A PROJECT REPORT ON

"Virtual Interviewer"

Submitted to

UNIVERSITY OF MUMBAI

In Partial Fulfilment of the Requirement for the Award of

BACHELOR'S DEGREE IN
COMPUTER ENGINEERING

BY

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UNDER THE GUIDANCE OF
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DEPARTMENT OF COMPUTER ENGINEERING
Anjuman-I-Islam's Kalsekar Technical Campus
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Plot No. 2 3, Sector - 16, Near Thana Naka,
Khandagaon, New Panvel - 410206

2021-2022

AFFILIATED TO

UNIVERSITY OF MUMBAI

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CERTIFICATE

This is certify that the project entitled

"Virtual Interviewer"

submitted by

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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 2021-2022, under our guidance.

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Project I Approval for Bachelor of Engineering

This project entitled ***Virtual Interviewer*** by ***Pathan Asiya, Kazi Aman, Tisekar Salwa and Shaikh Shahidraja*** is approved for the degree of ***Bachelor of Engineering in Department of Computer Engineering.***

Examiners

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

Supervisors

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

Chairman

.....

Declaration

We declare that this written submission represents our ideas in our own words and where others' ideas or words have been included, we have adequately cited and referenced the original sources. We also declare that We have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in our submission. We 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.

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ABSTRACT

In a job interview one needs technical skills as well as soft skills. Many a times students don't understand why are they not able to crack an interview. This project is a virtual interviewer for students which guides them to improve their communication, body language, skills, more soft skills for an interview, so that they get familiar to an interview experience. Our Virtual Interviewer system will guide the candidate to learn and understand the positives and negatives of an individual. This Virtual Interviewer will act as our mock interviewer and will decrease the anxiousness in students with regards to interview and will give a clear idea for an interview.

We seek to create a website where students can login and understand the areas of improvement. We have use image processing algorithm to note the facial expressions of the candidate and understand his/her way of expressing the answer. Also used audio processing techniques to analyse the pitch of the candidate to determine the confidence level of the candidate.

We developed an agent-based virtual interview training system which can help college students with high shyness level to improve interview skills and reduce their anxiety by themselves before they take a real interview. User Study indicates the system can help shy college students cope with interview anxiety and improve their interview training performance effectively.

Keywords:

Framework, Architecture, Virtual, Self-assessment, Fumble, Stimulation, Paradigm, Traits, Carousels, Acoustic Features, Entropy, Regression, Elicited

Glossary:

AF- Acoustic Features: The acoustic features of speech sound in a model of auditory processing: vowels and voiceless fricatives. The acoustic features of three classes of complex sounds (complex tones, vowels and voiceless fricatives) were analyzed using a model of auditory signal processing.

A- Architecture: The complex or carefully designed structure of something.

C- Carousels: In the context of a website or application, the carousel meaning indicates a collection or ’filmstrip’ of images that move in a step wise or smooth manner around a central axis.

E- Elicited: evoke or draw out (a reaction, answer, or fact) from someone.

E- Entropy: lack of order or predictability; gradual decline into disorder.
F- Framework: a basic structure underlying a system, concept, or text.
F- Fumble: an act of doing or handling something clumsily.
P- Paradigm: a set of linguistic items that form mutually exclusive choices in particular syntactic roles.
SA- Self-assessment: calculation of one's own taxable liability.
S- Stimulation: encouragement of something to make it develop or become more active.
T- Traits: a distinguishing quality or characteristic, typically one belonging to a person.
V- Virtual: almost or nearly as described, but not completely or according to strict definition.

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Chapter 1

1. Introduction

1.1. Purpose

A Virtual Interviewer for students to practice and improvise their skills by understanding where do they lack and how to fill up that gap between them and their dream company. Candidates suffering for job because of communication and other such factors need an interface where they can get an opportunity to practice and gain the confidence of cracking an interview. Evaluate eligibility of candidates, skill sets, behavior and areas of improvement.

1.2. Project Scope

• The candidate using our website will acquire a report of their performance and will most probably work on it and use the learning in their upcoming interviews.
• Complete analysis of the candidate's position in corporate world.
• Candidate will be provided with the progress history.

1.3. Project Goals and Objectives

1.3.1. Goals: A Virtual Interviewer for students to practice and improve their skills by understanding where do they lack and how to fill up that gap between them and their dream company. After studies students try to find jobs. Along with technical skills one needs to work on soft skills too for cracking an interview easily and get placed in a decent company. Mostly some candidates become either under-confident or over-confident during an interview and that is the reason the percentage of unemployment is increasing day by day. Hence to decrease the percentage of unemployment in India we decided to make a website for guiding them to get through this interview process. Making candidate face all challenges they might have to face in their coming future. Give the candidates the practice of online interviews and how to crack them by understanding their pros and con

1.3.2. Objectives: Decrease the rate of unemployment in our country. Guide the candidate to learn and understand the negatives and positives of him/her.

1.4. Organization of Report

The report is organized in a way that it consists of the certificate acknowledgement, Content table, purpose of project, goal, and objectives along with the scope of project.

Literature survey for understanding the idea behind the project via IEEE papers, the report was then followed by technical review and project planning. Project management approach, ground rules for project, budget, timeline and the software hardware requirements were also specified. System architecture along with use case diagram was elaborated. The report comes to an end with the conclusion, future scope and references.

Chapter 2

2. Literature Survey

2.1. Intelligent virtual agents for social coaching in job interviews

The TARDIS project aims to build a scenario-based serious-game simulation platform for NEETs and job-inclusion associations that support social training and coaching in the context of job interviews. This paper presents the general architecture of the TARDIS job interview simulator, and the serious game paradigm. During the virtual interview, the user will receive "credits" for a range of properties concurrent with appropriate behavior in job interviews. These credits will contribute to an overall score upon the conclusion of the interview. Completing a level will occur once a specified score has been achieved. They can then attempt a job interview at a more challenging level. As the user progresses within the game, "levels" will not result in a different location in the physical world as in a platform game. Rather, the setting will remain the same, and the internal states of the virtual recruiter will reflect advancement. For instance, the recruiter may become less patient, or more reactive to inappropriate behaviors. This can be reflected in the agent's reaction to individual behaviors or movements of the player. It can also be built into the agent's internal state. For instance, they could be aggressive or docile, friendly or aloof, and become less facilitate or forgiving of mistakes as the player progresses. Since the objective of TARDIS is to achieve a sense of independence and inclusion for the youngsters to use it.

2.1.1. Advantages

1. Competitive interview.
2. Personality trait development.

2.1.2. Disadvantages

The agent may become less patient or more reactive which might impact the candidate.

2.1.3. How to overcome the problems mentioned in paper?

System does not provide any rounds for analysis and completes it in one go

2.2. Trusting Virtual Agents: The Effect of Personality

An AI interviewer engages a user (interviewee) in a text-based conversation (c), powered by two core engines: (a) a personality engine and (b) a conversation engine. The personality engine analyzes a user's interaction behavior and automatically infers the user's personality traits and beyond, such as strengths and weaknesses. The conversation engine enables an AI interviewer to engage a user in a mixed-initiative conversation. Similar to a human interviewer, an AI interviewer takes initiatives to guide the interview flow and solicit information from a user, while it allows the user to pose questions whenever appropriate. For example, a user may ask a clarification question or inquire about the position that s/he is applying for. In such a case, the conversation engine interprets the user's request and then decides how to respond to the request. To help business users (e.g., a hiring manager or a market researcher) use interview results to make decisions, it provides an interactive visual dashboard that summarizes interview results.

2.2.1. Advantages

1. Examination of how agent's personalities and users' own personalities influence users' behavior—their willingness.
2. To conde in and listen to an agent during an interview in two very different contexts: a high-stakes job interview and a low-stakes educational setting.

2.2.2. Disadvantages

Little control on the type of data to be collected.

2.2.3. How to overcome the problems mentioned in paper?

Using Data Preprocessing techniques and data mining process we can process the data to make it in understandable format.

2.3. Predicting Student Performance using Advanced Learning Analytics

Educational Data Mining (EDM) and Learning Analytics (LA) research have emerged as interesting areas of research, which are unfolding useful knowledge from educational databases for many purposes such as predicting students' success. The ability to predict a student's performance can be beneficial for actions in modern educational systems. Existing methods have used features which are mostly related to academic performance, family income and family assets; while features belonging to

family expenditures and students' personal information are usually ignored. In this paper, an effort is made to investigate aforementioned feature sets by collecting the scholarship holding students' data from different universities of Pakistan. Learning analytic, discriminate and generative classification models are applied to predict whether a student will be able to complete his degree or not. Experimental results show that proposed method significantly outperforms existing methods due to exploitation of family expenditures and students' personal information feature sets. Outcomes of this EDM/LA research can serve as policy improvement method in higher education.

2.3.1. Advantages

It adapts the process of feature subset selection in order to identify the most effective determinants for student academic performance prediction.

2.3.1. Disadvantages

1. The system is not flexible enough.
2. Result extraction is a challenge.

2.3.3. How to overcome the problems mentioned in paper?

Providing a flexible system which is easy to use and acquire results.

Features	Paper 1	Paper 2	Paper 3	Proposed System
Easy Access	yes	no	no	yes
Flexible	yes	no	no	yes
User-Friendly Agent	no	yes	yes	yes

Table 2.1. Summary of Literature Review

2.4. Technical Review

2.4.1. Advantages of Technology:

• Python: Python is an interpreted high-level general-purpose programming language. Python is dynamically-typed and garbage-collected. It supports multiple programming paradigms, including structured (particularly, procedural), object-oriented and functional programming. Python consistently ranks as one of the most popular programming languages.

• Django: Django is a high-level Python web framework that enables rapid development of secure and maintainable websites. Built by experienced developers, Django takes care of much of the hassle of web development, so you can focus on writing your app without needing to reinvent the wheel.

• HTML: The Hyper Text Markup Language or HTML is the standard markup language for documents designed to be displayed in a web browser. HTML is backbone of websites.HTML is the language for describing the structure of Web pages. HTML gives authors the means to: Publish online documents with headings, text, tables, lists, photos, etc. Retrieve online information via hypertext links, at the click of a button.

• CSS: CSS stands for Cascading Style Sheets, and it's used to add style to a web page by dictating how a site is displayed on a browser. CSS is unique in that it doesn't create any new elements, like HTML or JavaScript. Instead, it's a language used to style HTML elements.

• JavaScript: JavaScript is a text-based programming language used both on the client side and server-side that allows you to make web pages interactive. ... Incorporating JavaScript improves the user experience of the web page by converting it from a static page into an interactive one. To recap, JavaScript adds behavior to web pages.

• Bootstrap: Bootstrap is an HTML, CSS JS Library that focuses on simplifying the development of informative web pages (as opposed to web apps). The primary purpose of adding it to a web project is to apply Bootstrap's choices of color, size, font and layout to that project.

• CNN: The deep neural network (CNN) designed for the classification task is reported operationally. The network can work on vectors of 40 features for each audio file provided as input. The 40 values represent the compact numerical form of the audio frame of 2s length.

• MLP: A multilayer perceptron (MLP) is a class of feed forward artificial neural network (ANN). MLP utilizes a supervised learning technique called back propagation for training.

