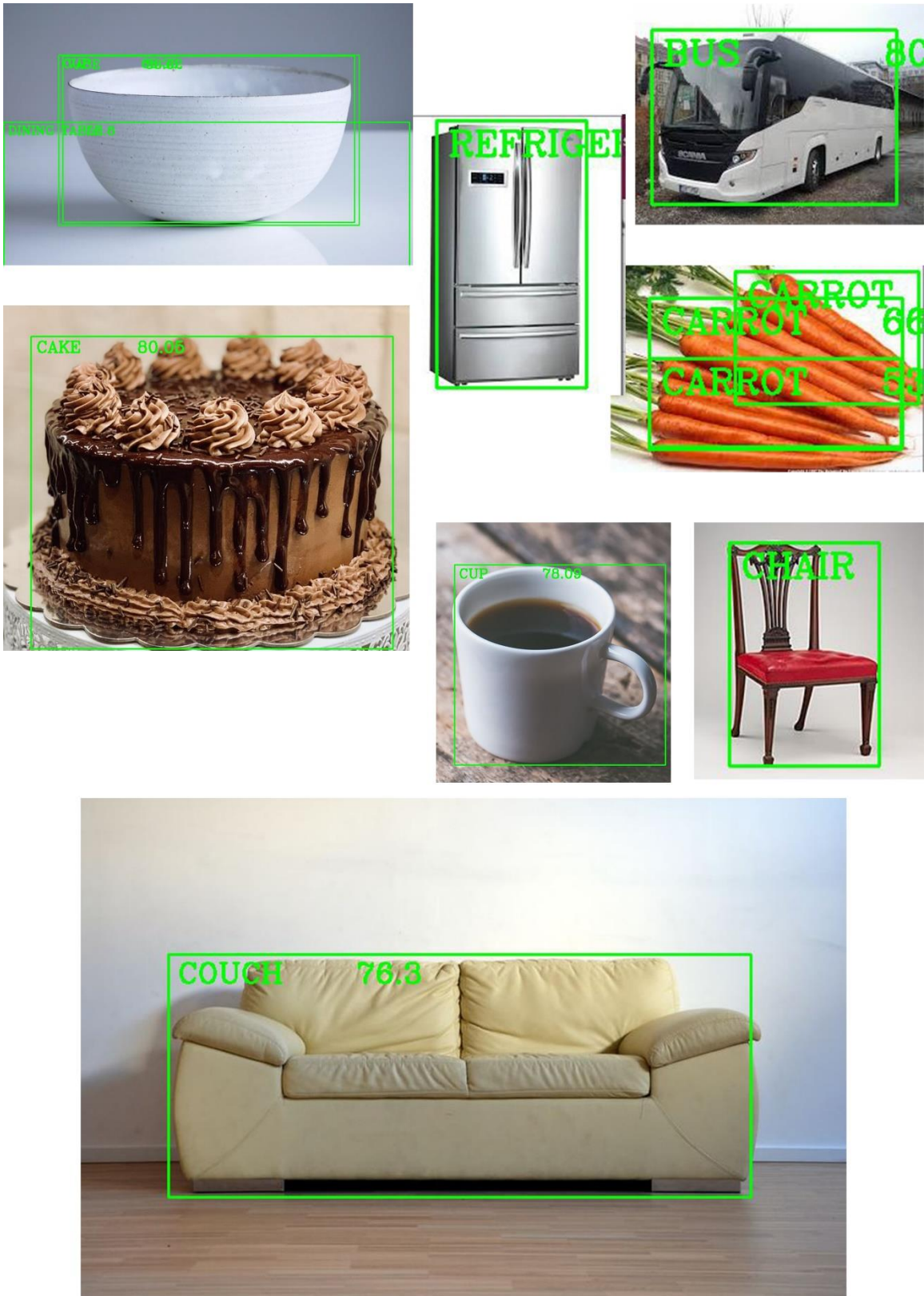Figure 4.2.B : Object Detection Results
