A PROJECT REPORT

ON

“PARLEY”

(Hand Gesture Recognition for Deaf and Dumb people)

Submitted to

UNIVERSITY OF MUMBAI

In Partial Fulfilment of the Requirement for the Award of

BACHELOR’S DEGREE IN
COMPUTER ENGINEERING

BY

Mansoori Abdul Rehman Abdullah Saima Bano	17CO34
Siddique Zeeshan Azam Sayeba	17CO50
Pathan Yunus Abdul Bari Anwari Begum	16CO43
Irfan Khan Iqbal	15CO18

UNDER THE GUIDANCE OF
PROF. Amer Syed

DEPARTMENT OF COMPUTER ENGINEERING
Anjuman-I-Islam’s Kalsekar Technical Campus
SCHOOL OF ENGINEERING & TECHNOLOGY
Plot No. 2 3, Sector - 16, Near Thana Naka,
Khandagaon, New Panvel - 410206

2020-2021

AFFILIATED TO

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A PROJECT II REPORT
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CERTIFICATE

This is certify that the project entitled

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submitted by

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Siddique Zeeshan Azam Sayeba	**17CO50**
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Irfan Khan Iqbal	**15CO18**

is a record of bonafide work carried out by them, in the partial fulfilment of the requirement for the award of Degree of Bachelor of Engineering (Computer Engineering) at ***Anjuman-I-Islam's Kalsekar Technical Campus, Navi Mumbai*** under the University of MUMBAI. This work is done during year 2020-2021, under our guidance.

Date: 25/ 05/ 2021

(Prof. Amer Syed)
Project Supervisor

(Prof. Prof. Kalpana R. Bodke)
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Mansoori Abdul Rehman Abdullah Saima Bano
Siddique Zeeshan Azam Sayeba
Pathan Yunus Abdul Bari Anwari Begum
Irfan Khan Iqbal

Project I Approval for Bachelor of Engineering

This project entitled ***P̈arley (Hand Gesture Recognition for Deaf and Dumb people)*¨** by ***Mansoori Abdul Rehman Abdullah*** , ***Siddique Zeeshan Azam*** , ***Pathan Yunus Abdul Bari***, ***Irfan Khan*** is approved for the degree of ***Bachelor of Engineering in Department of Computer Engineering.***

Examiners

1. ....
2. ....

Supervisors

1. ....
2. ....

Chairman

....

Declaration

I declare that this written submission represents my ideas in my own words and where others ideas or words have been included, I have adequately cited and referenced the original sources. I also declare that I have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in my submission. I understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

Mansoori Abdul Rehman Abdullah
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ABSTRACT

1. According to 2011 census of India states that 7 million Indians are suffering from hearing and speech impairment.

2. Sign languages are a visual representation of thoughts through hand gestures, facial expressions, and body movements.

3. Their circle is very much limited. They should not be part of the deaf world alone,which seems cloistered sometimes.

4. Recognition of sign language can be done in two ways, either glove based recognition or vision based Recognition. So, the proposed system uses the vision based recognition method.

5. So conversing in their regional sign language brings more comfort for the people to share their ideas and thoughts among their near and dears.

Keywords: Indian Sign language (ISL), Sign language recognition, Machine Learning, Algorithm, NLP, API, Dataset, Framework, User Interface, Hand Gesture, Convolutional Neural Network (CNN).

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Chapter 1

Introduction

In our society we have people with disabilities. The technology is developing day by day but no significant developments are undertaken for the betterment of these people. Communications between deaf-mute and a normal person have always been a challenging task. Sign language helps deaf and dumb people to communicate with other people. But not all people understand sign language.

1.1 Purpose

It is very efficient system when compared to the existing system. The main objective of this project is to achieve communication of deaf-mute people like a normal person.

1.2 Project Scope

- We develop a complete product that will help the speech and hearing impaired people, and thereby reduce the communication gap.
- It benefits people to share there problems in emergency situation by converting Indian Sign Language (ISL) into text or speech.
- Reducing the communication gap between normal people, deaf and dumb people using our system.
- Our system brings more comfort for deaf and dumb people to share their ideas and thoughts among their near and dears ones.

1.3 Project Goals and Objectives

1.3.1 Goals

- Our main goal with this project is to achieve communication between dumb (person unable to speak) and a normal person.
- We are trying to achieve this goal with minimum expense so that every person can make use of this technology.

1.3.2 Objectives

- Our main Objective with this project is to make an efficient model for this project which works better than the available systems working in the same field.
- We are working tirelessly to provide our users to use this technology without requiring any additional hardware or processor.

1.4 Organization of Report

- Our system brings more comfort in our surrounding for deaf and dumb people to share their ideas and thoughts among their near and dears ones.
- It benefits people to share there problems in emergency situation by converting Indian Sign Language (ISL) into text or speech.

Chapter 2

Literature Survey

2.1 Real-Time Recognition of Indian Sign Language

The real-time sign language recognition system is developed for recognising the gestures of Indian Sign Language (ISL). Generally, sign languages consist of hand gestures and facial expressions. For recognising the signs, the Regions of Interest (ROI) are identified and tracked using the skin segmentation feature of OpenCV. The training and prediction of hand gestures are performed by applying fuzzy c-means clustering machine learning algorithm. The gesture recognition has many applications such as gesture controlled robots and automated homes, game control, Human-Computer Interaction (HCI) and sign language interpretation. The proposed system is used to recognize the real-time signs. Hence it is very much useful for hearing and speech impaired people to communicate with normal people.

2.1.1 Advantages of Paper

a. It takes less datasets as compared to others.

b. The proposed system has produced 75% accuracy in gesture labelling.

2.1.2 Disadvantages of Paper

a. It consume more computational time as compared to other systems..

b. It requies high dimensionality datasets.

2.1.3 How to overcome the problems mentioned in Paper

a. To increase accuracy we used CNN model instead of FCM model.

b. Our system required low dimensionality datasets.

2.2 Real Time Sign Language Gesture Recognition From Video Sequences

Inability to speak is considered to be true disability. People with this disability use different modes to communicate with others, there are number of methods available for their communication one such common method of communication is sign language. Developing sign language application for deaf people can be very important, as they'll be able to communicate easily with even those who don't understand sign language. Our project aims at taking the basic step in bridging the communication gap between normal people, deaf and dumb people using sign language. The main focus of this work is to create a vision based system to identify sign language gestures from the video sequences. The reason for choosing a system based on vision relates to the fact that it provides a simpler and more intuitive way of communication between a human and a computer. In this report, 46 different gestures have been considered.

2.2.1 Advantages of Paper

a. Average accuracy obtained using this approach is 93.3333

b. It requires low resolutions images.

2.2.2 Disadvantages of Paper

a. It requires very large amount of datasets.

b. It requires more training time.

2.2.3 How to overcome the problems mentioned in Paper

a. We develope a system to generate datasets which requires very less time as compare to actually collecting datasets.

b. We use GPU accelaration to reduce training time.

Chapter 3

Project Planning

3.1 Members and Capabilities

Table 3.1: Table of Capabilities

SR. No	Name of Member	Capabilities
1	Mansoori Abdul Rehman Abdullah	Model creating, Database, UI Design
2	Siddique Zeeshan Azam	Model creating, Database, UI Design
3	Yunus Pathan	Dataset Collecting
4	Irfan Khan	Dataset Collecting

3.2 Roles and Responsibilities

Table 3.2: Table of Responsibilities

SR. No	Name of Member	Role	Responsibilities
1	Mansoori Abdul Rehman Abdullah	Team Leader, Developer	Model creating, UI Design
2	Siddique Zeeshan Azam	Developer	Model creating, UI Design
3	Yunus Pathan	Dataset Collector	CollectingDataset
4	Irfan Khan	Dataset Collector	CollectingDataset

3.3 Assumptions and Constraints

3.3.1 Assumptions

- We will get all the resources we need.
- Our team members have all the required skills.

3.3.2 Constraints

- All the resources we required to work with are not available .
- We did not achieve the first milestone within the first month which was required for the further tasks.

- Few of the Engineers were not COMPETENT enough for the project .

3.4 Project Management Approach

1. Agile project management approaches :

   • Simply put, Agile project management is a collaborative methodology comprising short development cycles called "sprints" that incorporate feedback as the project progresses in an effort to embrace flexibility and continuous improvement. The methodology was developed by 17 people in 2001 as an optimized approach for software development. (Read the official Manifesto for Agile Software Development here). Agile project management focuses more on team collaboration and less on a hierarchical leadership structure.

2. We use one of the most popular Agile approaches called as Adaptive Project Framework (APF):

   • This approach is also suited to IT projects requiring a high level of flexibility and adaptability. It was developed by industry expert Robert K. Wysocki and is laid out step by step in his book, Adaptive Project Framework: Managing Complexity in the Face of Uncertainty.

   (a) In the Agile methodology, each project is broken up into several 'Iterations'.

   (b) All Iterations should be of the same time duration (between 2 to 8 weeks).

   (c) At the end of each iteration, a working product should be delivered.

   (d) In simple terms, in the Agile approach the project will be broken up into 10 releases (assuming each iteration is set to last 4 weeks).

   (e) Rather than spending 1.5 months on requirements gathering, in Agile software development, the team will decide the basic core features that are required in the product and decide which of these features can be developed in the first iteration.

   (f) Any remaining features that cannot be delivered in the first iteration will be taken up in the next iteration or subsequent iterations, based on priority.

(g) At the end of the first iterations, the team will deliver a working software with the features that were finalized for that iteration.

(h) There will be 10 iterations and at the end of each iteration the customer is delivered a working software that is incrementally enhanced and updated with the features that were shortlisted for that iteration.

3.5 Ground Rules for the Project

1. Team location: Location of the team is essential in defining ground rules. A combination of stationary and virtual teams would require additional ground rules.

2. Team ethnicity: Consider the ethnicity of the team members and add few ground rules for effective team work.

3. Project duration: Ground rules are important for any project irrespective of the length of the project. Consider the length of the project for defining urgency of implementation.

4. Team skills and expertise: Team members should have a mix of skills and expertise in the domain to ensure the success of a project.

5. Project meeting

   - Be on time for all team meetings.Team leader must create and disseminate agendas for each team meeting.
   - Team leader must create and disseminate minutes after each team meeting.
   - Attend full duration of all team meetings unless a case of emergency.
   - Avoid informal/social talk during team meetings. Build in brief informal/-social talk time before or after team meetings.
   - Be patient with alternative viewpoints, different kinds of learners, writers, speakers.
   - No responsibilities to be assigned unless the person who is being assigned the responsibility accepts it. If a person to be given a responsibility is not at the meeting, the team leader must review that assignment or action item with the person before the responsibility is designated.
   - Set aside a regular weekly meeting time that's kept open by all members from week to week.

- Keep the meeting schedule flexible, arranging meetings as needed and based on availability.

6. Project decisions

   - Require consensus on all major team decisions.
   - Avoid apathetic/passive decision making (e.g., “whatever you all think is right”).

7. Project delivery

   - Inform team leader if unable to complete work on time.
   - Seek reader/listener feedback before handing in all deliverables.
   - Set deadlines for each deliverable in advance of due date to allow for collaborative revisions.