2.4.2. Reasons to use this Technology:

- HTML, CSS, JavaScript and Bootstrap were the backbone for frontend development of the project.
- Python was used for basic programming requirements and Django as a framework for web development so that we could get an interface to present our model on. An interface for communication of users with the system we have created.
- MLP, CNN are the major contributors of the model we created. They were used for Speech emotion recognition. Machine learning OpenCV was used for Face emotion recognition majorly. So all these technologies made our project possible and our idea came to a result as our Final Year major project.

Chapter 3

3. Project Planning

3.1. Members and Capabilities

Asiya Pathan: A keen and hardworking member with knowledge in Django, Javascript, Database Management, Machine Learning and excellent team skills. Helpful and ready to work on any given work. Problem Solver with the capability of analyzing, designing and planning technological implementations of code.

Salwa Tisekar: An enthusiastic member with creativity and frontend skills. Knowledge of Django, frontend development, Machine Learning and DBMS. A good team player with coordinative nature.

Aman Kazi: Member with a great vision towards project. Knowledge in Machine learning, Ajax, Django and an excellent motivating team player.

Shahidraja Shaikh: Most hardworking member with a good intellectual behavior. Knowledge in neural networks and machine learning. Having good hands-on Django and database connectivity.

3.2. Roles and Responsibilities

Asiya Pathan: Face emotion recognition and Web Development.

Salwa Tisekar: Web development and Speech emotion recognition.

Aman Kazi: Speech emotion recognition, Ajax and Hosting.

Shahidraja Shaikh: Face emotion recognition, CNN and Hosting.

3.3. Assumptions and Constraints

To create a domain specific interviewer with capabilities of judging a candidate on basis on language, voice, answers postures and gestures. Mobile application for the same.

Time constraints being the major barrier for making an interviewer which is fast and live with the results and NLP for answers checking being a future scope in regards of domain specific interviewer for creating the Corpus. The time constraint again being a problem for making a mobile application for the website we created.

3.4. Project Management Approach

Project was divided into Model creation, frontend, backend, integration and connectivity.

Two models were required. Face emotion recognition and Speech emotion recognition,

The two models were divided among the four in a group of two. Once the model was ready frontend and backend was divided. A member then connected the frontend with backend. Then solving problems in an iterative manner.

To begin with our final year project we studied many IEEE papers to grab some ideas. Out of which three papers fascinated us. They were Intelligent virtual agents for social coaching in job interviews, Trusting Virtual Agents: The Effect of Personality and Predicting Student Performance using Advanced Learning Analytics. We even went through some live projects like Tardis and Hirevue so make a complete planning for the project. Finally, we decided to make our final year project on the topic "Virtual Interviewer". The next step was understanding the software model. Iterative model suited our project the best. In first iteration image processing and testing, second iteration is audio processing and testing, third iteration is integration using API and testing and last iteration will be deployment. Implementation was then started. From the video input first extraction of audio and images was to be done. After extraction Image processing and audio processing for emotion recognition of the candidate. Moreover, speech to text being the next step as answers verification, grammar check. Pronunciation and fluency also need to be checked. After all these steps combining all the results and calculating the average. Next step is training our agent to ask questions. Creating the website and connecting Database and Model to front-end. The next step is Deployment. Bringing the project to its destination by hosting it as the last.

3.5. Ground Rules for the Project

The ground rules for the project were timely completion of project. The model shall have good accuracy. The target for this project was minimum 80%. The website with good UI/UX for an attractive and user-friendly website. A clear website which is easy to use and understand.

Ground rules for the members:

1. We treat each other with respect.

2. We intend to develop personal relationships to enhance trust and open communication.

3. We value constructive dialogue. We will avoid being defensive and give feedback in a constructive manner.

4. Each side will come to the table as prepared as possible to expedite the process.

5. One person talks at a time; there are no side discussions

6. We emphasize open and honest communication - there are no hidden agendas.

7. We de-personalize discussion of issues - no attacks on people.

8. We will listen, be non-judgmental and keep an open mind on issues until it is time to decide.

9. You are encouraged to ask “genuine questions of clarification.” Please avoid asking “questions of attack.”

10. Please use each other’s first names, not the pronouns “he” or “she.”

11. Speak for yourself only.

12. Appeals and attempts to convince should be made to each other and not

to the mediator.

13. If something is not working for you, speak up.

14. Try to avoid establishing hard positions, expressing yourself instead in terms of your interests, intentions, and the outcomes that you would like to create.

3.6.Project Budget

Hosting of the project was done on Amazon Cloud Services via EC2. The hosting costs Rs. 3,528. Hence, the project was completed within 4k. Creating website and datasets were available at free on internet. Other resources were also available at free. Model creation was done by the ream members. The external cost for this project was only hosting.

3.7.Project Timeline

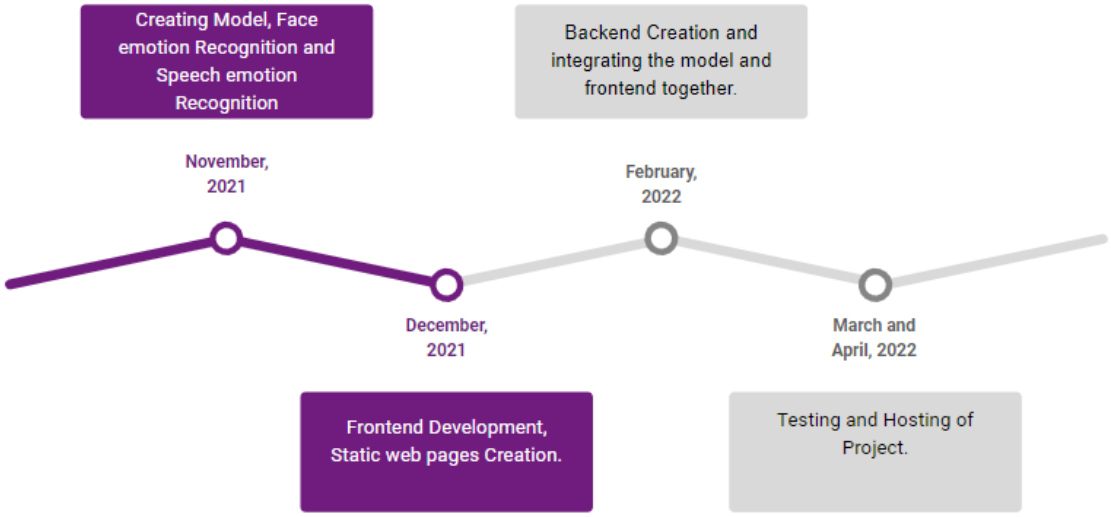

Fig. 3.1. Timeline

Chapter 4

4. Software Requirement Specification

4.1. Overall Description

Our aim is to create a virtual interviewer for students which guides them to improve their communication, body language, skills etc. so that they are ready to give an interview and clear it easily.
In a job interview one needs technical skills as well as soft skills. Many a times students don't understand why are they not able to crack an interview. So our Virtual Interviewer Our system will guide the candidate to learn and understand the negatives and positives of him/her. This Virtual Interviewer will act as our mock interviewer.
This will decrease the rate of unemployment in our country.

4.1.1. Product Perspective:

User friendly website which is easy to use and understand and gives proper analysis of how the user has performed in the interview. This product would be best for candidates to give mock interview and make themselves interview ready.

4.1.2. Product Features:

The product has features like judging the candidate on basis of facial expressions and audio. Predicting the confidence level of a candidate to displaying it live via profile page which consists of pie chart and bar graphs for giving even better understanding so that the user could improvise till the next interview. The interview could be given multiple times. The products consist of home page, about page explaining the website, contact us page, Login/Signup Page, interview page where the interview could be given and profile page so that the candidate to check the status of their interview and scopes of improvement.

4.1.3. User Classes and Characteristics

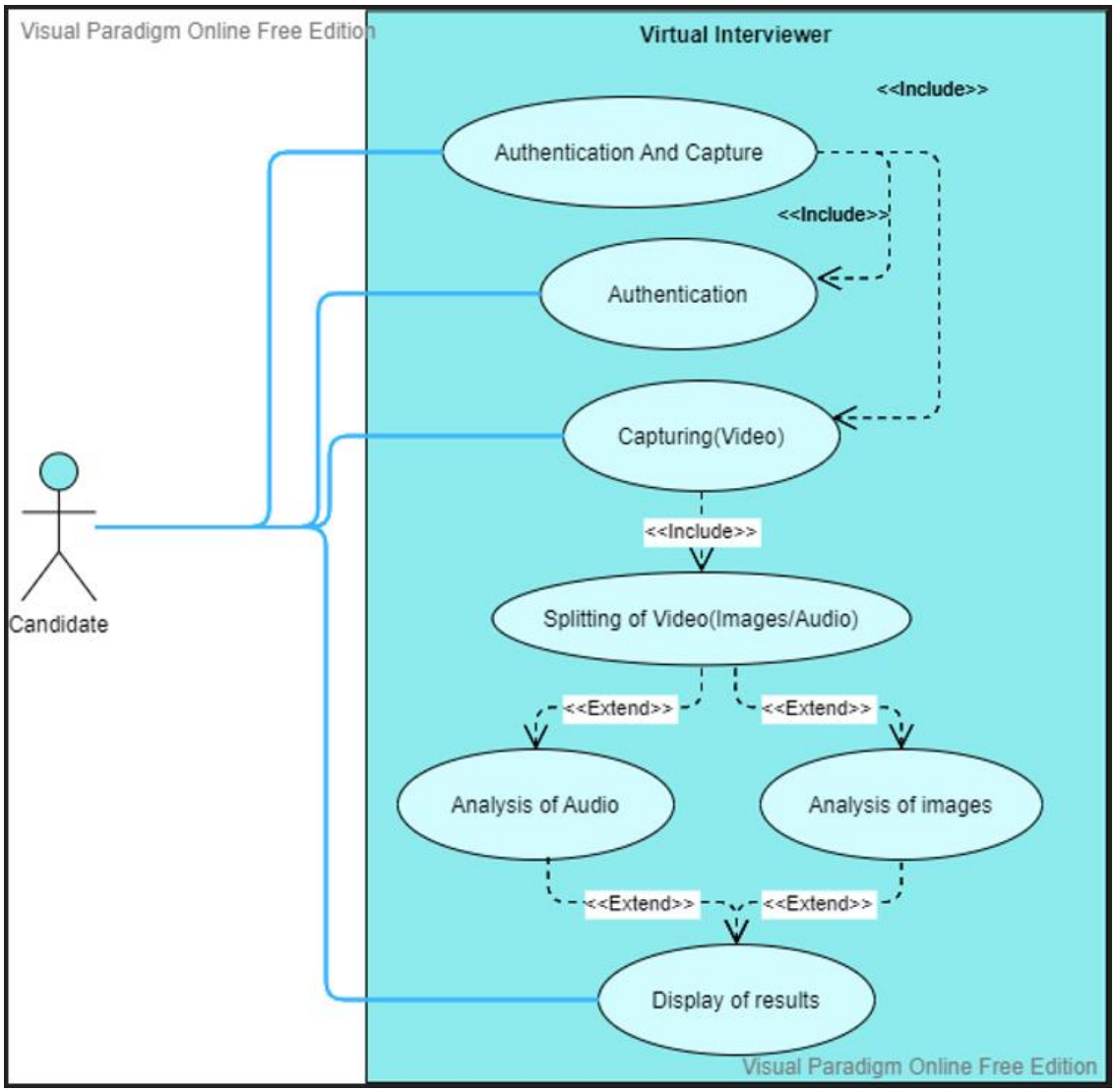

Fig 4.1.Use Case Diagram

4.1.4. Operating Environment:

The operating environment for the project is laptop with internet connectivity. The laptop shall contain web camera and microphone.