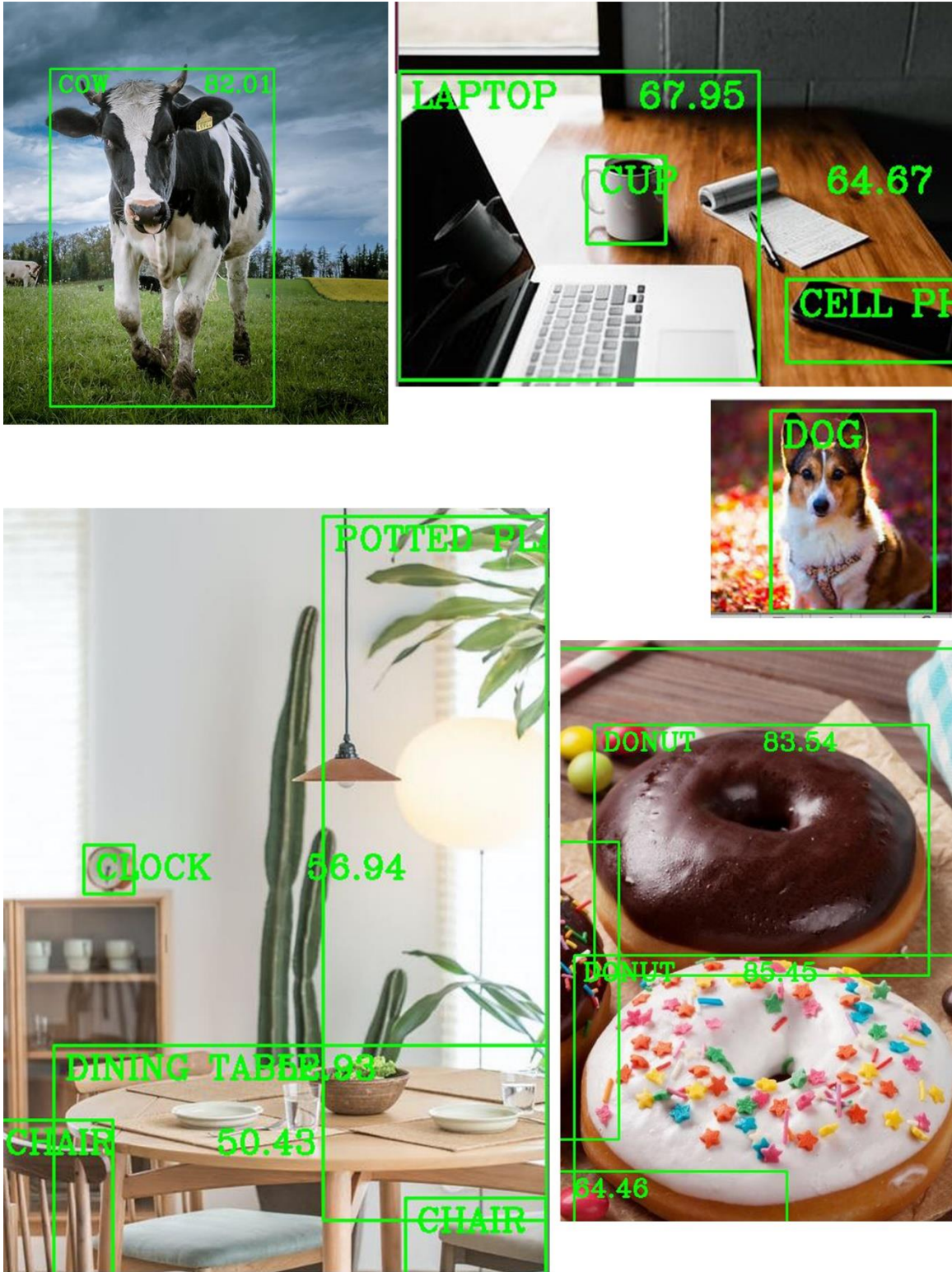
Figure 4.2.C : Object Detection Results