8. Team attitude and culture

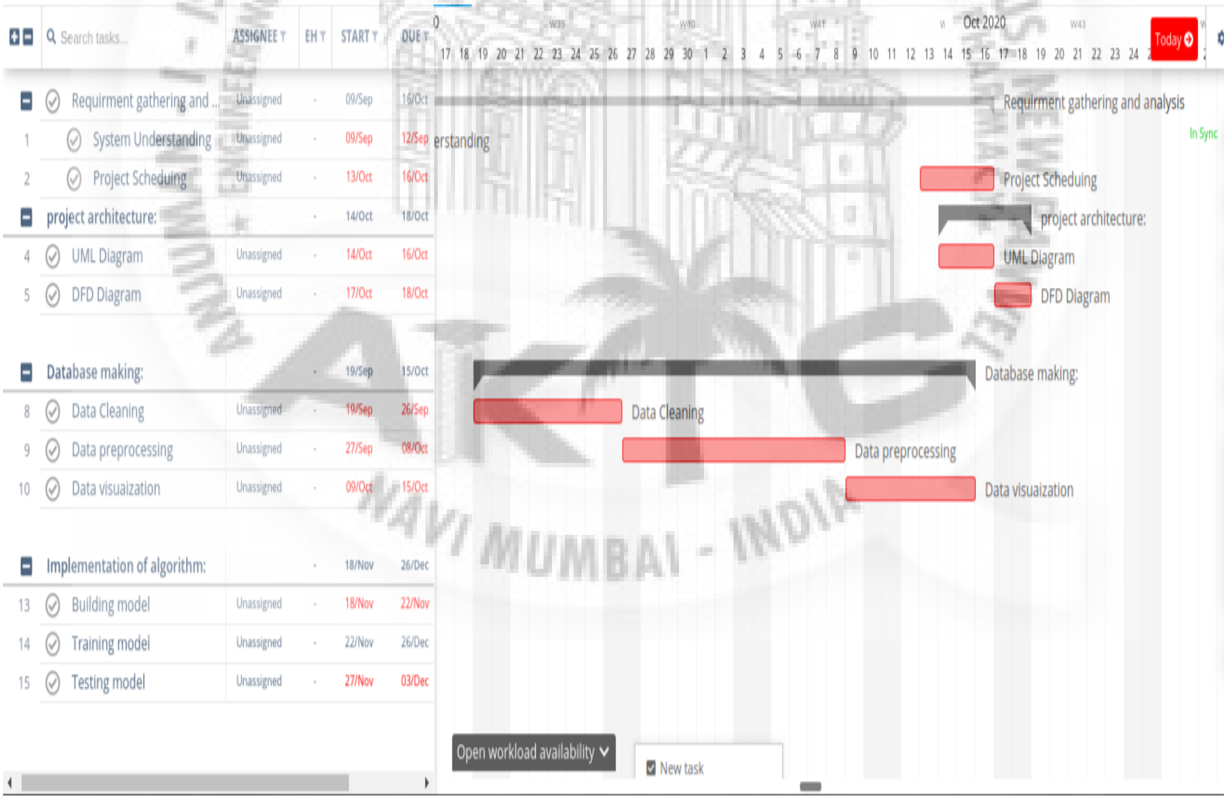
   - Rotate responsibilities so each person gets experience with several aspects regardless of quality or qualifications.
   - Make criticisms constructive with suggestions for improvement and nonjudgmental language.
   - Confront issues directly and promptly.
   - Promptly relay all interpersonal concerns/conflicts to team leaders.
   - Keep a positive attitude toward the team, individual members, projects and course.
   - Take initiative by offering ideas and volunteering for tasks.
   - Play an equal role in the team by contributing equally to every task.
   - Be honest with any team member who is not pulling her/his weight.
   - Help one another with difficult or time consuming deliverables.
   - Ask for help from the team or other resources if “stuck” or falling behind.
   - Treat each other with respect.
   - Accept responsibility and accountability along with the authority given.

3.6 Project Budget

SR. No	Project cost category	Example
1	Human resources	20000/- per Person (4)
2	Travelling spendings	10000/- for Data collecting
3	Training fees	20000/- for training team members
4	Material resources	85000/- (Laptops, Electricity, etc.)
5	Research expenses	5000/- for IEEE Papers
6	Professional services	5000/- for Consultation
7	Capital expenditures	5000/- for Camera
8	Contingency reserves	20000/-

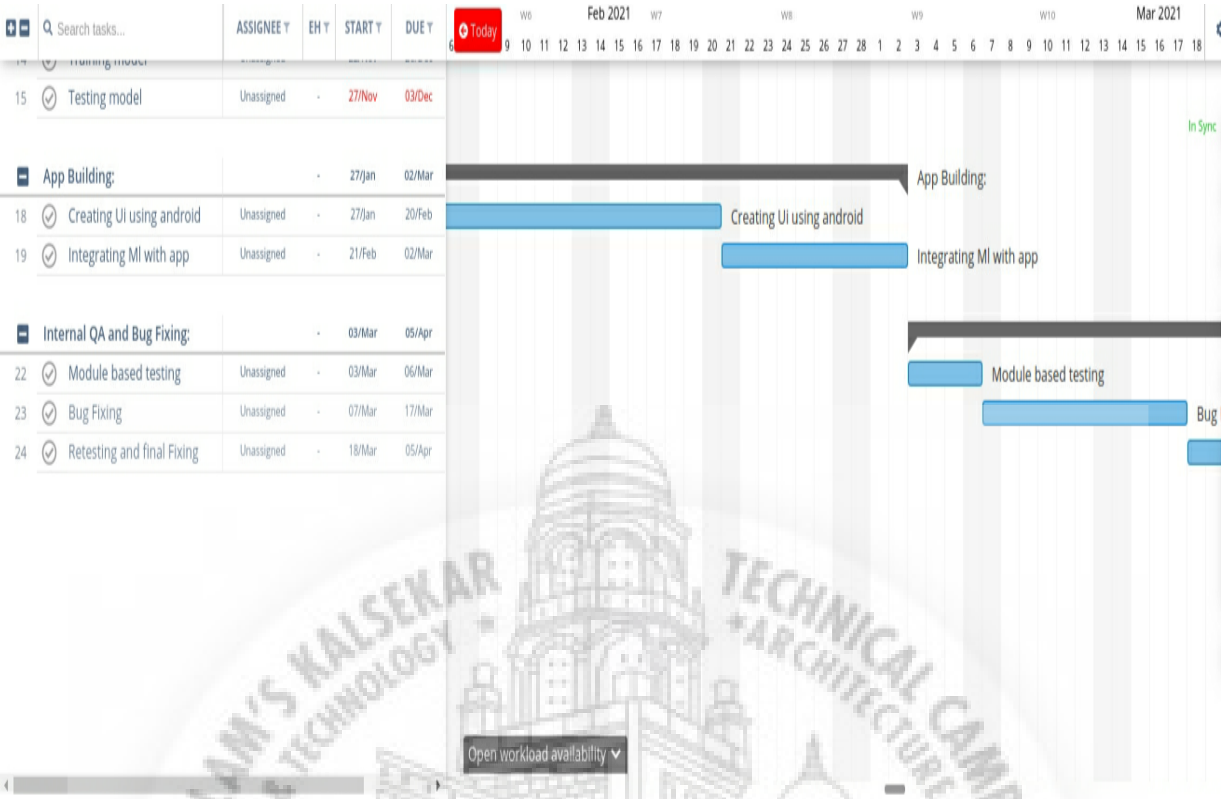
- The Total Budget of our project is around 230000/-

3.7 Project Timeline



	Search tasks...	ASSIGNEE	EH	START	DUE
	Requirment gathering and ...	Unassigned	-	09/Sep	16/Oct
1	System Understanding	Unassigned	-	09/Sep	12/Sep
2	Project Scheduing	Unassigned	-	13/Oct	16/Oct
	project architecture:		-	14/Oct	18/Oct
4	UML Diagram	Unassigned	-	14/Oct	16/Oct
5	DFD Diagram	Unassigned	-	17/Oct	18/Oct
	Database making:		-	19/Sep	15/Oct
8	Data Cleaning	Unassigned	-	19/Sep	26/Sep
9	Data preprocessing	Unassigned	-	27/Sep	08/Oct
10	Data visuaization	Unassigned	-	09/Oct	15/Oct
	Implementation of algorithm:		-	18/Nov	26/Dec
13	Building model	Unassigned	-	18/Nov	22/Nov
14	Training model	Unassigned	-	22/Nov	26/Dec
15	Testing model	Unassigned	-	27/Nov	03/Dec

Figure 3.1: Initial 4 Months



	Search tasks...	ASSIGNEE	EH	START	DUE
14	Training model	Unassigned	[illegible]	[illegible]	[illegible]
15	Testing model	Unassigned	-	27/Nov	03/Dec
	App Building:		-	27/Jan	02/Mar
18	Creating Ui using android	Unassigned	-	27/Jan	20/Feb
19	Integrating Ml with app	Unassigned	-	21/Feb	02/Mar
	Internal QA and Bug Fixing:		-	03/Mar	05/Apr
22	Module based testing	Unassigned	-	03/Mar	06/Mar
23	Bug Fixing	Unassigned	-	07/Mar	17/Mar
24	Retesting and final Fixing	Unassigned	-	18/Mar	05/Apr

Figure 3.2: Last 4 Months

Chapter 4

Software Requirements Specification

4.1 Overall Description

4.1.1 Product Perspective

The system consists of user and admin. User will be interacting using web application and admin will be managing the system using admin panel/admin dashboard. The user can be the normal member and premium member based on that they can predict gesture, read notices, give feedback and suggestion, register and login, etc.

- The main aim of our project is to improve the communication between a signing and a non-signing person.
- To do so, we developed a software that is capable of recognizing gestures, finding their meaning in a linked dictionary and sending the translation to a correspondent via a websocket channel.[1].

4.1.2 Product Features

- The users module involves Login/Sign Up.
- Converted gestures into commands and perform related task in real-time.
- Trained the system for identifications of gestures.
- Communicate at a distance.
- Speed and sufficient reliable for recognition system. Good performance system with complex background.
- The admin module involves Login/Sign Up, maintain users, access user feedback and suggestion, etc.

4.1.3 Operating Environment

- The users required internet connectivity which is the one of the essential need for operating web applications.
- The users will also need a HD quality camera for predicting there gestures.
- Trained the system for identifications of gestures.

4.1.4 User Classes and Characteristics

The project is an web application mostly for deaf and dumb people. User of project includes premium members and others. An app is created to handle both the users data by super-user (admin). All the user should have knowledge of Internet and should have knowledge about how to use an android phone.

4.1.5 Design and Implementation Constraints

The product is made using Django framework hence, both website and smart phone users can use this application. User may access the product using any devices. The information of all the users, notices, member data must be stored in database. Internet connectivity is the main source to use this product. Admin should use correct username and password to manage user, authentication, database, feedback and suggestion, etc.

4.2 System Features

- Login/Sign Up: If User or Admin are already registered, they can login through username and if user or admin is not register they can register/Sign Up through registered form or Email-Id, if the user or admin is registering using email-id they will have to fill the fields like username, first name, last name, Email-id, password. After clicking on register/login, the user or admin have to confirm the registration of account by providing proper details.
- About: User can easily get to know more about the projects like project usage, performance, accuracy, statistic report, etc.
- Service: Uses can get to know about the service provided through our web app like high-performance services to tackle the ever-changing challenges of today's communication between special and impaired peoples, real-time method

for hand gesture recognition, raise awareness of the importance of sign languages, etc.

- Preview: User can predict his/her sign gestures by allowing the camera permissions and predict there gesture on real time also they can uses our text to speech button which is a speak button to hear those predicted word into voice.
- Contact: If user wants to share there feedbacks and suggestions with us so they can easily do that by filling the contact form once they are login successfully.

Functional Requirements

- REQ-1: Users are not limited to any specific Operating System..
- REQ-2: Admin is limited to Linux or Windows(7 and above).
- REQ-3: Access to the Databases.
- REQ-4: Access to Internet.
- REQ-5: Access to camera or webcam.

4.3 External Interface Requirements

4.3.1 User Interfaces

HTML, Bootstrap, js, json provides a variety of prebuilt UI components or we can change properties through css such as structured layout objects and UI controls that allow to build the graphical user interface for web app. Bootstrap, Html, js also provides other UI modules for special interfaces such as alert, validation, navigation, slider, menus, icons, etc. The navigation bar consist of user home, services, about, preview, our team, contact and login/ logout tab. The GUI is very simple and easy for look and feel.

4.3.2 Hardware Interfaces

- Specification Processor :Intel core i3 and above and other processor
- RAM :2GB
- HardDisk : 10GB

4.3.3 Software Interfaces

- OPERATING SYSTEM: Windows,Linux.
- Languages: python3, html5, css3, bs4, JavaScript, Django, OpenCV.
- IDE: Visual studio code, Jupyter Notebook.
- Deep Learning, Tensorflow, convolution neural network (CNN).

4.3.4 Communications Interfaces

We created a contact form section on our web application for easy communication and also for most valuable feedback. So basically a Contact Form is an element on a page where you would find a set of questions asking for information such as the name, contact details, with a space for your visitors to leave the website a message. Its main purpose is to quickly effectively communicate from our web app. Users can also share there feedback and there suggestions through this contact form easily. Admin can also view the users name, email and also there feedback and suggestion through the admin dashboard once the admin is login successfully. In case of any difficulties while using application user can contact through whatsApp or call also.

4.4 Nonfunctional Requirements

4.4.1 Performance Requirements

Performance of overall system is very efficient and well optimize. The time taken to show gesture prediction on preview board section would take a sec. Process and everything is well organized. The messages related to any contact purpose or other will be delivered to the admin in a very short time.