4.1.5. Design and Implementation Constraints:

Mobile application for the same project was not possible because of the web camera and questions frame size. Due to frontend compatibility issues with mobile phone because of the size and structure of the product imposed

a design constraint. Implementation constraints was NLP over answers checking as providing a corpus for training the machine for HR questions or any domain specific question was a big challenge for implementing.

4.2. System Features

• For Storing the data in our project we will use SQLite. It can run nearly anywhere. SQLite has been ported to a wide variety of platforms: Windows, MacOS, Linux, iOS, Android, and more. The source code for SQLite is public domain, so it can be reused in other programs with no practical restrictions.

• For Storing the data in our project we will use SQLite. It can run nearly anywhere. SQLite has been ported to a wide variety of platforms: Windows, MacOS, Linux, iOS, Android, and more. The source code for SQLite is public domain, so it can be reused in other programs with no practical restrictions.

• Django Framework will be used by us to create website and use APIs. Django is the best framework for web applications, as it allows developers to use modules for faster development. As a developer, you can make use of these modules to create apps, websites from an existing source. It speeds up the development process greatly, as you do not have to code everything from scratch.

• The programming Language to be used in this project is Python. Python is commonly used for developing websites and software, task automation, data analysis, and data visualization. Since it's relatively easy to learn, Python has been adopted by many nonprogrammers such as accountants and scientists, for a variety of everyday tasks, like organizing finances. Python is highly productive as compared to other programming languages like C++ and Java. ... Python is also very famous for its simple programming syntax, code readability and English-like commands that make coding in Python lot easier and efficient.

• HTML, CSS, Bootstrap and JavaScript are the backbone of a website.HTML provides the basic structure of sites, which is enhanced and modified by other technologies like CSS and JavaScript. CSS is used to control presentation, formatting, and layout. JavaScript is used to control the behavior of different elements. Bootstrap includes HTML and CSS based design templates for typography, forms, buttons, tables, navigation,

modals, image carousels and many other, as well as optional JavaScript plugins. Bootstrap also gives you the ability to easily create responsive designs.

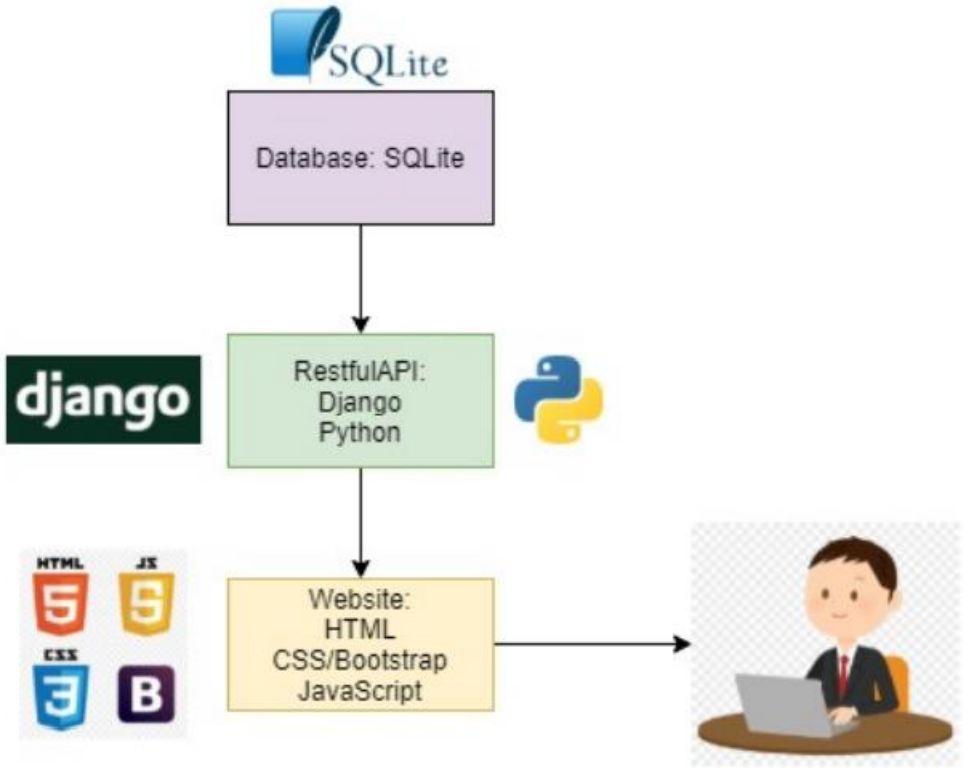

Fig. 4.2.Sytem Features and insights

4.3.External Interface Requirements

4.3.1. User Interfaces

User interface is the website with which he/she would be interacting while giving an interview. The login/register page would be the first step towards getting to the mock interviewer present on the interview page. At last, the user would be interacting with the profile page for understanding the scopes of improvement for the interview given.

4.3.2. Hardware Interfaces

Laptop or Desktop with good configuration of RAM and storage is hardware interfaces for the user. Web cam and microphone would be also required.

4.3.3. Software Interfaces

Internet connectivity with any web browser would be

enough for the website to work along with good internet connectivity.

4.3.4. Communications Interfaces

The user itself is enough for communicating with the product for the interview.

4.4.Non-Functional Requirements

4.4.1 Performance Requirements:

The website works with good speed if the internet connectivity is good. RAM and storage also play a major role behind the performance of the system.

4.4.2. Safety Requirements:

Authentication of user is done while doing signup to ensure there is safety. The system is safe to use with no virus in it. Could be opened on any web browser easily.

4.4.3. Security Requirements:

The data of the user is kept secure in the database via encryption technique.

Chapter 5

5. System Design

5.1.System Requirements Definition

For a project to be completed properly the candidate and developers always have some software and hardware requirements which needs to get fulfilled. Some software and hardware requirements with respect to this project are listed below.

5.1.1. Functional requirements:

- Internet Connectivity: Internet connectivity is necessary for the candidate to access the website. Website is hosted online and needs internet to be used.

- Code Editor: This would be required for writing code of our system which would be used for making our project.

- Python 3.9.0: For writing our code in python language, python needs to be installed.

5.1.2. System requirements (non-functional requirements):

- Computer or Laptop: Computer or laptop is necessary for the candidate to use our laptop or computer by using which they can open the website and use further.

- Web Camera: Web camera is important so that can give video call interview and images could be extracted for emotion recognition of the candidate.

- Microphone: Audio collection could be done using microphone. This audio which would be recorded will be used for emotion recognition with reference to audio.

- Speaker: so that the candidate could hear the questions asked by the

- Agent (Apparently his/her mock interviewer)

5.2. System Architecture Design

The candidate will login to our website and then interview video will be taken as input which would be further extracted into audio and images. Firstly, via audio emotion recognition, pronunciation and fluency in the speech would be performed and checked. Secondly from images facial expression analysis would be performed and from both we will acquire an overall performance report of the candidate which would be further presented on the profile page in fractions of minutes to him/her so that improvement could be made.

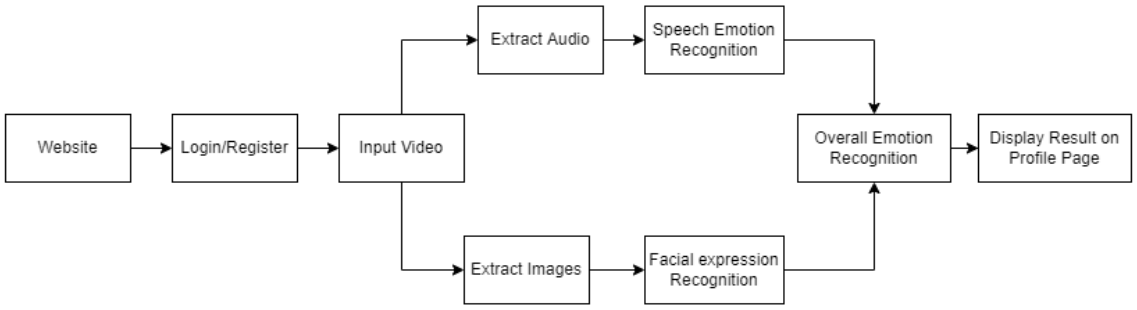

Fig. 5.1.System Architecture

5.3. Sub-system Development

5.3.1. Module1:

Face emotion recognition is the first module of the system. OpenCV and DeepFace model was used for Facial expression analysis.

5.3.2. Module2:

Speech emotion recognition for analyzing the audio of the user and predicting the confidence level of a candidate.

5.4. System Integration

5.4.1. Class Diagram:

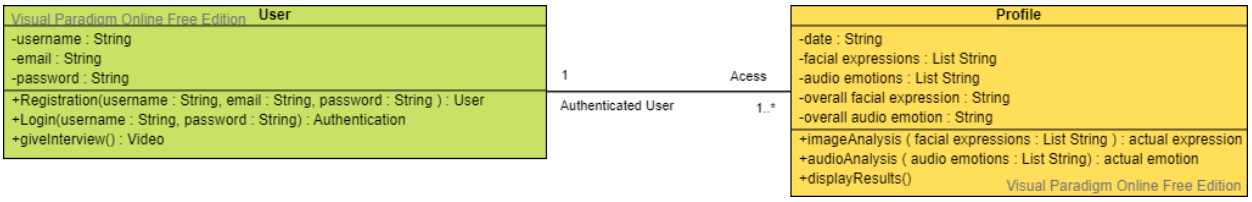

Fig. 5.2. Class Diagram for Virtual Interviewer.