Figure 4.2.D : Object Detection Results

Figure 4.2.E : Object Detection Results

Figure 4.2.F : Object Detection Results
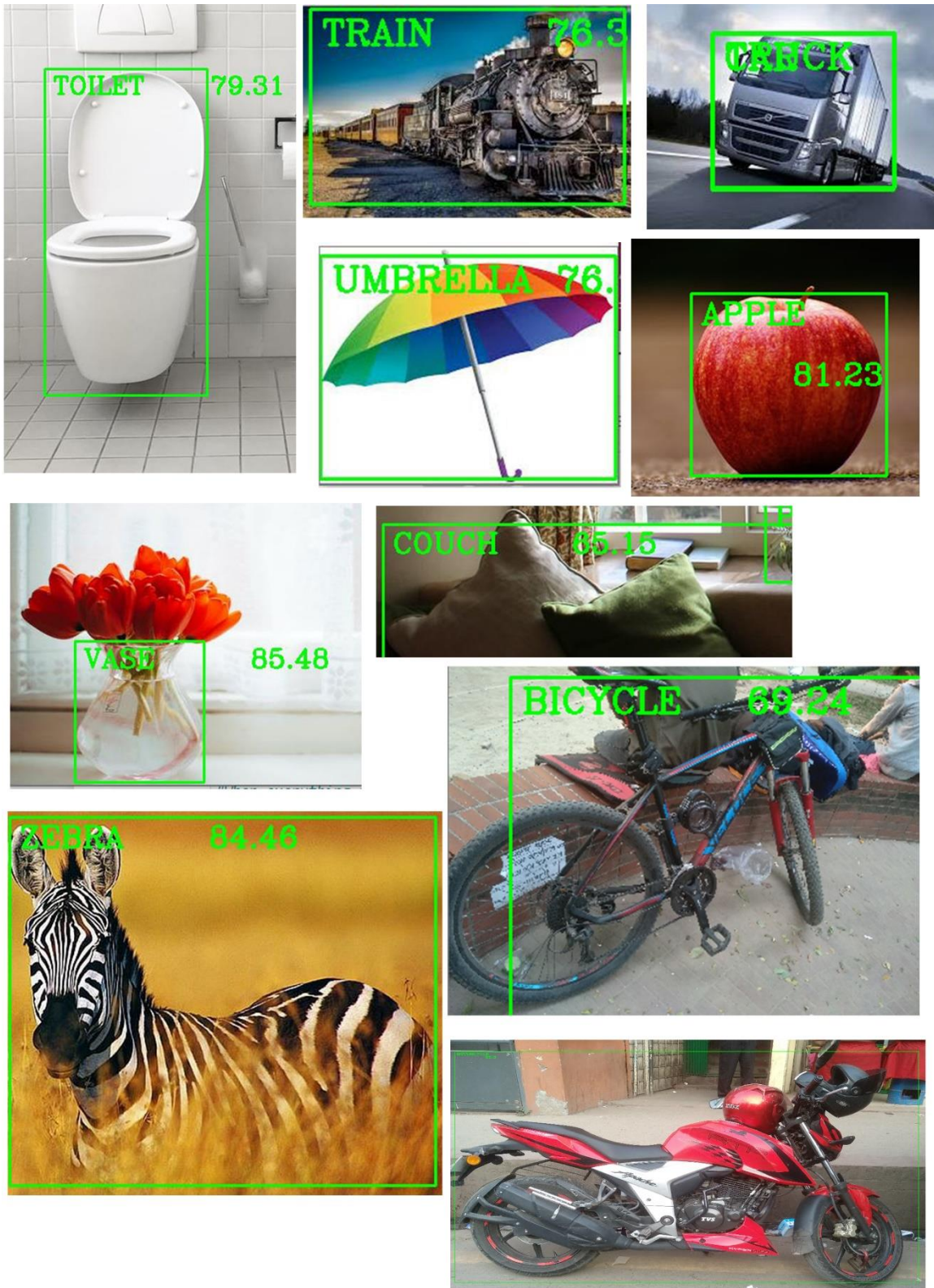
Figure 4.2.G : Object Detection Results

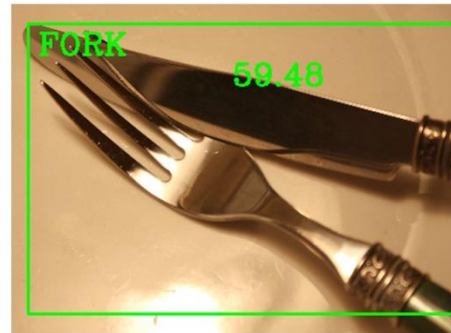Figure 4.2.H : Object Detection Results

Figure 4.2.I : Object Detection Results

4.3 Analysis & Discussion

We totally collected 271 pictures of 91classes objects. Some image aren't classified properly. They shows wrong information. The percentage of bad results is very low. We got a high accuracy. We tested 91 images and from theses 12 images give wrong information and 79 images gave correct information. Our accuracy is 86.81%.

Hope, we can improve it to 100% accuracy and make our project from software to hardware that will help blind people for detecting and also robot in automation.

CHAPTER 5

ENVIRONMENT AND SUSTAINABILITY

5.1 Impact on Society

In automation system, normally the project we have done is used. It will be good influence on our society, if it is used properly. Our life will be more easier by this. This project can be used on glasses of blind peoples. The glasses need to have camera and it will detect object through camera and it will tell the blind people about object through bluetooth headphone. This project can also used in autonomous car and robot. So, it will have a good impact on society.