4.4.2 Safety Requirements

Login and sign up must be authenticated for the pre-existing users.
Data of every user should maintain properly.
User can delete the session by logs out.

4.4.3 Security Requirements

Sign In: Only registered user can access his/her account.
Sign Up: No duplicate of the data of the user should be there.
The password of the user is encrypted using PBKDF2 algorithm with a SHA256 hash provided by django framework so there data is completely secured.

Chapter 5

System Design

5.1 Framework:- Django

Figure 5.1: Django.

- Django makes it easier to build better Web apps more quickly and with less code.

- Django is a high-level Python Web framework that encourages rapid development and clean, pragmatic design.

- Built by experienced developers, it takes care of much of the hassle of Web development, so you can focus on writing your app without needing to reinvent the wheel.

- **Ridiculously fast**:- Django was designed to help developers take applications from concept to completion as quickly as possible.

- **Reassuringly secure**:- Django takes security seriously and helps developers avoid many common security mistakes.
- **Exceedingly scalable:-** Some of the busiest sites on the Web leverage Django's ability to quickly and flexibly scale.

5.2 Python

Figure 5.2: Python.

1. Getting Started
   - Python can be easy to pick up whether you're a first time programmer or you're experienced with other languages.
   - The following pages are a useful first step to get on your way writing programs with Python!
2. Friendly Easy to Learn
   - The community hosts conferences and meetups, collaborates on code, and much more.
   - Python's documentation will help you along the way, and the mailing lists will keep you in touch.
3. Applications
   - The Python Package Index (PyPI) hosts thousands of third-party modules for Python.

- Both Python's standard library and the community-contributed modules allow for endless possibilities.

4. Open-source

   - Python is developed under an OSI-approved open source license, making it freely usable and distributable, even for commercial use.
   - Python's license is administered by the Python Software Foundation.

5.3 JavaScript

Figure 5.3: JavaScript.

- JavaScript.com is a resource built by the Pluralsight team for the JavaScript community.
- Because JavaScript is a great language for coding beginners, we've gathered some of the best learning resources around and built a JavaScript course to help new developers get up and running.
- With the help of community members contributing content to the site, JavaScript.com aims to also keep more advanced developers up to date on news, frameworks, and libraries.

5.4 Machine learning

- Machine learning is the study of computer algorithms that improve automatically through experience.
- It is seen as a subset of artificial intelligence.

Figure 5.4: Machine learning.

- Machine learning algorithms build a model based on sample data, known as ”training data”, in order to make predictions or decisions without being explicitly programmed to do so.

5.5 Convolutional Neural Network

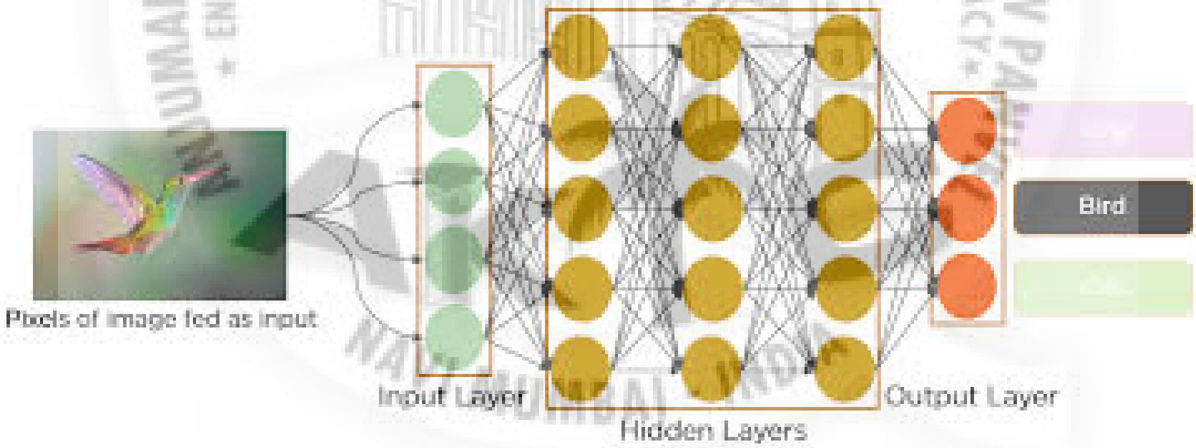


Figure 5.5: Basic Structure of CNN.

- In deep learning, a convolutional neural network is a class of deep neural networks, most commonly applied to analyzing visual imagery.
- They are also known as shift invariant or space invariant artificial neural networks, based on their shared-weights architecture and translation invariance characteristics.

- They have applications in image and video recognition, recommender systems, image classification, medical image analysis, natural language processing, brain-computer interfaces, and financial time series.

5.6 System Architecture Design

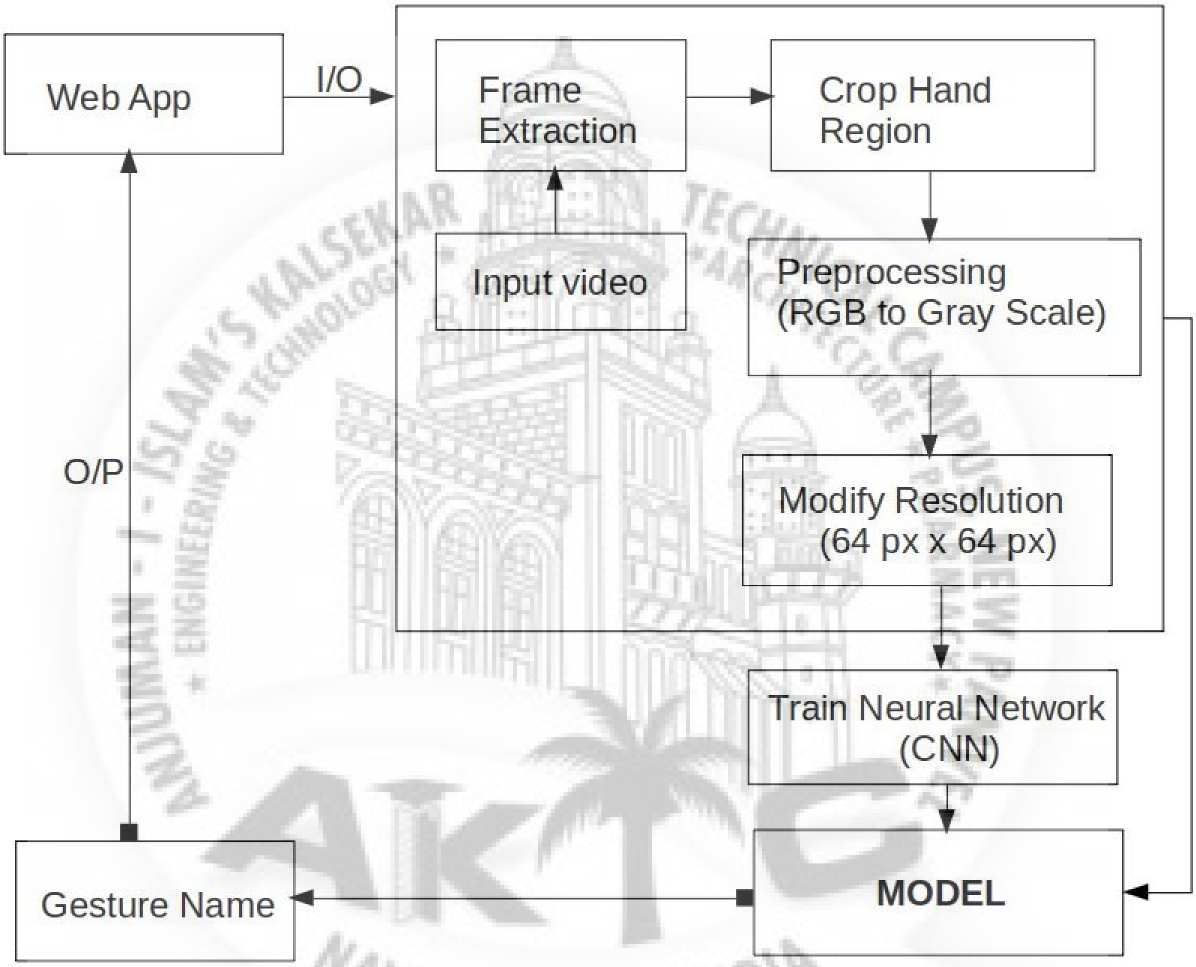

Web App
I/O
Frame Extraction
Crop Hand Region
Input video
Preprocessing (RGB to Gray Scale)
O/P
Modify Resolution (64 px x 64 px)
Train Neural Network (CNN)
Gesture Name
MODEL

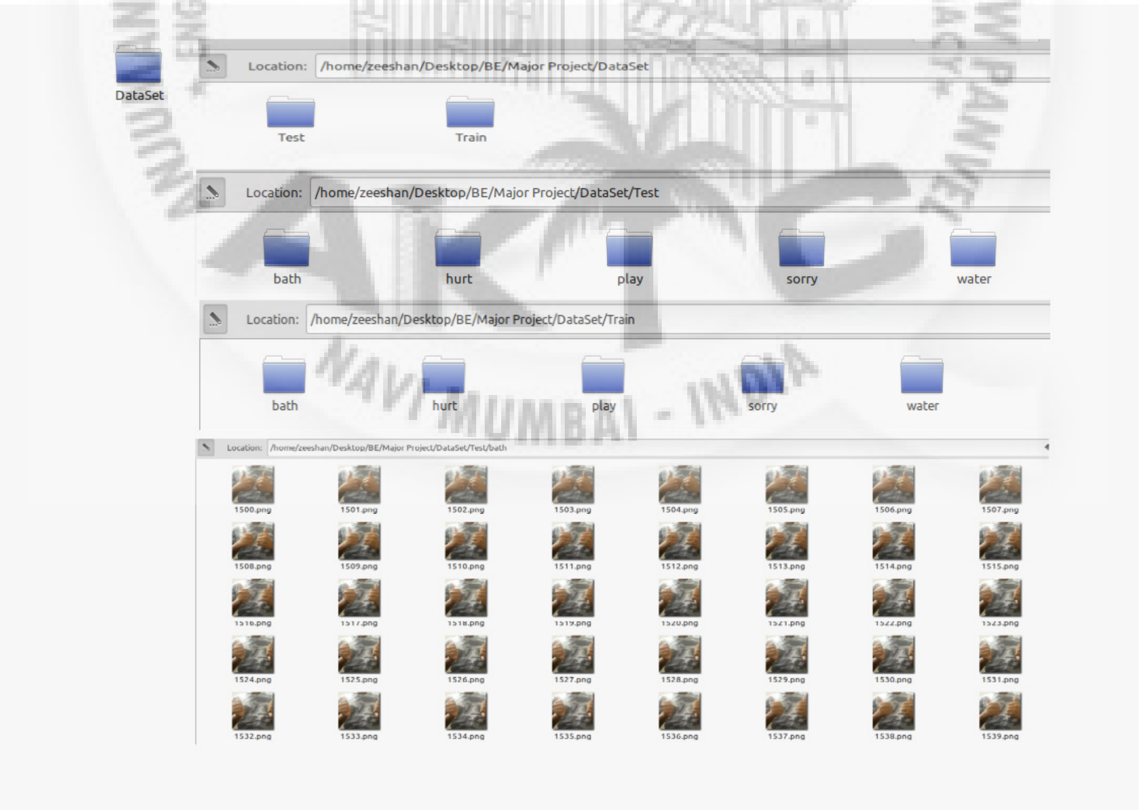
Figure 5.6: System Architecture.

Chapter 6

Implementation

The proposed system has a camera unit for capturing the gestures of the hearing and speech impaired people. The real-time sign language recognition system was designed as a portable unit for more convenience of the users. The raw videos taken in a dynamic background is given as an input to the system. The image frames are resized to maintain the equality among all the videos. OpenCV (Open Source Library for Computer Vision) is used for feature extraction and video classification.

6.1 Creating Dataset



Location: /home/zeeshan/Desktop/BE/Major Project/DataSet

Location: /home/zeeshan/Desktop/BE/Major Project/DataSet/Test

Location: /home/zeeshan/Desktop/BE/Major Project/DataSet/Train

Location: /home/zeeshan/Desktop/BE/Major Project/DataSet/Test/bath

Figure 6.1: CREATED DATASET

1. The First and Foremost Problem that arises was how can we collect this Huge amount of dataset.

2. To solve this problem we have created a python program which can capture 1000 images in just 4-5 minutes.

3. Through this automated datasets creator we can easily generate a huge amount of datasets which was required to train our convolutional neural network (CNN) model.