5.4.2. Sequence Diagram:

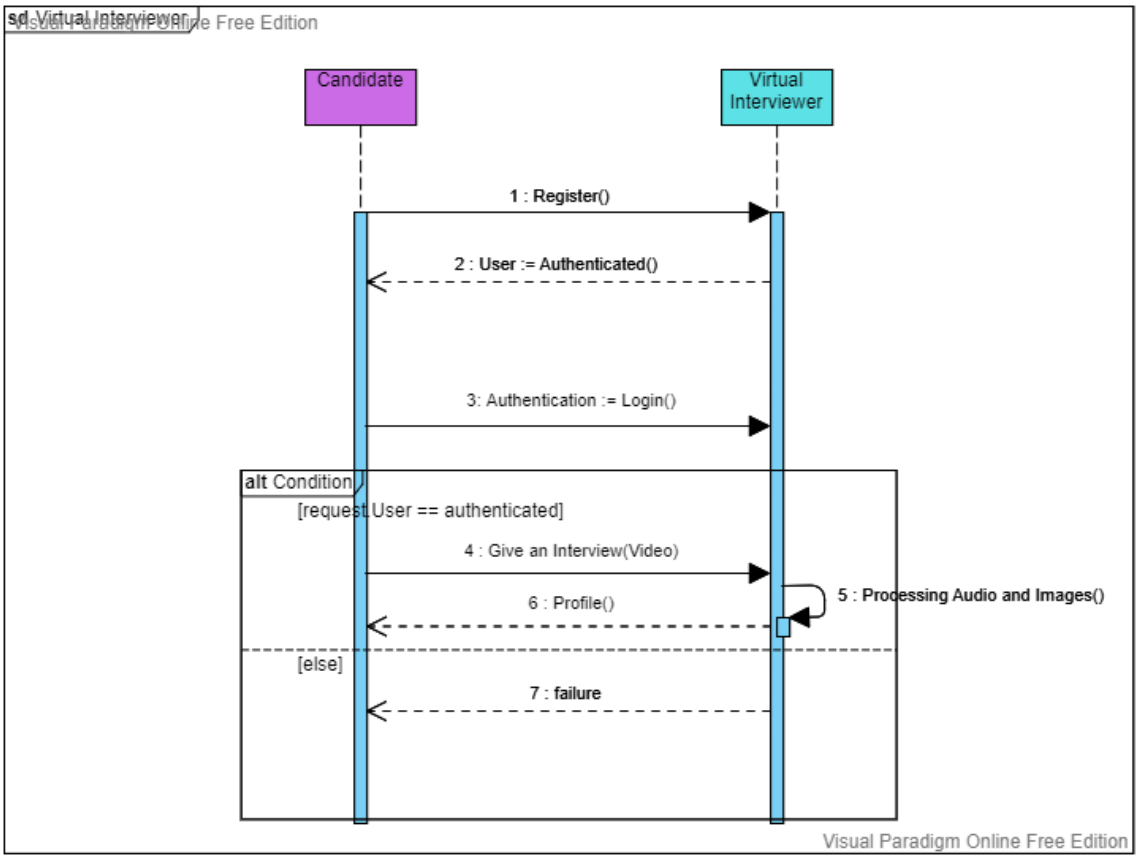

Fig. 5.3. Sequence Diagram for Virtual Interviewer.

Chapter 6

6. Implementation

From the video of interview two things would be extracted, first the images for the emotion recognition of the candidate. Deep neural network and OpenCV algorithms will be used for this. Module Deepface playing an important role in it. DeepFace is trained on a large dataset of faces, an identity labeled dataset of four million facial images belonging to more than 4,000 identities, acquired from a population vastly different than the one used to construct the evaluation benchmarks. In other words, each identity had an average of a thousand samples. The DeepFace algorithm, first aligns a face so that the person in the picture faces forward, using a 3-D model of an "average" forward-looking face. Then it uses the deep learning to find a numerical description of the forward-looking face. Emotion Detection — Classifying the emotion on the face as happy, angry, sad, neutral, surprise, disgust or fear. Different emotion types are detected through the integration of information from facial expressions, body movement and gestures, and speech A modern face recognition pipeline consists of 4 common stages: detect, align, represent Deepface handles all these common stages in the background. You can just call its verification, find or analysis function with a single line of code. OpenCV checks whether Web camera is present or not for video capturing. It creates different frames for image capturing.

Secondly Audio will be extracted from the video for emotion analysis based on audio. The Algorithm being used for it are Deep Learning, SVM (Support Vector Machine), CNN and MLP. classification model of emotion elicited by speeches based on deep neural networks (CNNs), SVM, MLP Classification based on acoustic features such as Mel Frequency Cepstral Coefficient (MFCC). The model has been trained to classify eight different emotions (neutral, calm, happy, sad, angry, fearful, disgust, surprise). Dataset the dataset is built using 5252 samples from: 1.Ryerson Audio-Visual Database of Emotional Speech and Song (RAVDESS) dataset. 2.Toronto emotional speech set (TESS) dataset. The audio file is divided into frames, usually using a fixed window size, to obtain statistically stationary waves. The amplitude spectrum is normalized with a reduction of the "Mel" frequency scale. This operation is performed for empathizing the frequency more meaningful for a significant reconstruction of the wave as the human auditory system can perceive. For each audio file, 40 features have been extracted. The feature has been generated by converting each audio file to a floating-point time series. Then, an MFCC

sequence has been created from the time series. The model has been trained to classify seven different emotions (neutral, calm, happy, sad, angry, fearful, disgust, surprised) and obtained an overall F1 score of 0.85 with the best performances on the Happy class (0.90) and worst on the calm class (0.77). To obtain such a result, we extracted the MFCC features (spectrum of-a-spectrum) from the audio files used for the training. Emotion recognition here proposed is based on a deep learning strategy based on convolutional neural networks (CNN), Support Vector Machine (SVM) classifier, MLP Classifier. The key idea is considering the MFCC commonly referred to as the ”spectrum of a spectrum”, as the only feature to train the model.

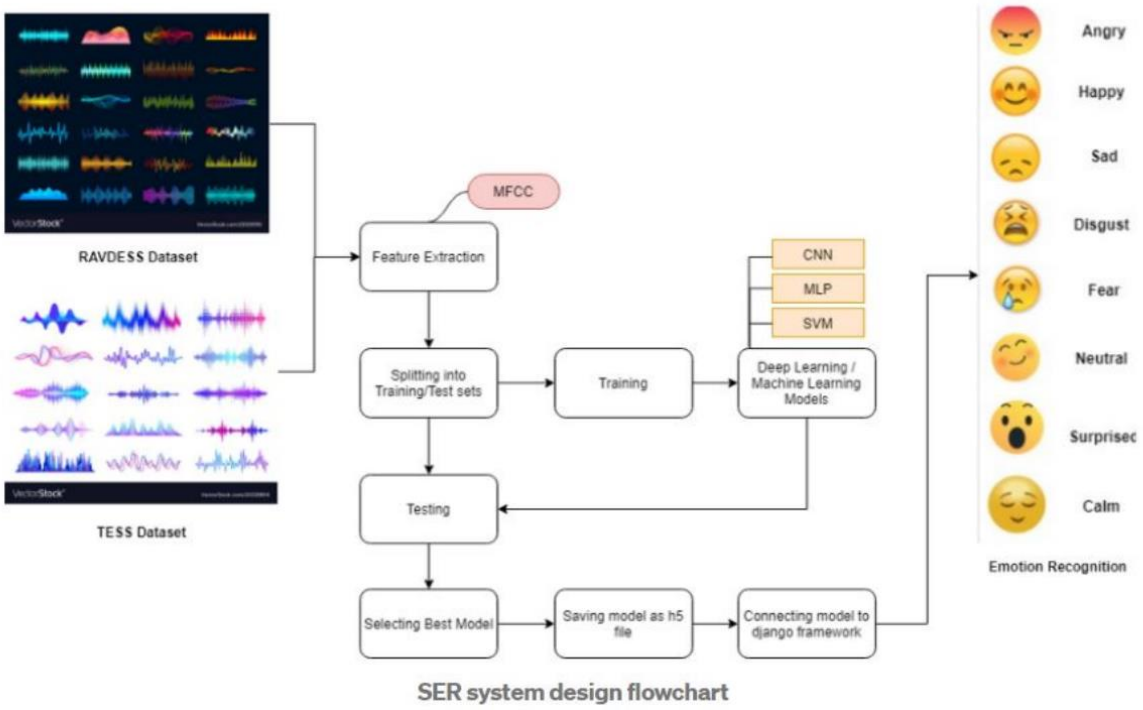

Fig. 6.1.SER system Design

Analysis Code:

7. Facial expression recognition

```
import cv
from deepface import DeepFace
import json
import os
# from . import queue
def analyze(queue):
```

```
temp = []
res = {}
while len(queue) > 0:

    # if len(queue)>0 :

    # analysis
    data = queue.pop(-1)
    cap = cv2.VideoCapture(data[1])

    di = {}
    flag = True
    f = open("emotions.txt", "w")
    count =0
    di ={"happy":0, "sad":0, "angry":0, "neutral":0, "surprise":0, "fear":0, "disgust":0}
    while flag:
        ret, frame = cap.read()
        # print(ret)
        # print(count)
        if ret:
            if count %8 ==0:
                result = DeepFace.analyze(frame, actions = ['emotion'], enforce_detection=False)
                f.write(result['dominant_emotion'])
                # gray = cv2.cvtColor(frame, cv2.COLOR_BGR2GRAY)
                # cv2.imshow('Original video', frame)
                emotions = result['dominant_emotion']
                di[emotions] += 1
                # di.append(result['dominant_emotion'])
        else:
            flag = False
            # continue

        count +=1

        if cv2.waitKey(2) & 0xFF == ord('q'):
            break
        # print(result['dominant_emotion'])
    cap.release()
    cv2.destroyAllWindows()
    # print(data[0])
    res[data[0]] = di
    with open("result.json","w") as file :
        json.dum(res, file)
   temp.append((data[0],di))
    print(data[1])
    os.remove(data[1])
```

8. Audio emotion recognition

```
import os
import speech_recognition as sr
import ffmpeg
from pydub import AudioSegment
from pydub.utils import make_chunks
import os


def process_audio(path,rel_path):
        i = 0
        j = len(path)
        while i < j:
                file_path = path[i][1]
                destin_path = rel_path +"audioData/"
                com1 = f"ffmpeg -i {file_path} {destin_path}/{path[i][0]}.wav"
                os.system(com1)
                myaudio = AudioSegment.from_file(f"{destin_path}/{path[i][0]}.wav", "wav")
                chunk_length_ms = 8000 # pydub calculates in millisec
                chunks = make_chunks(myaudio,chunk_length_ms) #Make chunks of one sec
                for idx, chunk in enumerate(chunks):
                        chunk_name = f'{destin_path}' + f"{path[i][0]}" +
"_{0}.wav".format(idx)
                        chunk.export(chunk_name, format="wav")
                i +=1



  from tensorflow.keras.models import load_model
  import numpy as np
  import librosa
  import os
  class livePredictions:

     def __init__(self,
  path=r"../Interviewer/static/model/testing10_model.h5"):
        self.path = path
        # self.file = file
        print("loading Model ...")
        self.loaded_model =load_model(self.path)
```

```
    def makepredictions(self,file):
        data, sampling_rate = librosa.load(file)
        mfccs = np.mean(librosa.feature.mfcc(y=data,
sr=sampling_rate, n_mfcc=40).T, axis=0)
        x = np.expand_dims(mfccs, axis=1)
        x = np.expand_dims(x, axis=0)
        # predictions = self.loaded_model.predict_classes(x)
        predictions = np.argmax(self.loaded_model.predict(x),
axis=-1)
        # print("Prediction is", " ",
self.convertclasstoemotion(predictions))
        pred = self.convertclasstoemotion(predictions)
        # print(pred)
        return pred

    @staticmethod
    def convertclasstoemotion(pred):
        label_conversion = {'0': 'neutral',
                            '1': 'calm',
                            '2': 'happy',
                            '3': 'sad',
                            '4': 'angry',
                            '5': 'fearful',
                            '6': 'disgust',
                            '7': 'surprised'}

        for key, value in label_conversion.items():
            if int(key) == pred:
                label = value
        return label
```

Project code:

https://github.com/salwa2411/Virtual_interviewer/tree/main/temporary_folder/Interviewer

Chapter 7

9. System Testing

9.4. Test Cases and Test Results

Testing was divided into different parts. The models were created first. Individual testing was done on both the models. Accuracy of the models was checked. Accuracy of Face emotion recognition model was 92.67% and Speech emotion Recognition was 84.53%. The test results were very close to our expectations. The result is displayed on profile page and testing of the website was also performed. Speed was slow initially but later by applying celery on django speed was acquired in the product. The result got displayed live at a better speed.