5.2 Impact on Environment

Genuinely it won't affect on environment. It will not be harmful for nature and our environment because it is just a software. But it can be help to nature and our environment. If we use this technology in recycling company's robot, then it will detect objects and sort the item quickly. That will be helpful for the society.

5.3 Ethical Aspects

From the view of ethical aspect, there are no problem. No cheat or harmful are done by it. For making people's life style easier, it is helping to produce more services. Moor explains computer ethics is a research area that deals with the analysis of the social impact that computer technology causes. Computer ethics is a branch of information ethics that has been built on the foundation of information ethic.

5.4 Sustainability Plan

The sustainability of our project is impressive. Because This era is going to enter in new technology that all are being automation. Everything is getting easier, coming in handy. World's peoples want everything is being easier. We can produce service easily, if the technology can be applied correctly.
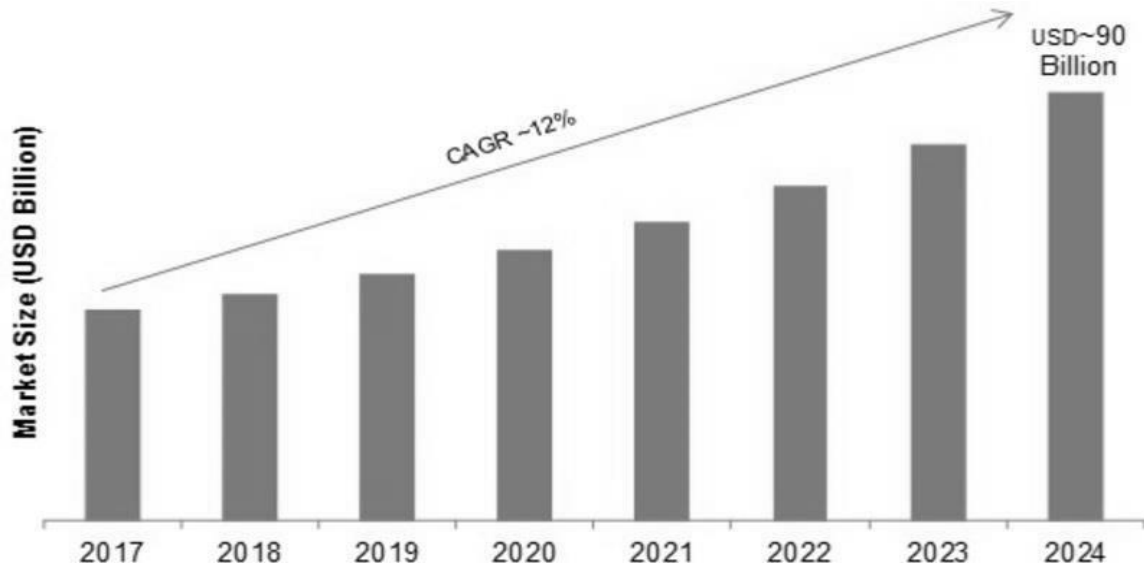
Figure 5.4: Market Size of Automation

Sustainability of this project is assumed from the above statistics. From the report we can see the market size of will reach in 2024 up to $90 Billion USD and this automation is increasing day by day [9].

CHAPTER 6
SUMMARY

6.1 Summary of the Study

The main goal of our project was detecting object. We have a plan that if we can detect any object we can use this method in various ways. In different sector, it will be helpful., we used ninety one different types of vegetable in this project primarily.

To detect those objects we used OpenCV. Also there are some dependencies and library which has already narrated above in this report. We used for training two hundred and seventy three images. We got up to 99% accuracy from test data after training our model.

6.2 Conclusions

Our technology detect multiple objects which is based on Deep Learning. ssd_mobilenet_v3 is a deep learning object detection API which is based on programming model, along single machine and distributed implementations of this programming model. There are two hundred and seventy three images of ninety one different items of real objects. We got up to 99% accuracy from test data after training our model.

In future, we will try by increasing the items and dataset for improved performance and acceptance work. And we also hope that in the field of Object Detection, our project can make the advantage of the computer science.

6.3 Implication for Further Study

For future implication there are many options. Our next mission is convert our project from software to hardware. We want to add it in a glasses which frame have attached camera. Our software will install on the frame and it will detect the objects through the camera and tell the object name through a bluetooth headphone. This will help blind people to detect the objects easily and make their life more easier and efficient.

Reference:

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