6.1.1 Python code for creating Dataset

```
import cv2
import os


def createFolder():
    if not os.path.exists(”./DataSet/Train/” + ges_name):
        os.makedirs(”./DataSet/Train/” + ges_name)
    if not os.path.exists(”./DataSet/Test/” + ges_name):
        os.makedirs(”./DataSet/Test/” + ges_name)


def imageCapture():

    cam = cv2.VideoCapture(0)

    createFolder()
    t_counter = 1
    training_set_image_name = 1400
    test_set_image_name = 1100

    while t_counter < 501:

        _, frame = cam.read()
        frame_crop = frame[112:368, 192:448]  # size = (256, 256)
        cv2.imshow(”Frame Crop”, cv2.resize(
            cv2.flip(frame_crop, 1), (768, 768)))
        frame_crop = cv2.resize(frame_crop, (64, 64))

        c = ord(”c”)

        if cv2.waitKey(1) == c:

            if t_counter < 401:
                img_name = ”./DataSet/Train/{}/{}.png”.format(
                    ges_name, training_set_image_name)
                cv2.imwrite(img_name, frame_crop)
                print(”{} written!”.format(img_name))
                training_set_image_name += 1

            else:
                img_name = ”./DataSet/Test/{}/{}.png”.format(
                    ges_name, test_set_image_name)
                cv2.imwrite(img_name, frame_crop)
                print(”{} written!”.format(img_name))
                test_set_image_name += 1

            t_counter += 1

    cam.release()
    cv2.destroyAllWindows()


if __name__ == ”__main__”:
    ges_name = input(”Enter the Gester Name you want to Capture: ”)
    imageCapture()
```

6.2 Formatting Dataset

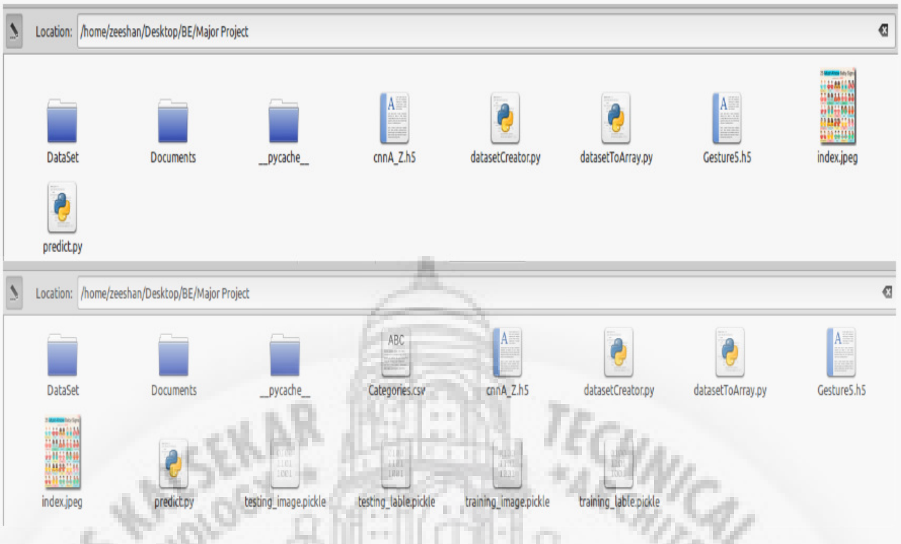


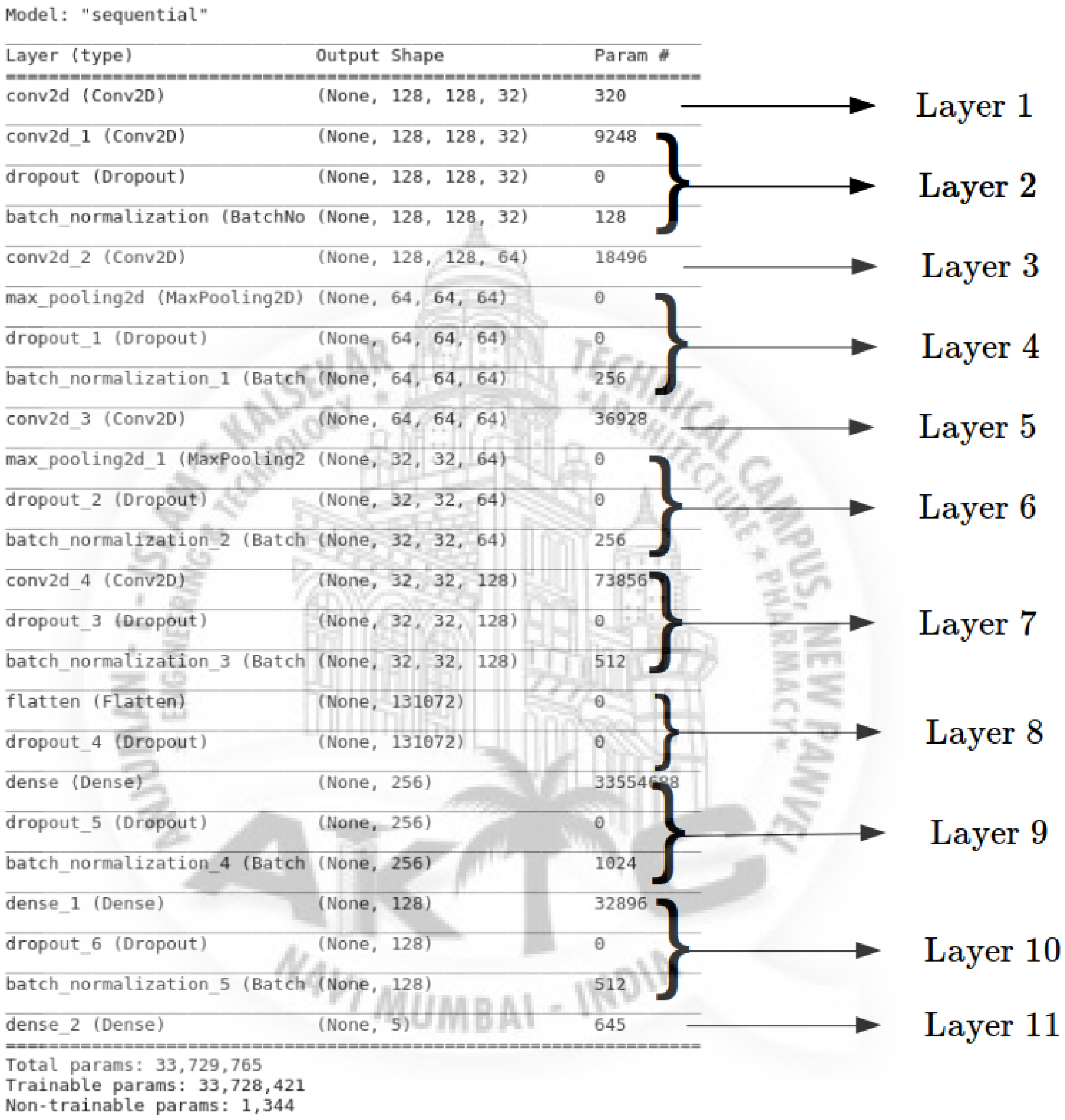
Figure 6.2: Formatted Dataset.

1. Now when the Dataset is generated but the format of the Dataset is in (.png) which is not accepted by the CNN Model.
2. So to convert these Images into the accepted format of CNN Model which is Numpy Array format we have created a python program.
3. This program take these Thousands of Images one by one with the help of OpenCV Module and convert these Images into Numpy Array.
4. After converting it into numpy array then it will distributes the data into Training Dataset and Testing Dataset and stores all these images into pickel file with Numpy Array format using pickel module in python.

6.2.1 Python code for Formating Dataset

```

import numpy as np
import random
import pickle
import csv
import cv2
import os


def createTrainingData():

    training_data = []

    for category in categories:
        path = os.path.join(dataDirTrain, category)
        category_num = categories.index(category)
        for img in os.listdir(path):
            img_array = cv2.imread(os.path.join(
                path, img), cv2.IMREAD_GRAYSCALE)
            training_data.append([img_array, category_num])

    return training_data


def createTestingData():

    testing_data = []

    for category in categories:
        path = os.path.join(dataDirTest, category)
        category_num = categories.index(category)
        for img in os.listdir(path):
            img_array = cv2.imread(os.path.join(
                path, img), cv2.IMREAD_GRAYSCALE)
            testing_data.append([img_array, category_num])

    return testing_data


def seperateData():

    training_image = []
    training_lable = []
    testing_image = []
    testing_lable = []

    for image, lable in training_data:
        training_image.append(image)
        training_lable.append(lable)

    for image, lable in testing_data:
        testing_image.append(image)
        testing_lable.append(lable)

    training_image = np.array(
        training_image).reshape(-1, image_size, image_size, 1)
    training_lable = np.array(training_lable)

    testing_image = np.array(testing_image).reshape(-1,
                                                    image_size, image_size, 1)
    testing_lable = np.array(testing_lable)

    return (training_image, training_lable, testing_image, testing_lable)


def storeData():
    pickle_out = open(”training_image.pickle”, ”wb”)
    pickle.dump(training_image, pickle_out)
    pickle_out.close()

    pickle_out = open(”training_lable.pickle”, ”wb”)
    pickle.dump(training_lable, pickle_out)
    pickle_out.close()

    pickle_out = open(”testing_image.pickle”, ”wb”)
    pickle.dump(testing_image, pickle_out)
    pickle_out.close()

    pickle_out = open(”testing_lable.pickle”, ”wb”)
    pickle.dump(testing_lable, pickle_out)
    pickle_out.close()

    with open(”Categories.csv”, ”w”) as f:
        writer = csv.writer(f)
        writer.writerow(categories)


if __name__ == ’__main__’:

    dataDirTrain = ”./Zeeshan_DataSet/Train”
    dataDirTest = ”./Zeeshan_DataSet/Test”

    categories = os.listdir(dataDirTrain)

    image_size = 64

    training_data = createTrainingData()
    testing_data = createTestingData()

    random.shuffle(training_data)
    random.shuffle(testing_data)

    (training_image, training_lable, testing_image, testing_lable) = seperateData()
    storeData()
```

6.3 Creating and Training Model



```
Model: "sequential"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
conv2d (Conv2D)              (None, 128, 128, 32)      320
_________________________________________________________________
conv2d_1 (Conv2D)            (None, 128, 128, 32)      9248
_________________________________________________________________
dropout (Dropout)            (None, 128, 128, 32)      0
_________________________________________________________________
batch_normalization (BatchNo (None, 128, 128, 32)      128
_________________________________________________________________
conv2d_2 (Conv2D)            (None, 128, 128, 64)      18496
_________________________________________________________________
max_pooling2d (MaxPooling2D) (None, 64, 64, 64)        0
_________________________________________________________________
dropout_1 (Dropout)          (None, 64, 64, 64)        0
_________________________________________________________________
batch_normalization_1 (Batch (None, 64, 64, 64)        256
_________________________________________________________________
conv2d_3 (Conv2D)            (None, 64, 64, 64)        36928
_________________________________________________________________
max_pooling2d_1 (MaxPooling2 (None, 32, 32, 64)        0
_________________________________________________________________
dropout_2 (Dropout)          (None, 32, 32, 64)        0
_________________________________________________________________
batch_normalization_2 (Batch (None, 32, 32, 64)        256
_________________________________________________________________
conv2d_4 (Conv2D)            (None, 32, 32, 128)       73856
_________________________________________________________________
dropout_3 (Dropout)          (None, 32, 32, 128)       0
_________________________________________________________________
batch_normalization_3 (Batch (None, 32, 32, 128)       512
_________________________________________________________________
flatten (Flatten)            (None, 131072)            0
_________________________________________________________________
dropout_4 (Dropout)          (None, 131072)            0
_________________________________________________________________
dense (Dense)                (None, 256)               33554688
_________________________________________________________________
dropout_5 (Dropout)          (None, 256)               0
_________________________________________________________________
batch_normalization_4 (Batch (None, 256)               1024
_________________________________________________________________
dense_1 (Dense)              (None, 128)               32896
_________________________________________________________________
dropout_6 (Dropout)          (None, 128)               0
_________________________________________________________________
batch_normalization_5 (Batch (None, 128)               512
_________________________________________________________________
dense_2 (Dense)              (None, 5)                 645
=================================================================
Total params: 33,729,765
Trainable params: 33,728,421
Non-trainable params: 1,344
```

Figure 6.3: CNN MODEL LAYERS.