Test Case ID	1	**Test Case Description**	Test the Login Functionality.		
Created By	Asiya	**Reviewed By**	Salwa	**Version**	1.0

QA Tester's Log	Candidate Registeration and login process.

Tester's Name	Asiya	**Date Tested**	18-May-2021	**Test Case (Pass/Fail/Not Executed)**	Pass

S #	Prerequisites:
1	Access to Chrome Browser
2	Internet Connection
3	
4	

S #	Test Data
1	Username = asiya
2	Password = Ashu@23#
3	
4	

Test Scenario	Verify on entering valid username and password, the candidate can login.

Step #	Step Details	Expected Results	Actual Results	Pass / Fail / Not executed / Suspended
1	Navigate to http://myinterviewer.ml	Site should open	As Expected	Pass

Test Case ID	2	**Test Case Description**	Test the hardware devices webcam and audio device.		
Created By	Aman	**Reviewed By**	Shahid	**Version**	1.0

QA Tester's Log	Enabling webcam and audio device of the users' system.

Tester's Name	Aman	**Date Tested**	May 18, 2021	**Test Case (Pass/Fail/Not Executed)**	Pass

S #	Prerequisites:
1	Access to Chrome Browser
2	Internet Connection
3	Webcam
4	Audio input device

S #	Test Data
1	Allow the pop up box for enabling camera and mic.
2	
3	
4	

Test Scenario	Verify on giving the permissions to the browser for camera and mic access for interview.

Step #	Step Details	Expected Results	Actual Results	Pass / Fail / Not executed / Suspended
1	Navigate to http://myinterviewer.ml/interview	Site gives a pop up for permission.	As Expected	Pass

Test Case ID	3	Test Case Description	Test the Profile page result after processing video input.		
Created By	Shahid	Reviewed By	Salwa	Version	1.0

QA Tester's Log	Enabling webcam and audio device of the users' system.

Tester's Name	Shahid	Date Tested	May 18, 2021	Test Case (Pass/Fail/Not Executed)	Pass

S #	Prerequisites:
1	Access to Chrome Browser
2	Internet Connection
3	Webcam
4	Audio input device

S #	Test Data
1	Allow the pop up box for enabling camera and mic.
2	Video saved on server.
3	
4	

Test Scenario	Verify on giving the permissions to the browser for camera and mic access for interview.

Step #	Step Details	Expected Results	Actual Results	Pass / Fail / Not executed / Suspended
1	Navigate to http://myinterviewer.ml/profile	Site displays the result through graphical elements.	As Expected	Pass

9.5. Sample of a Test Case.

1. Registration page

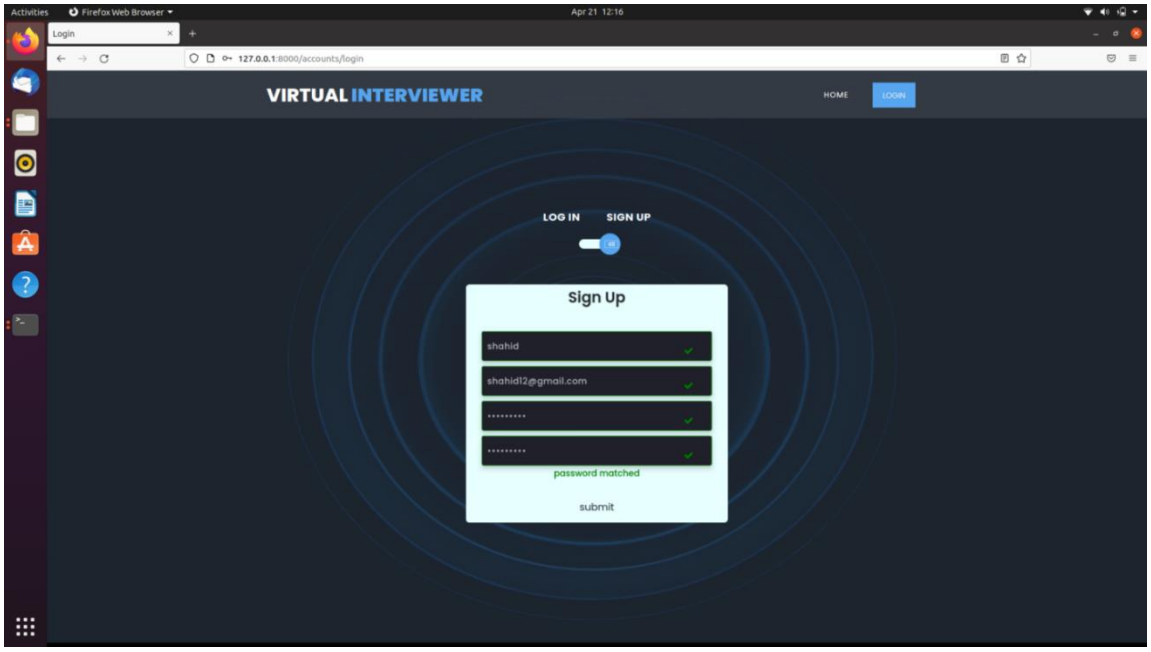

Fig. 7.1. Registration Page

2. Webcam and Audio device.

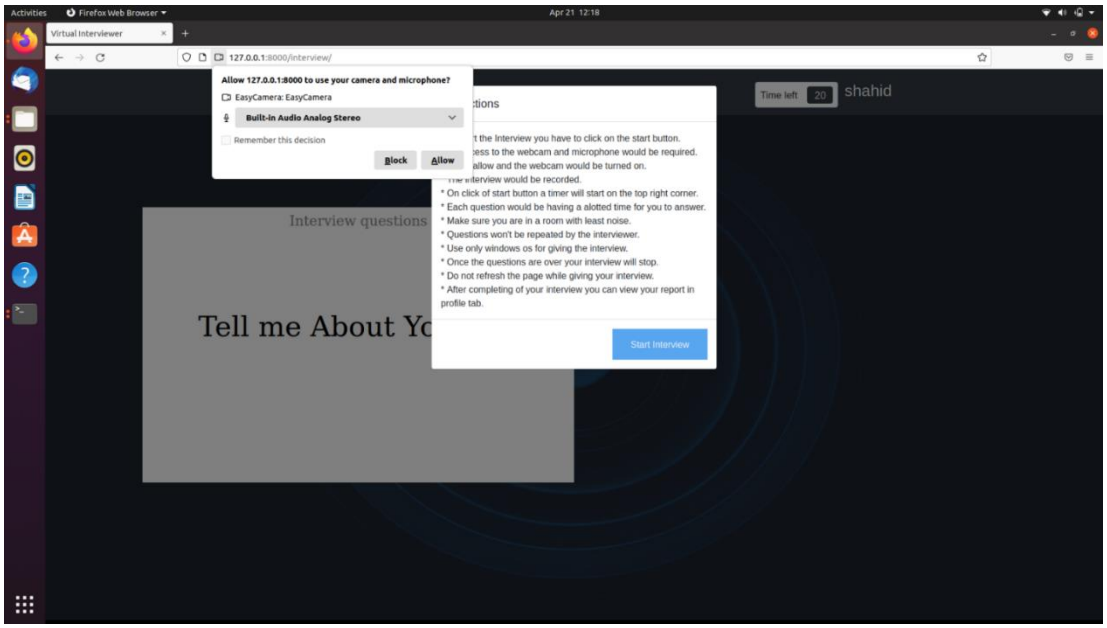

Fig. 7.2. Webcam and Audio Device Permission

3. Profile page testing.

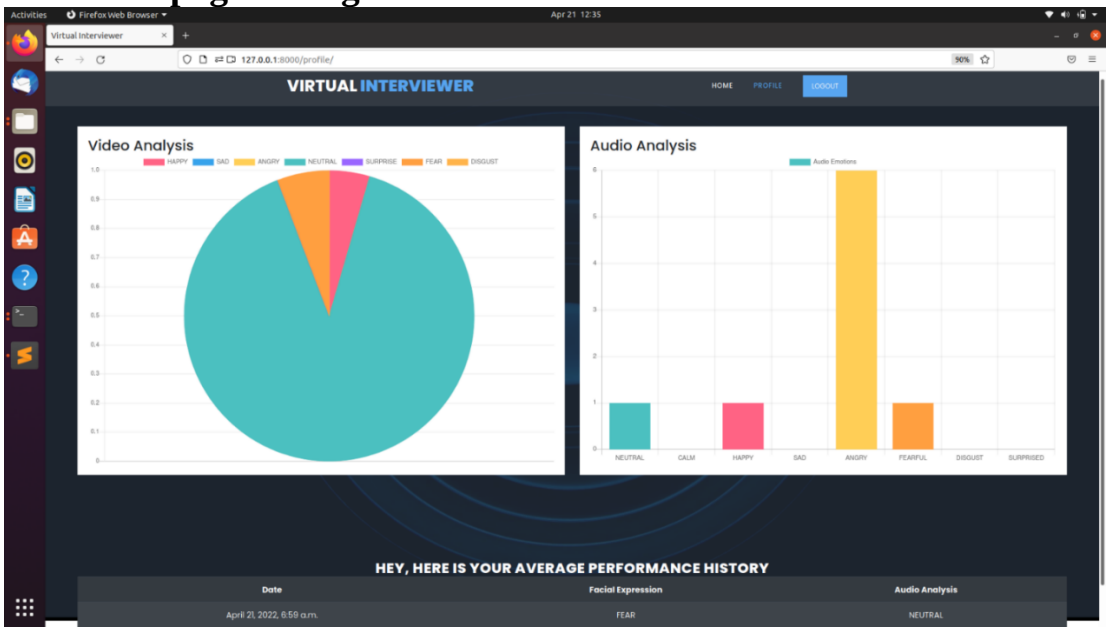

Fig. 7.3. Profile Page

9.6. Software Quality Attributes:

1. Availability:

Visibly notifying the user if hardware or software components fail. Website is available through any browser. Recommended Windows os

for clear audibility of interview questions.

2. **Performance:**
   Performance of the response time depends on the number of users accessing the site at same instant. Website has good response time. Ability of system to conform timing requirements.

3. **Testability:**
   Tested different aspects and purpose of our website and matched with the expected results. Initially practiced unit testing for testing each module. Then finally did the integration testing after integrating all the modules in a single unit.

4. **Security:**
   System protects the data and defend information from unauthorized access. This system is able to block malicious or unauthorized actions that could potentially destroy the system.

5. **Usability:**
   Users can easily give an interview on our system also through contact us information our system provides user support to solve any queries of the users.

6. **Functionality:**
   Fully functional fledge system with all required functionalities. Through testing achieved the desired functionality of the system. User can give an interview and view the results in profile page with quick response time.
   Faster processing for faster response is achieved through celery.