1. Now to Train with our Dataset we have created a CNN Model with the Total Number of 11 Layers.
2. There are in Total of 5 Convolving Layers with 2 Pooling Layers in between these Convolving Layers.

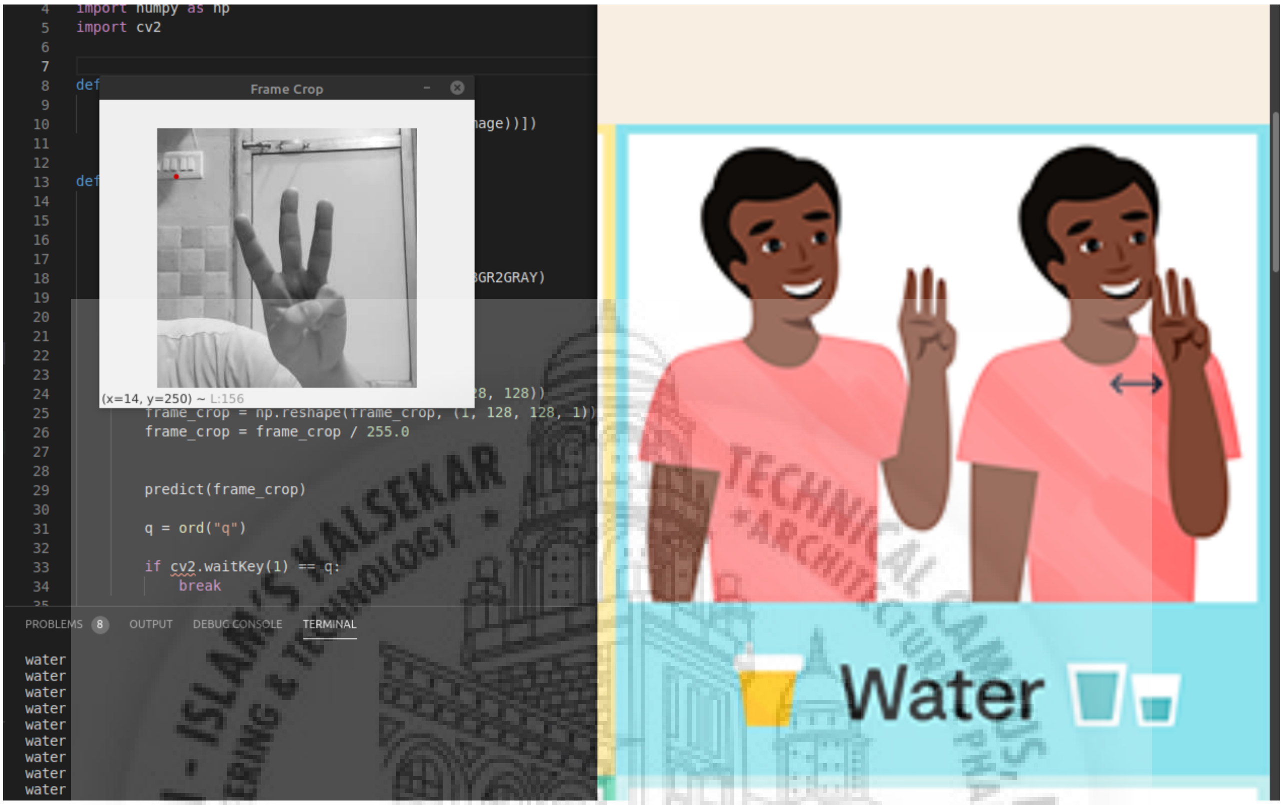
3. After these 7 layers there is 1 Flattening Layer which Flattens all the Parameters it receives in a single Layer.

4. There are 3 Dense Layers After this Flatten Layer which then take this Layer of over 1 Lakh Parameters and make it Dense to give 5 Outputs in the last Dense Layer.

6.3.1 Python code for creating and training model

```
from keras.layers import Dense, Dropout, Flatten, BatchNormalization, Activation
from keras.layers.convolutional import Conv2D, MaxPooling2D
from datasetToArray import loadData, loadCategories
from keras.constraints import maxnorm
from keras.models import Sequential
from keras.utils import np_utils

import numpy as np
import sys
import cv2


x_train = x_train.astype(”float32”)
x_test = x_test.astype(”float32”)
x_train = x_train / 255.0
x_test = x_test / 255.0

categories = loadCategories()

cnn = Sequential()

cnn.add(Conv2D(filters=32, kernel_size=(3, 3), activation=”relu”, input_shape=
    x_train.shape[1:], padding=”same”))

cnn.add(Conv2D(filters=32, kernel_size=(3, 3), activation=”relu”, padding=”same”
    ))
cnn.add(Dropout(0.2))
cnn.add(BatchNormalization())

cnn.add(Conv2D(filters=64, kernel_size=(3, 3), activation=”relu”, padding=”same”
    ))
cnn.add(MaxPooling2D(pool_size=(2, 2)))
cnn.add(Dropout(0.2))
cnn.add(BatchNormalization())

cnn.add(Conv2D(filters=64, kernel_size=(3, 3), activation=”relu”, padding=”same”
    ))
cnn.add(MaxPooling2D(pool_size=(2, 2)))
cnn.add(Dropout(0.2))
cnn.add(BatchNormalization())

cnn.add(Conv2D(filters=128, kernel_size=(3, 3), activation=”relu”, padding=”same
    ”))
cnn.add(Dropout(0.2))
cnn.add(BatchNormalization())

cnn.add(Flatten())
cnn.add(Dropout(0.2))

cnn.add(Dense(256, activation=”relu”, kernel_constraint=maxnorm(3)))
cnn.add(Dropout(0.2))
cnn.add(BatchNormalization())

cnn.add(Dense(128, activation=”relu”, kernel_constraint=maxnorm(3)))
cnn.add(Dropout(0.2))
cnn.add(BatchNormalization())

cnn.add(Dense(len(categories), activation=”softmax”))

cnn.compile(optimizer='adam',
            loss=”sparse_categorical_crossentropy”,
            metrics=[”accuracy”])

cnn.summary()
cnn.fit(x_train, y_train, validation_data=(x_test, y_test), epochs=10)
cnn.evaluate(x_test, y_test)
cnn.save(filepath=”cnnA_Z.h5”)
```

6.4 Gesture Prediction



```
import numpy as np
import cv2


def
                                   age))])


def





                                   GR2GRAY)





                                   8, 128))
        frame_crop = np.reshape(frame_crop, (1, 128, 128, 1))
        frame_crop = frame_crop / 255.0


        predict(frame_crop)

        q = ord("q")

        if cv2.waitKey(1) == q:
            break
```

```
water
water
water
water
water
water
water
water
water
```

Figure 6.4: MODEL PREDICTING GESTURE

1. Now here comes the Important part of Testing of our Model to test how accurate our Model is Predicting the Gestures.

2. In the Training Process of our Dataset, the Testing Accuracy of our Testing Dataset is about 90%

3. This Accuracy of 90% was obtained after running about 30 Epoch which is a time consuming Process.

4. Now to Test this much Accuracy of our Program. We have created a python program which uses OpenCV to take Image in Real Time and predict the Gesture in realtime

5. Below you can See an Example of our Model Predicting the Water Gesture in Real time in the Terminal

6.4.1 Python code for gesture prediction

```
from datasetToArray import loadCategories
from keras.models import load_model
```

```
import tensorflow as tf

import numpy as np
import cv2


def predict(image):

    print(categories[np.argmax(model.predict(image))])


def run():

    while True:

        _, frame = cam.read()

        frame = cv2.cvtColor(frame, cv2.COLOR_BGR2GRAY)
        frame = cv2.flip(frame, 1)
        frame_crop = frame[112:368, 192:448]
        cv2.imshow(”Frame Crop”, cv2.resize(frame_crop, (768, 768)))

        frame_crop = cv2.resize(frame_crop, (64, 64))
        frame_crop = np.reshape(frame_crop, (1, 64, 64, 1))
        frame_crop = np.astype(”float32”)
        frame_crop = frame_crop / 255.0

        predict(frame_crop)

        q = ord(”q”)

        if cv2.waitKey(1) == q:
            break

    cam.release()
    cv2.destroyAllWindows()


if __name__ == ”__main__”:

    cam = cv2.VideoCapture(1)

    model = load_model(’Gesture5.h5’)
    model.compile(optimizer=’adam’,
                  loss=”sparse_categorical_crossentropy”,
                  metrics=[”accuracy”])

    categories = loadCategories()

    run()
```

Chapter 7

System Testing

System testing is a level of software testing where a complete and integrated software is tested. The purpose of this test is to evaluate the system's compliance with the specified requirements.

7.1 Test Cases and Test Results

Test ID	Test Case Title	Test Condition	System Behavior	Expected Result
T01	User Registration	All Valid Input	User Registered Successfully/ Unsuccessfully	Success/ Failed
T02	User Login	Username and Password Required	User Login Successfully/ Unsuccessfully	Success/ Failed
T03	Preview	Allow Camera permission	Prediction Successfully	Sign to Text
T04	Speak	Successful Prediction	Speak the Text	Text to Speech
T05	Contact	Valid user	User contact info is stored into the database	Suggestion and feedback

7.2 Sample of a Test Case

Title: :User registration – Successfully register a new user

Description: A new user should be able to successfully register themselves.

Precondition: The user has given valid credentials.

*Assumption:*A supported Android version is being used.

Test Steps:

1. Click ’Sign Up’ button.
2. Enter valid credentials in the field.
3. Click ’Register’ button

Expected Result: User should be successfully registered on the App.

Actual Result: User is successfully registered.

Title: Login Page – Authenticate Successfully on our web app
Description: A registered user should be able to successfully login at our Parley webapp.

Precondition: the user must already be registered with an email address, username and password.

Assumption: a supported browser is being used.

Test Steps:

1. Navigate to Login page.
2. In the ’username’ field, enter the username of the registered user.
3. Enter the password of the registered user
4. Click ‘Log In’

Expected Result: A page displaying the user’s successfully Login message and redirected to Home page and than it will be easily access the contact form section.

Actual Result: User is redirected to home page.

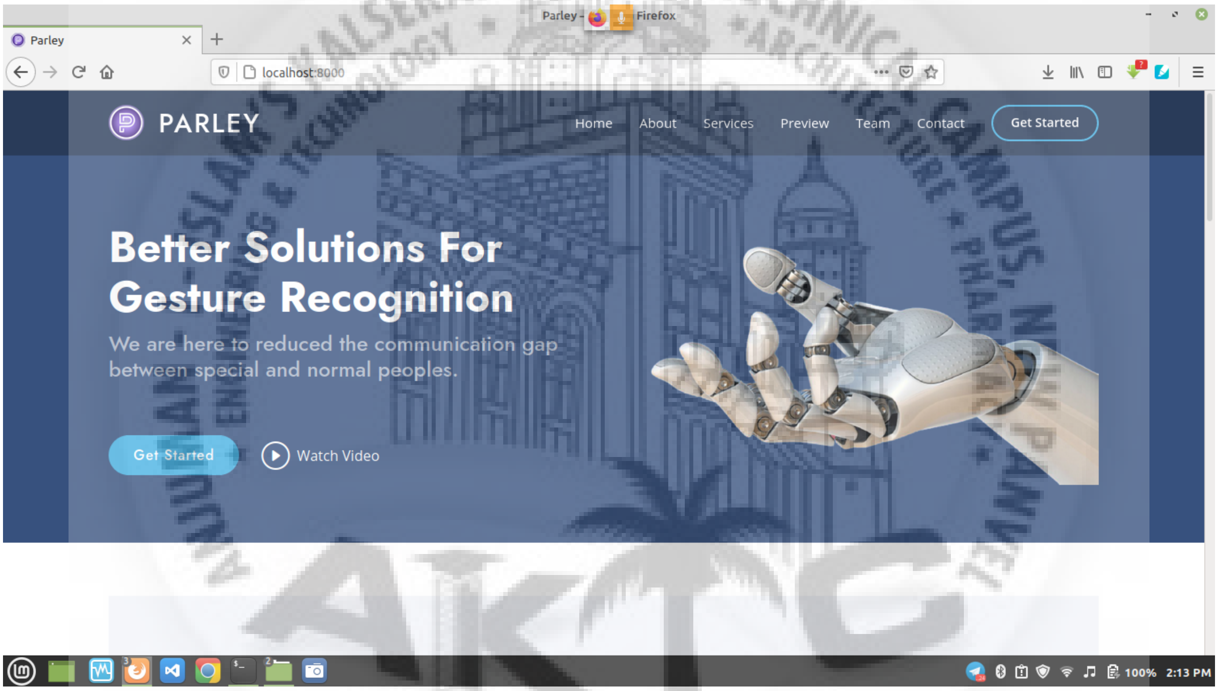
7.2.1 Software Quality Attributes

- **AVAILABILITY:** The system should not be down, whenever the user use the system the specific data should be available to the user.
- **CORRECTNESS:** As per the user search the the correct should be shown to the user like at time for searching the the similar type of app the system should show all the similar startup.
- **MAINTAINABILITY:** The administration of the system will maintain the system with effective updates though on air update if needed

Chapter 8

Screenshots of Project

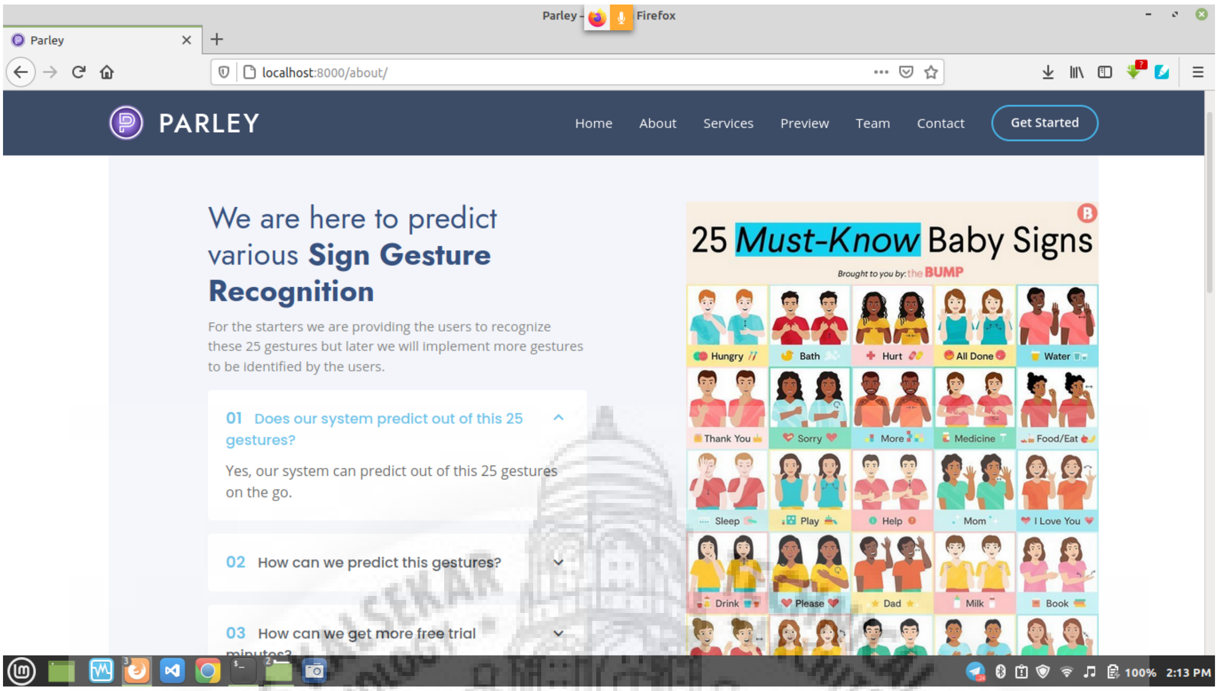
8.1 SECTION NAME



Better Solutions For Gesture Recognition

We are here to reduced the communication gap between special and normal peoples.

Figure 8.1: HOME PAGE.



We are here to predict various **Sign Gesture Recognition**

For the starters we are providing the users to recognize these 25 gestures but later we will implement more gestures to be identified by the users.

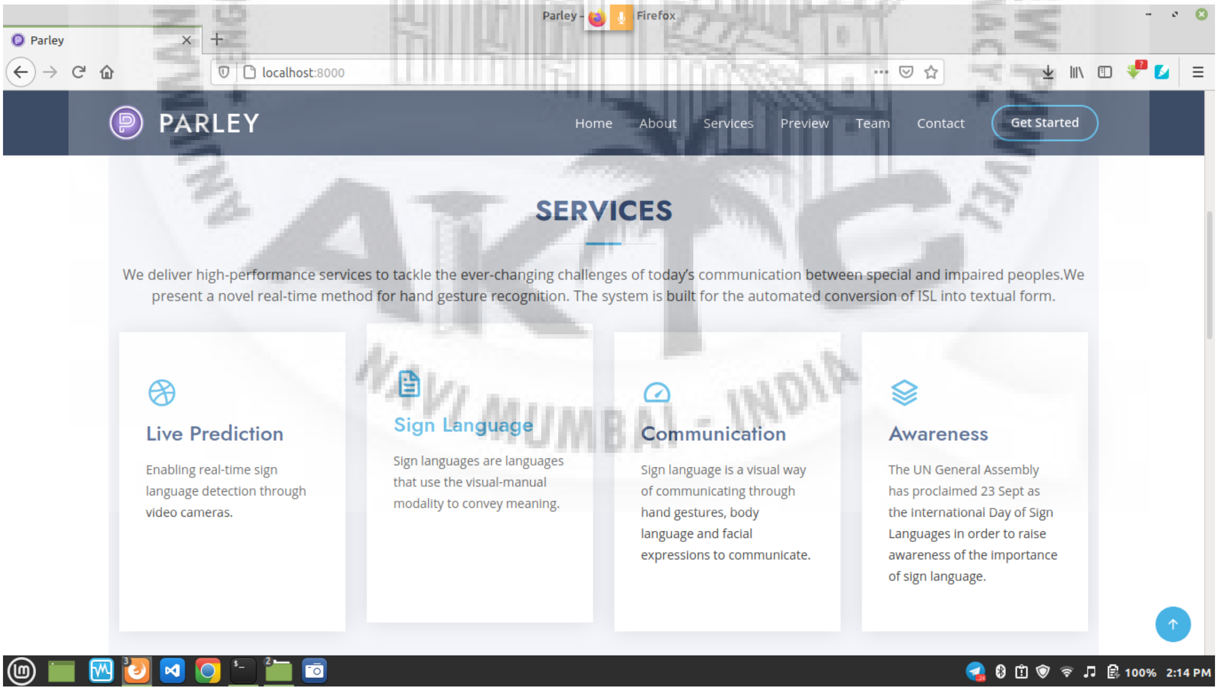
01 Does our system predict out of this 25 gestures?

Yes, our system can predict out of this 25 gestures on the go.

02 How can we predict this gestures?

03 How can we get more free trial minutes?

Figure 8.2: ABOUT PAGE.



SERVICES

We deliver high-performance services to tackle the ever-changing challenges of today's communication between special and impaired peoples.We present a novel real-time method for hand gesture recognition. The system is built for the automated conversion of ISL into textual form.

Live Prediction

Enabling real-time sign language detection through video cameras.

Sign Language

Sign languages are languages that use the visual-manual modality to convey meaning.

Communication

Sign language is a visual way of communicating through hand gestures, body language and facial expressions to communicate.

Awareness

The UN General Assembly has proclaimed 23 Sept as the International Day of Sign Languages in order to raise awareness of the importance of sign language.

Figure 8.3: SERVICES.

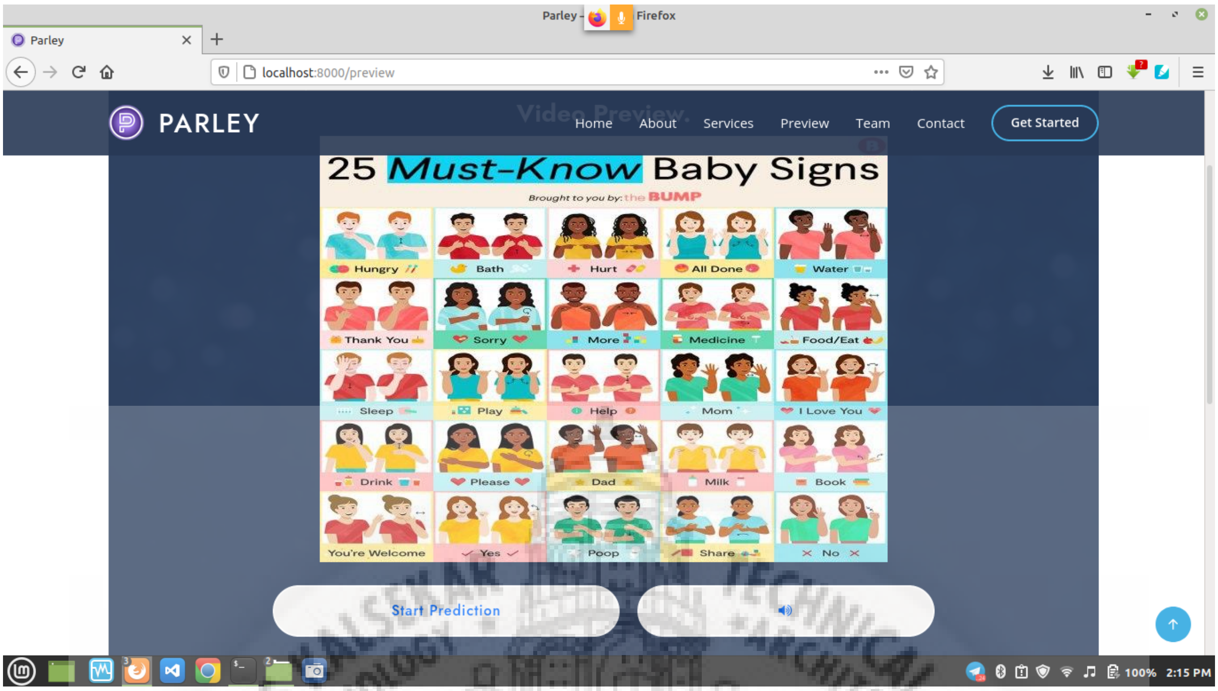


Figure 8.4: PREVIEW.