Chapter 8

10. Screenshots of Project

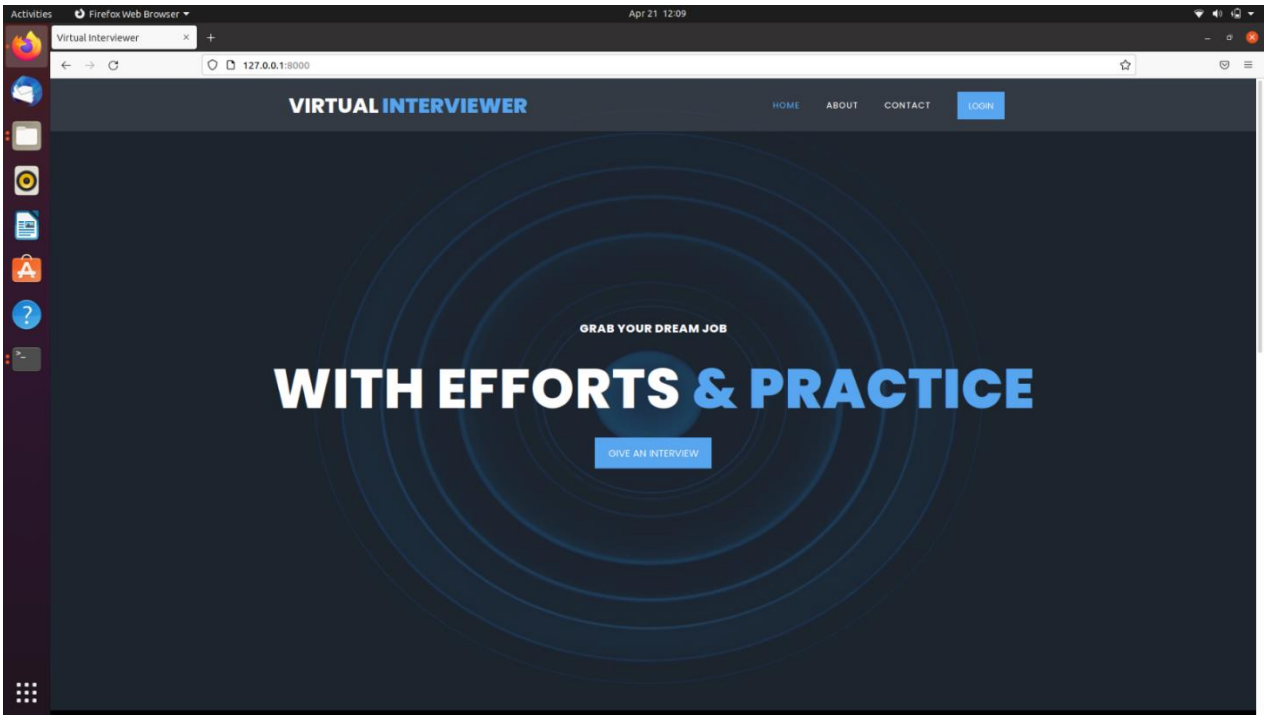

Fig.8.1. Home Page

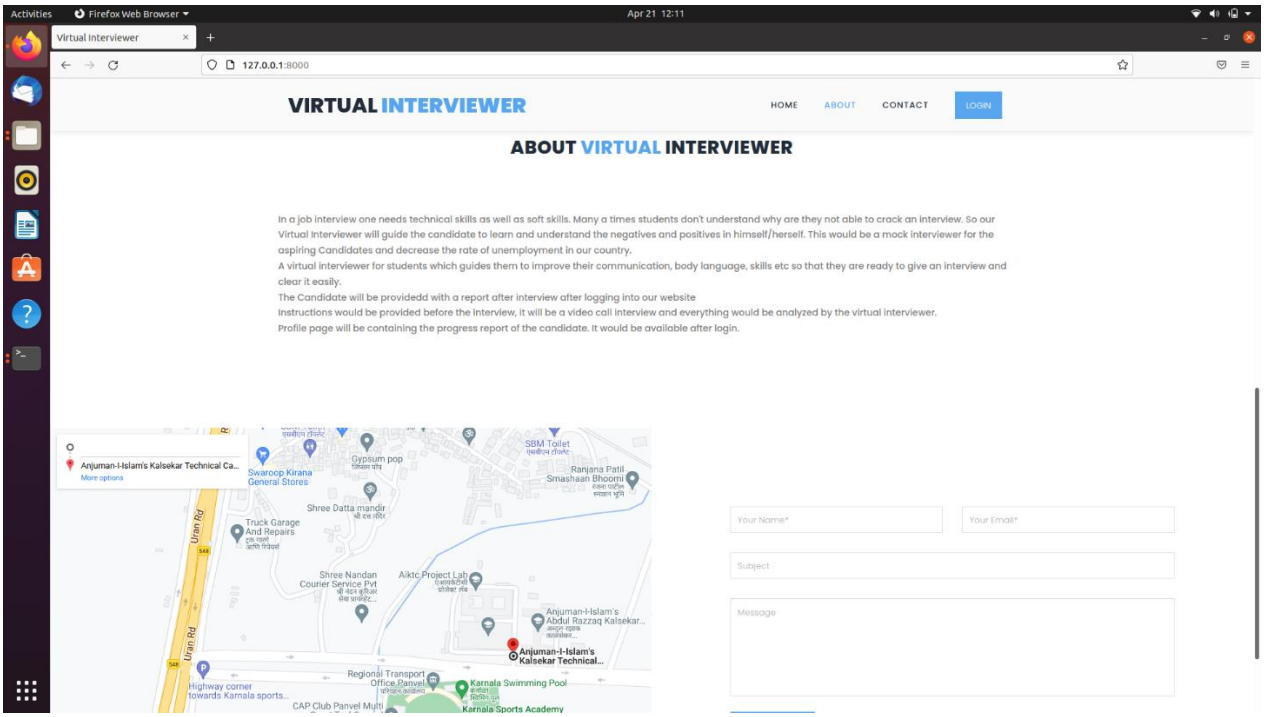

Fig.8.2. About and Contact Us Page

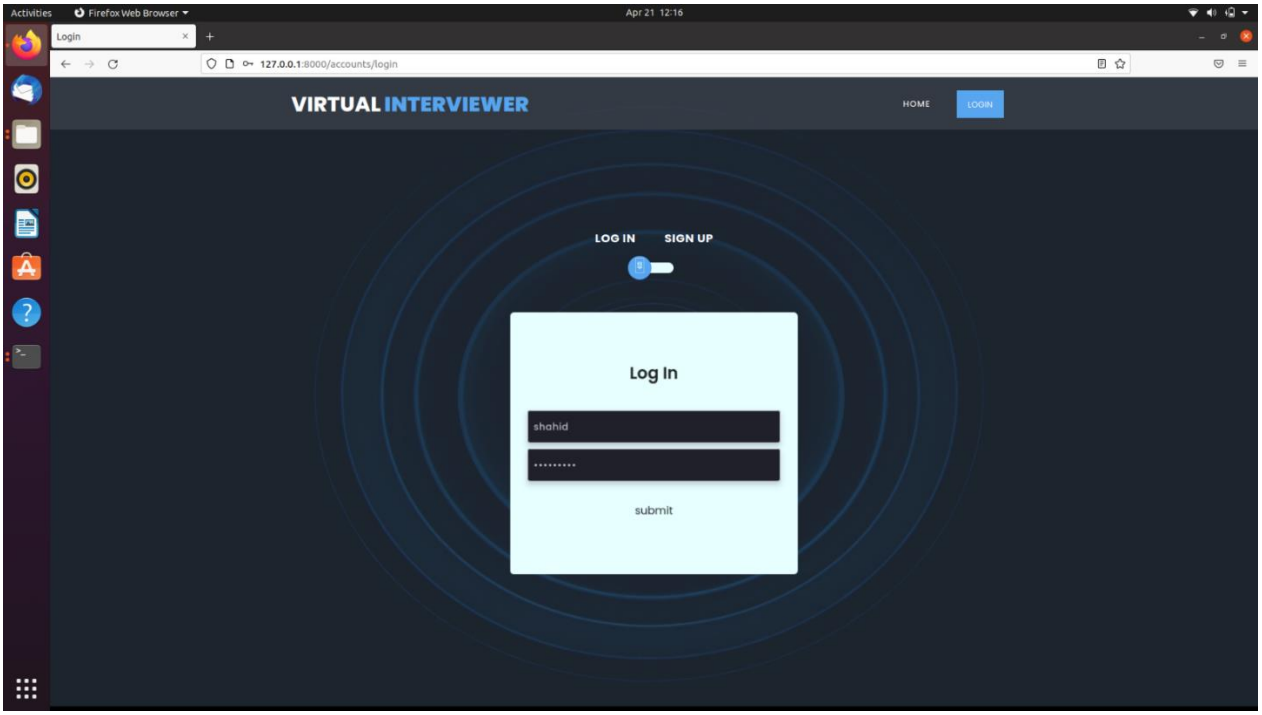

Fig.8.3. Login Page

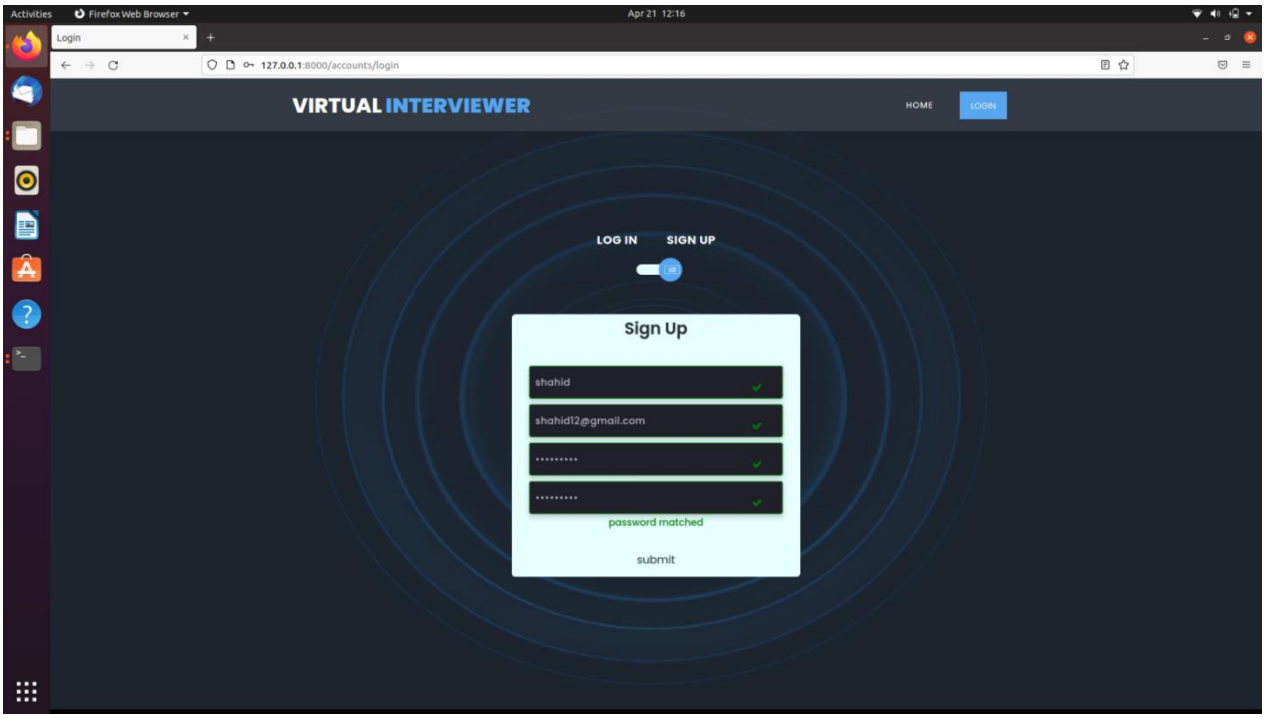

Fig.8.4. Sign Up Page

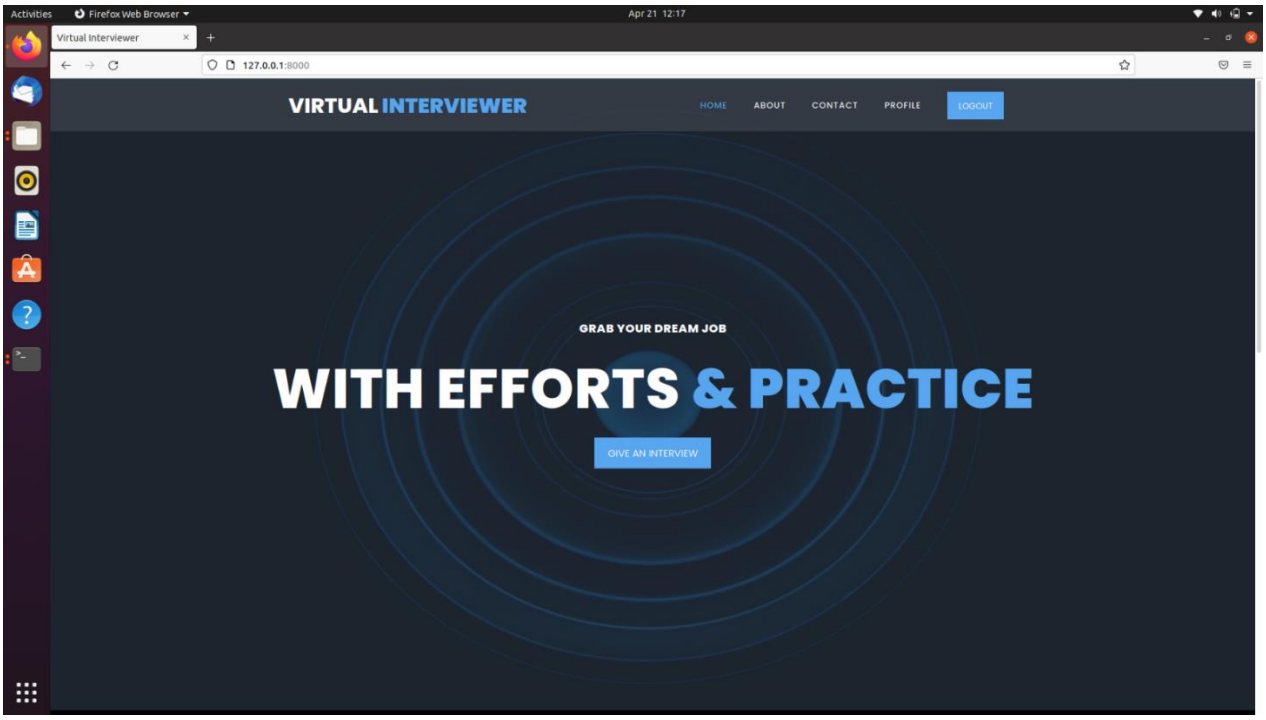

Fig.8.5. Home page after Authentication

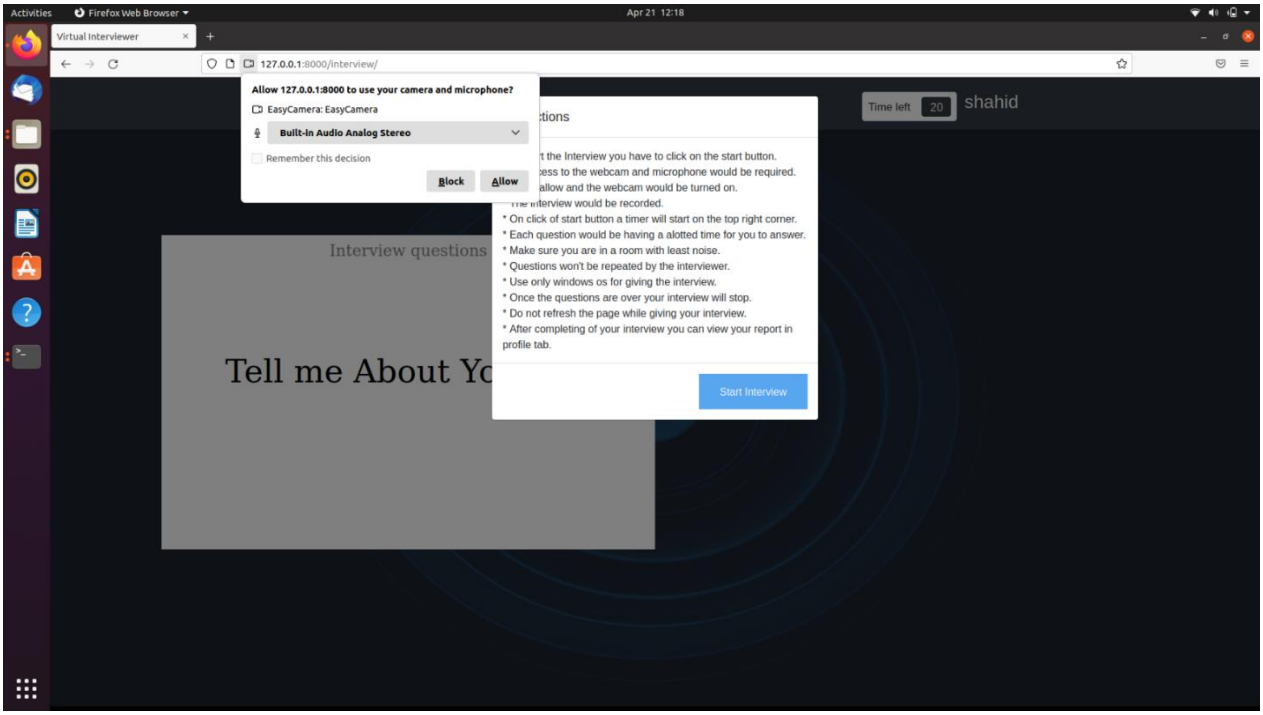

Fig.8.6. Interview Page with Modal of instructions and Permissions

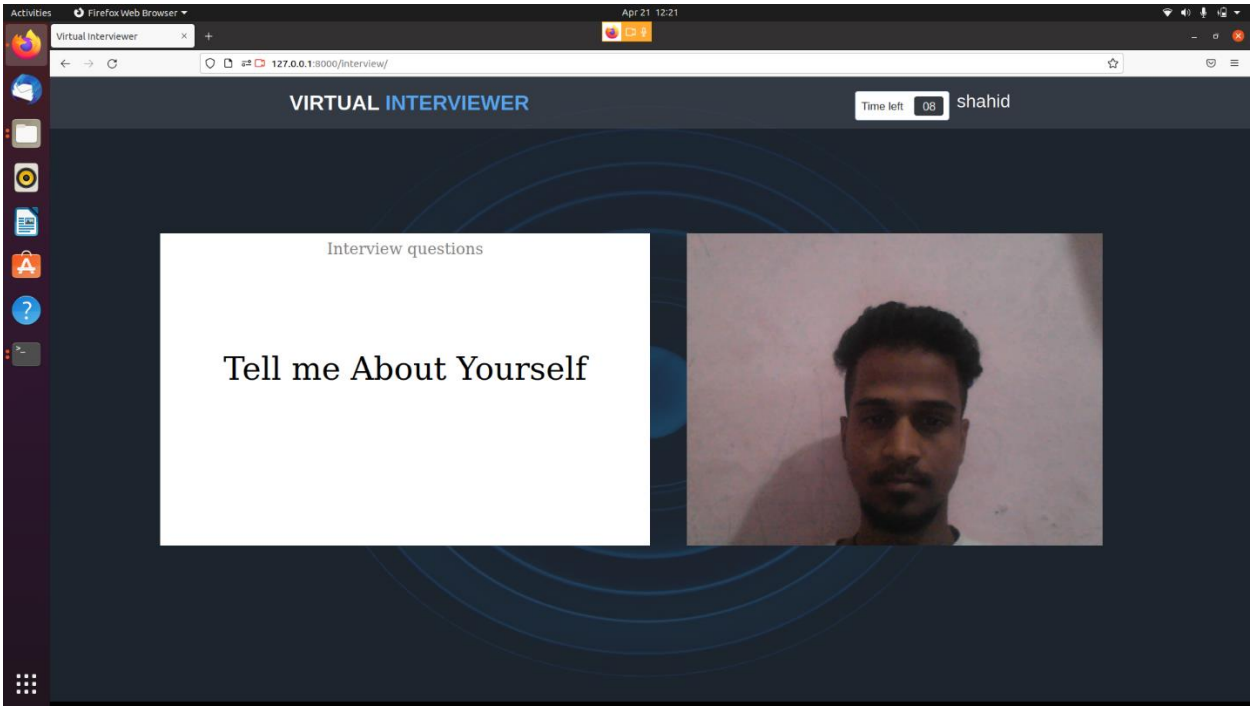

Fig.8.7. Interview Page

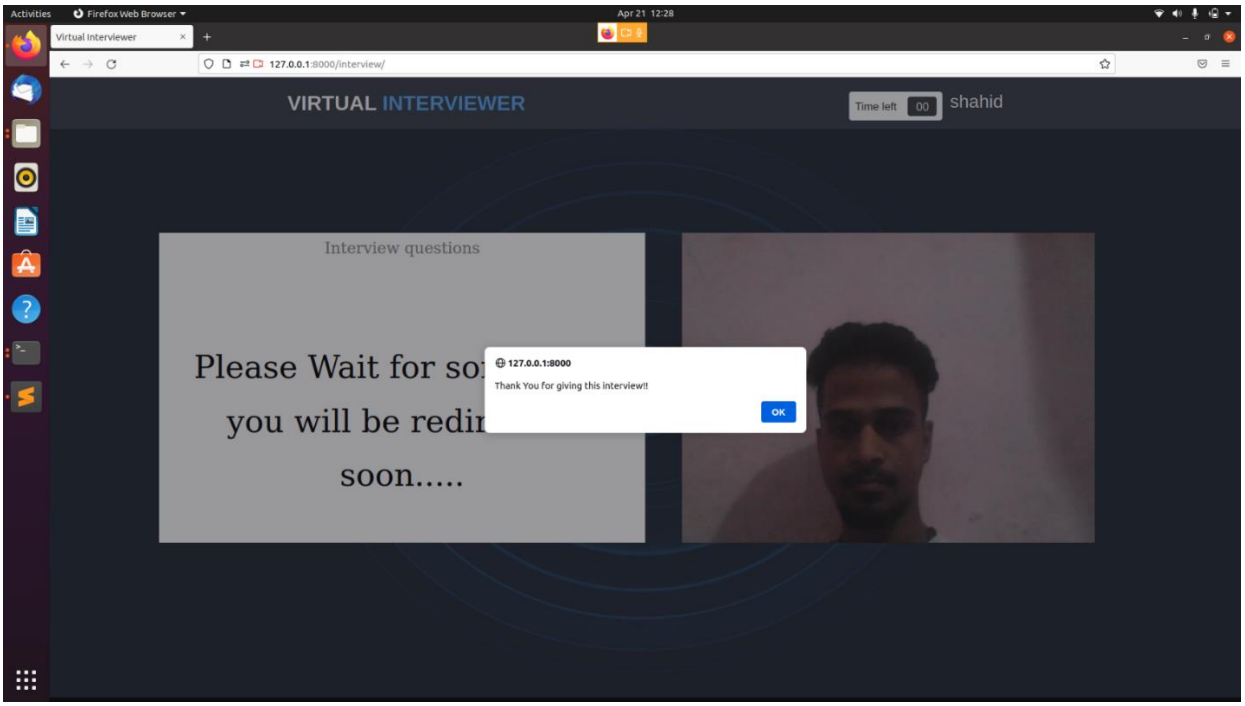

Fig.8.8. Interview Page after giving Interview

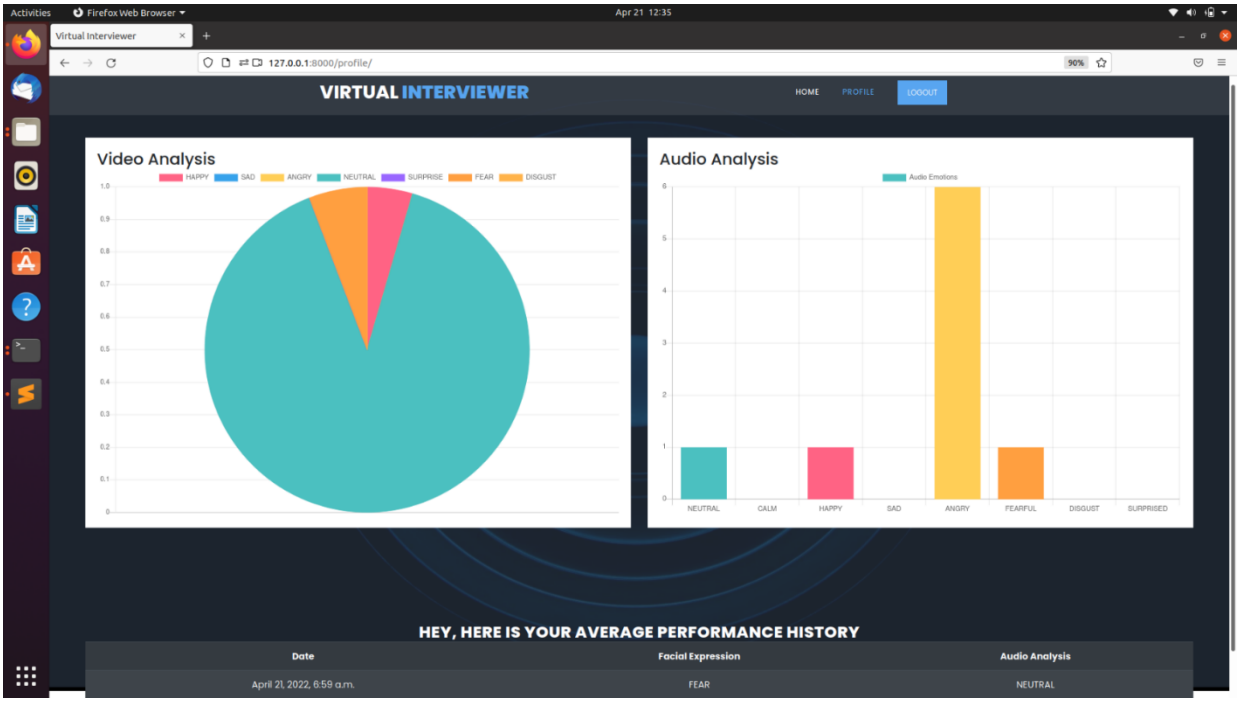

Fig.8.9. Profile Page

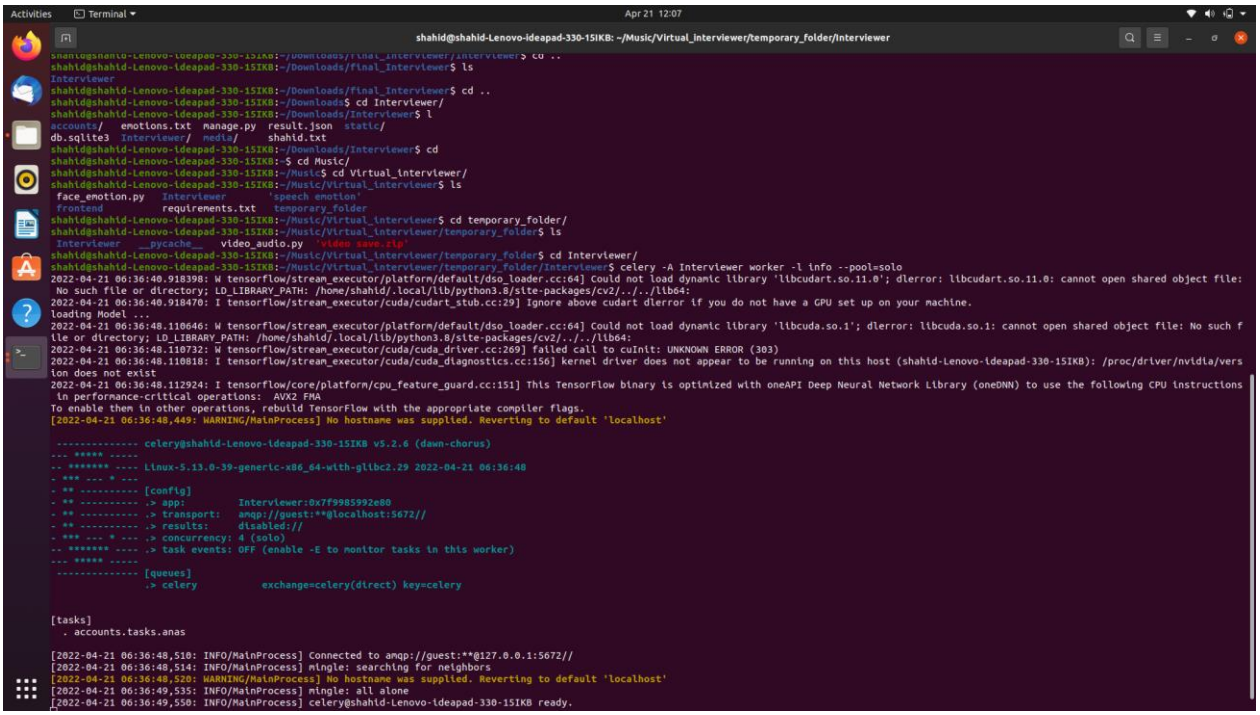

Fig.8.10. Terminal Page 1

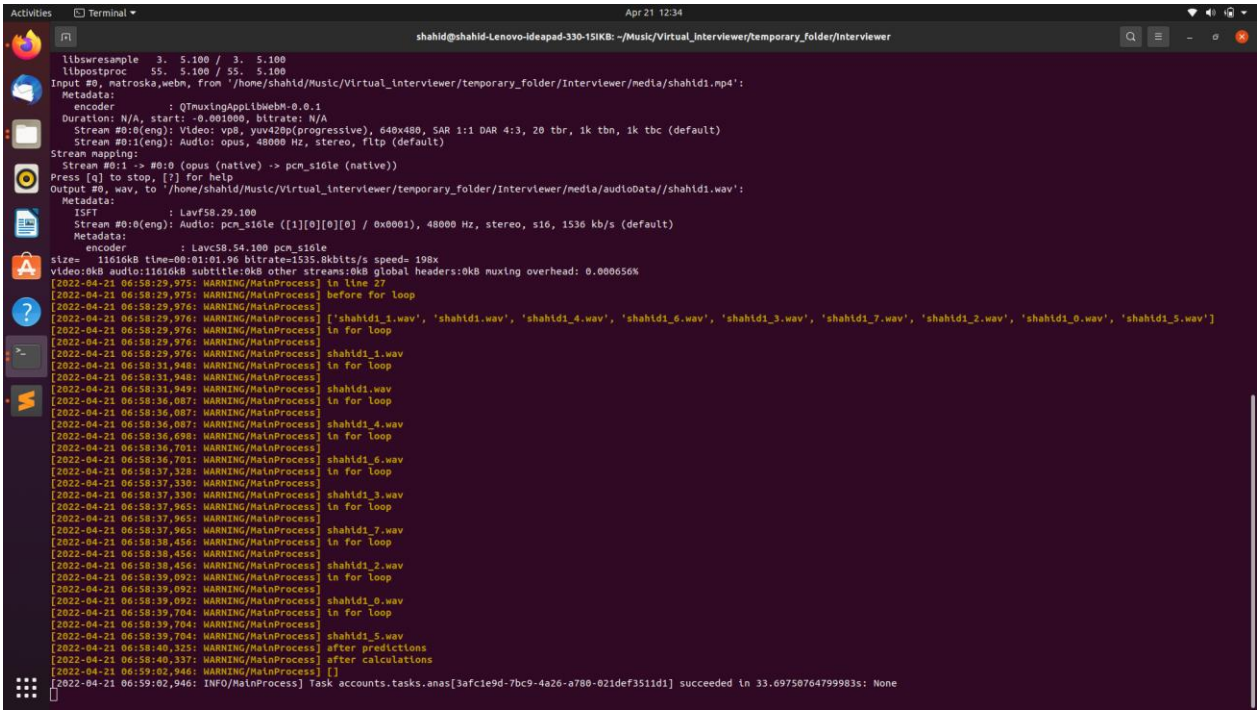

Fig.8.11. Terminal Page.

Chapter 9

11. Conclusion and Future Scope

11.4. Conclusion

Candidates will have positive attitude towards interview. With technologies like AI, ML we were able to think of making a website for students lacking in few areas by which students can practice on our platform and hence students became ready for the corporate interviews.

Candidates can analyse whether they are interview ready. This system is successfully able to detect real-time user's emotions and social attitudes through voice and facial expression recognition, and to adapt the progress of the candidate and the virtual interlocutor's behaviors to the individual users. The candidate using our website will acquire a report of their performance and will most probably work on it and use the learnings in their upcoming interviews. Complete analysis of the candidate's position in corporate world. Candidate will be provided with the progress history.

11.5. Future Scope

- Company recommendations according to candidate's eligibility.
- Chatbot for open live questions.
- Domain specific interviewer.
- Application for Android and IOS
- Personal recommendations of expected answers for individual candidate.
- Analysing answers using NLP via corpus training.

References

https://www.researchgate.net/publication/257652386_The_TARDIS_Framework_Intelligent_Virtual_Agents_for_Social_Coaching_in_Job_Interviews

https://www.researchgate.net/publication/331883917_Trusting_Virtual_Agents_The_Effect_of_Personality

https://www.wikipedia.org/

https://www.w3schools.com/

http://surl.li/anvbd

https://www.frontiersin.org/articles/10.3389/fpsyg.2015.01578/full

https://bit.ly/3CygeHE

https://www.youtube.com/