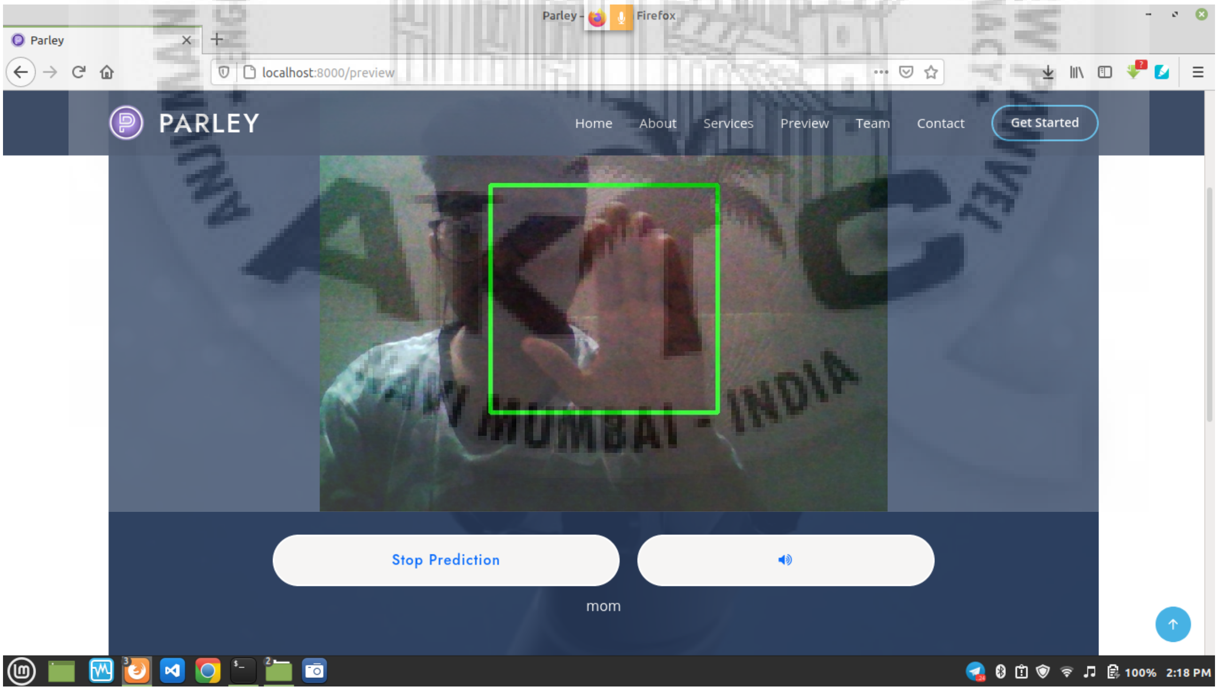
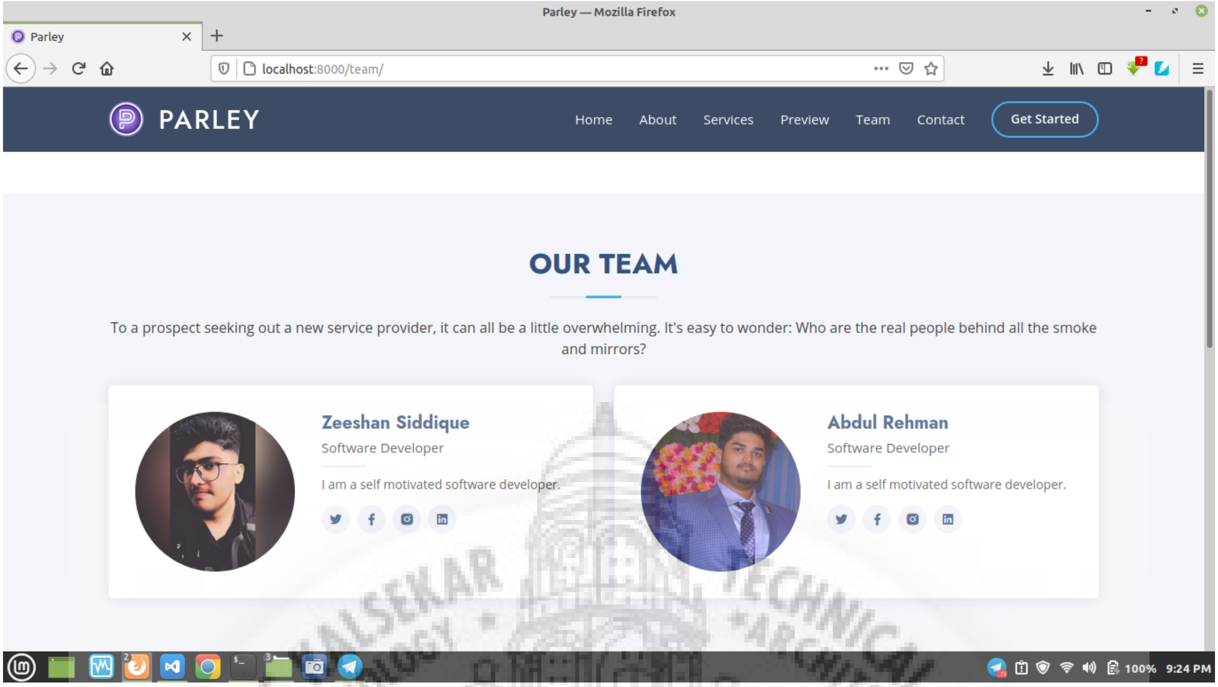


Figure 8.5: PREDICTING GESTURES.



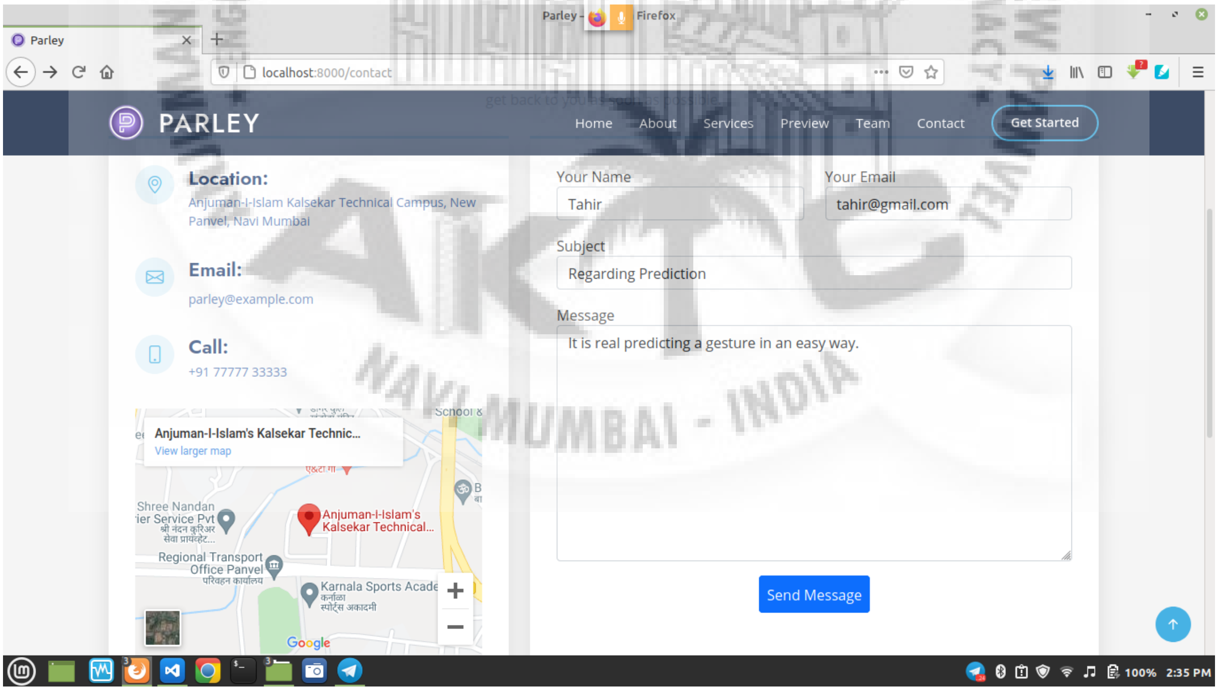
OUR TEAM

To a prospect seeking out a new service provider, it can all be a little overwhelming. It's easy to wonder: Who are the real people behind all the smoke and mirrors?

Zeeshan Siddique
Software Developer
I am a self motivated software developer.

Abdul Rehman
Software Developer
I am a self motivated software developer.

Figure 8.6: OUR TEAM.



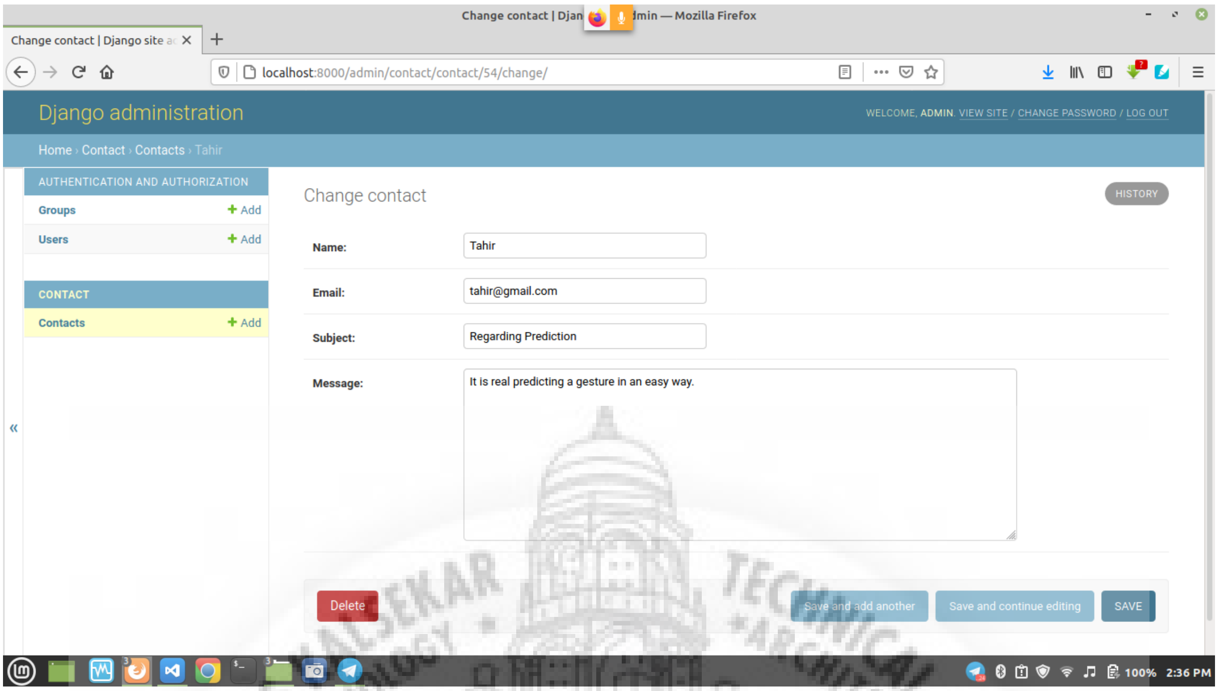
Location:
Anjuman-I-Islam Kalsekar Technical Campus, New Panvel, Navi Mumbai

Email:
parley@example.com

Call:
+91 77777 33333

Your Name: Tahir
Your Email: tahir@gmail.com
Subject: Regarding Prediction
Message: It is real predicting a gesture in an easy way.

Figure 8.7: CONTACT US.



Change contact | Django site admin — Mozilla Firefox
Change contact | Django site ad
localhost:8000/admin/contact/contact/54/change/
Django administration
WELCOME, ADMIN. VIEW SITE / CHANGE PASSWORD / LOG OUT
Home › Contact › Contacts › Tahir
AUTHENTICATION AND AUTHORIZATION
Groups
+ Add
Users
+ Add
CONTACT
Contacts
+ Add
HISTORY
Delete
Save and add another
Save and continue editing
SAVE
100%
2:36 PM

Change contact

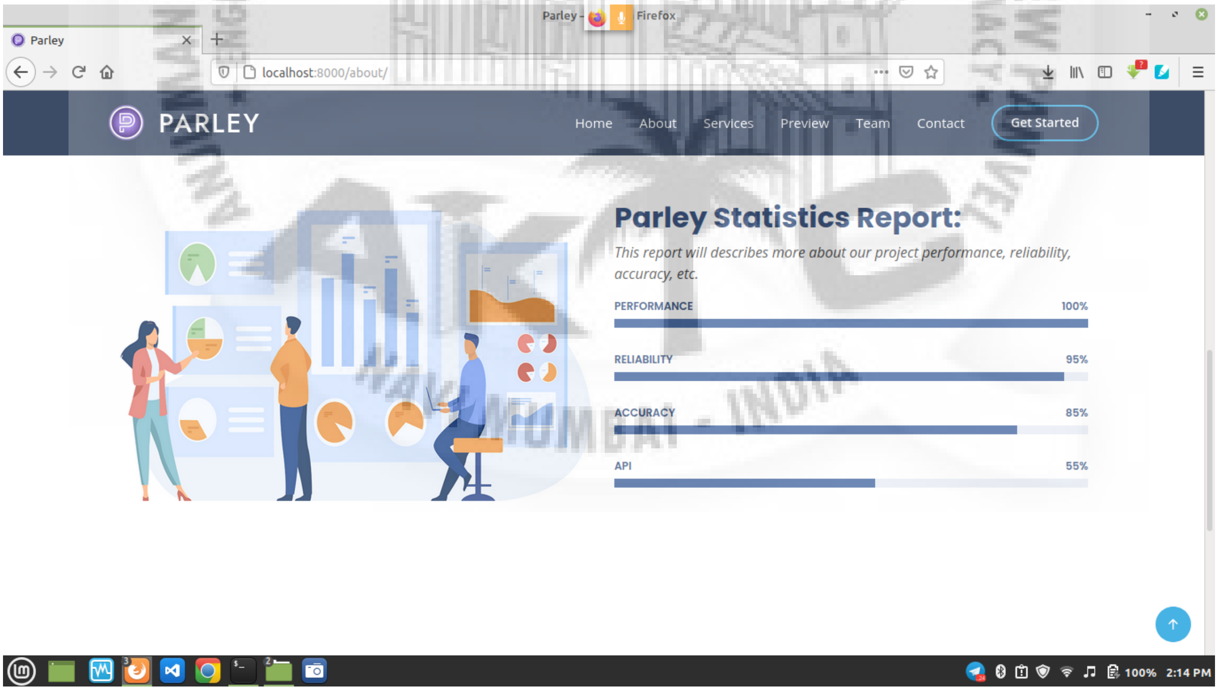
Name: Tahir

Email: tahir@gmail.com

Subject: Regarding Prediction

Message: It is real predicting a gesture in an easy way.

Figure 8.8: RECEIVED INFO.



Parley Statistics Report:

This report will describes more about our project performance, reliability, accuracy, etc.

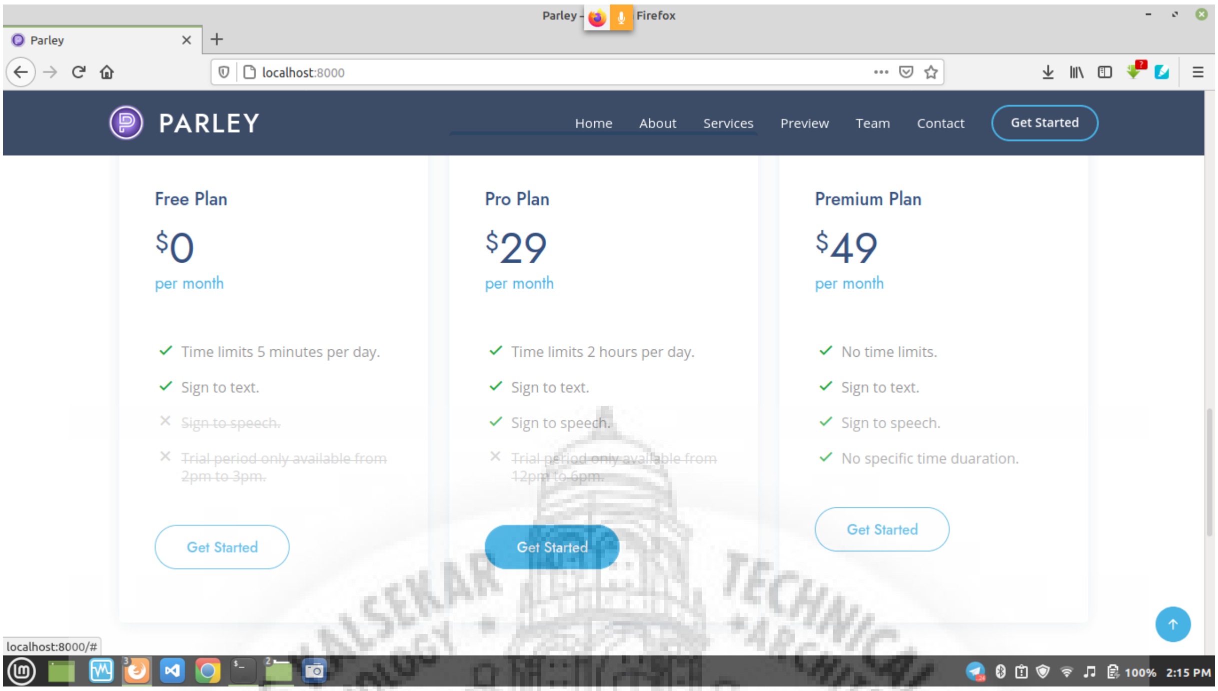
PERFORMANCE 100%

RELIABILITY 95%

ACCURACY 85%

API 55%

Figure 8.9: STATISTICS REPORT.



Parley — Firefox

localhost:8000

PARLEY

Home About Services Preview Team Contact Get Started

Free Plan

$0

per month

- ✓ Time limits 5 minutes per day.
- ✓ Sign to text.
- ✗ ~~Sign to speech.~~
- ✗ ~~Trial period only available from 2pm to 3pm.~~

Get Started

Pro Plan

$29

per month

- ✓ Time limits 2 hours per day.
- ✓ Sign to text.
- ✓ Sign to speech.
- ✗ ~~Trial period only available from 12pm to 6pm.~~

Get Started

Premium Plan

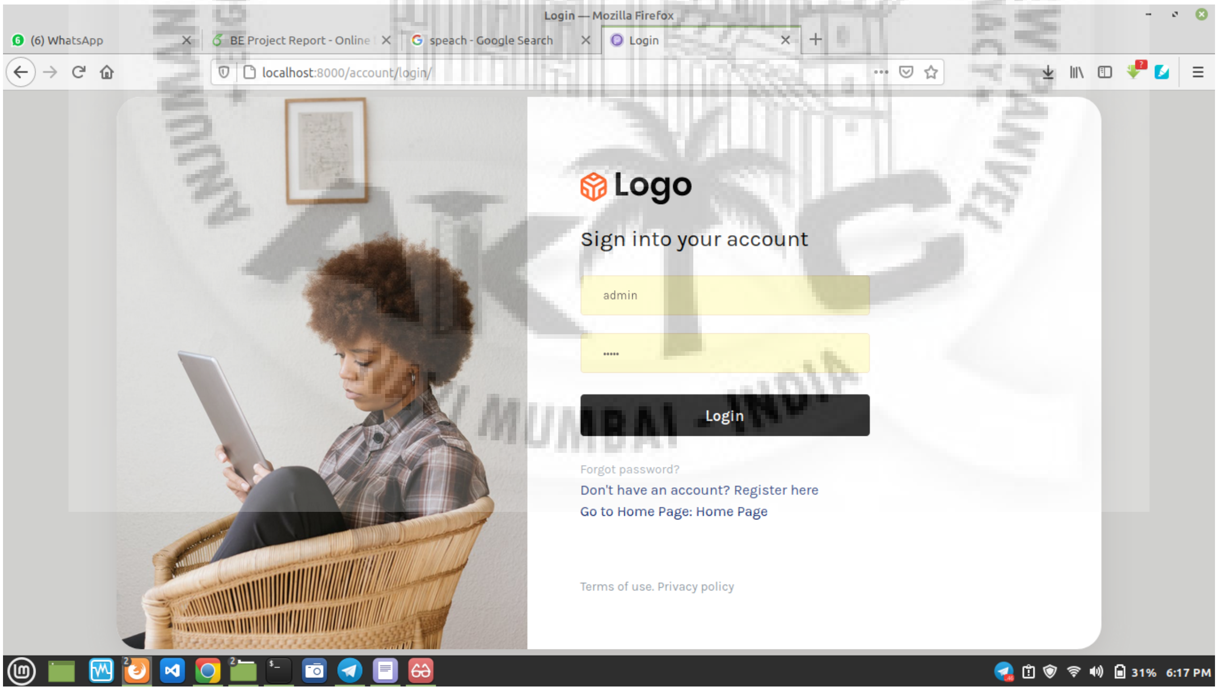
$49

per month

- ✓ No time limits.
- ✓ Sign to text.
- ✓ Sign to speech.
- ✓ No specific time duaration.

Get Started

Figure 8.10: PRICING SECTIONS.



Login — Mozilla Firefox

localhost:8000/account/login/

Logo

Sign into your account

admin

•••••

Login

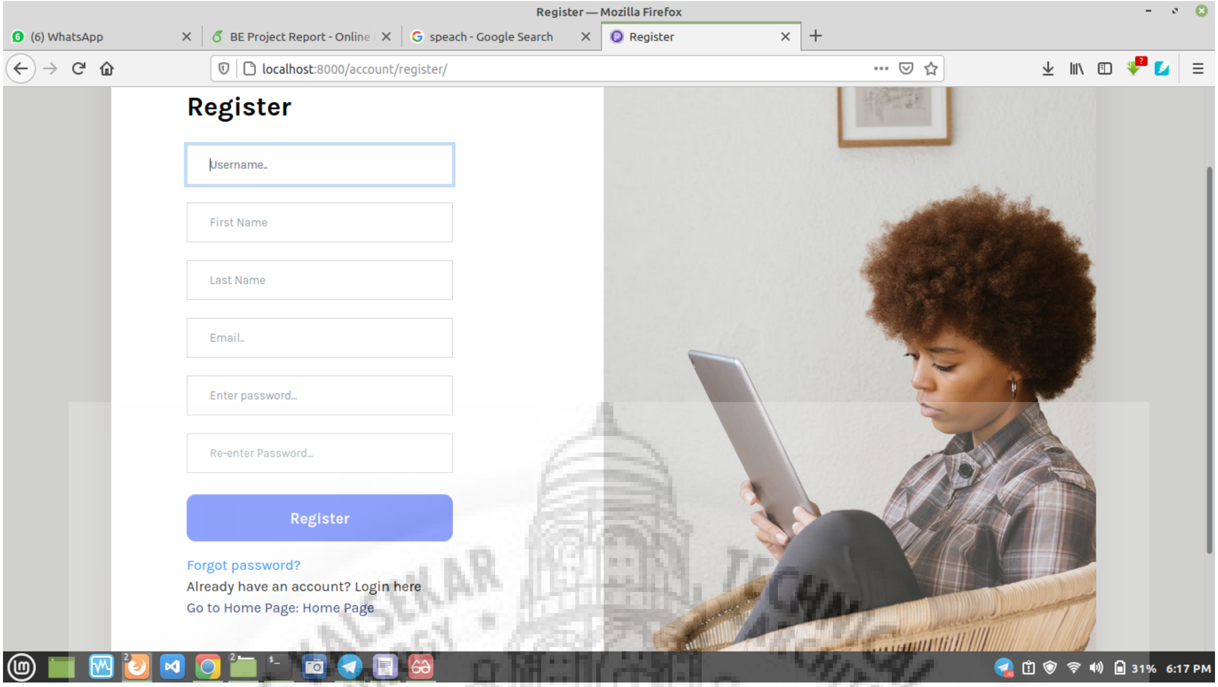
Forgot password?

Don't have an account? Register here

Go to Home Page: Home Page

Terms of use. Privacy policy

Figure 8.11: LOGIN PAGE.



Forgot password?

Already have an account? Login here

Go to Home Page: Home Page

Figure 8.12: REGISTER PAGE.

Chapter 9

Conclusion and Future Scope

9.1 Conclusion

- Hand Gesture recognition and text conversion for dumb and deaf person was successfully executed using image processing.
- The method takes image as input and gives text and speech as an output. Implementation of this system gives up to 90% accuracy and works successfully in most of the test cases.

9.2 Future Scope

- We can develop a model for ISL sentence level recognition. This will require a system that can detect changes with respect to the temporal space.
- We can develop a complete product that will help the speech and hearing impaired people, and thereby reduce the communication gap.
- Can have more images of gestures added to the datasets for the program to recognize.
- Language Model Enhancement: Building a bigram and trigram language model would allow us to handle sentences instead of individual words. Along with this comes a need for better letter segmentation and a more seamless process for retrieving images from the userat a higher rate.

References

[1] Muthu Mariappan H, Dr Gomathi V, ”Real-Time Recognition of Indian Sign Language”, Second International Conference on Computational Intelligence in Data Science (ICCIDS-2019)

[2] Harish Chandra Thuwal, Adhyan Srivastava, ”REAL TIME SIGN LANGUAGE GESTURE RECOGNITION FROM VIDEO SEQUENCES”, DEPARTMENT OF COMPUTER ENGINEERING FACULTY OF ENGINEERING AND TECHNOLOGY

[3] Geethu G Nath and Arun C S, ”Real Time Sign Language Interpreter,” 2017 International Conference on Electrical, Instrumentation, and Communication Engineering (ICEICE2017).

[4] Manasa Srinivasa H S and Suresha H S, ”Implementation of Real Time Hand Gesture Recognition,” International Journal of Innovative Research in Computer and Communication Engineering, Vol. 3, Issue 5, May 2015.

[5] Machine Learning Information based on Wikipedia [https://en.wikipedia.org/wiki/Machine$_{l}earning][https : //en.wikipedia.org/wiki/Convolutional_{n}eural_{n}etwork]$

Achievements

1. Publications
   (a) *NAME OF PAPER*; NAME OF AUTHORS,journal Name, month and year of published(http://EXAMPLE.com)
2. Conferences
   (a) *NAME OF PAPER*; NAME OF AUTHORS, Name of conference , month and year of attend(Venue :)
3. Project Competitions
   (a) *NAME OF PAPER*; NAME OF AUTHORS, Name of Event , month and year of attend(Venue :)