Project Analysis

Report

VERITAS

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1.0 Introduction

1.1 Description

Social media platforms such as Twitter, Facebook, and YouTube are seeing a rise in the spread of fake news and misinformation on their platforms. According to research, Facebook users engage with misinformation 70 million times per month on average [1]. The rise of fake news is problematic for societies. It has the potential to sway public opinion, promote conspiracy theories, and instill fear, thereby eroding confidence in public institutions, and in democracy.

Therefore, our project aims to combat the spread of political lies and misinformation in order to better inform the public about what politicians are saying. To this end, we will build either a YouTube wrapper website that would perform fake news labelling and fact checking on live-streamed political speeches. The main targets of this project are political speeches and presidential debates from the United States of America. In order to accomplish this task, multiple ML/NLP papers on fake news will be consulted. A fake news/fact checking classification model will be built and trained on an appropriate dataset. Once a good enough classifier is achieved based on the metrics deemed ideal for such a problem, a platform would be built to use this classifier on political speeches streamed on YouTube. The model would then inform the viewer of any wrong claims being said by the speaker through various tags and captions.

2.0 Current System

Since the rise of fake news on social media platforms is a new phenomena, some companies have started tackling this problem by creating apps and tools which detect fake news in the aforementioned platforms. As per our research, most of these companies are deploying machine learning algorithms, such as NLP (Natural Language Processing) to detect falsehoods in posts which are written in social media, such as tweets in twitter or facebook posts. As far as we have researched, most of these tools developed by different companies are detecting fake news through social media posts,

which is basically text, but there are no tools to detect over a speech video. Following are some of the companies which have developed such programs to detect fake news.

The first one is developed by Fraunhofer Institute for Communication, Information Processing and Ergonomics (FKIE). This tool checks social media posts, specifically twitter tweets for fake news. It processes texts and analyses the metadata of the tweet and then shows the findings in a visual form. [2]

Another tool developed to detect fake news is Fabula, which was developed by Fabula AI, a twitter-backed company based in London. This tool uses an algorithm called “Geometric Deep Learning” and uses this because the size of the datasets are too large and difficult to be analyzed by other deep learning algorithms. This tool again detects fake news over text and currently works on twitter platform. [3]

3.0 Proposed System

3.1 Overview

The Veritas system will be divided into the backend module and the frontend module. The backend module will consist of the fake news detection model built using machine learning algorithms, the transcription service, and a YouTube video extraction service. The frontend module will consist of a wrapper website for YouTube that would alert users of misinformation in political speeches.

A user would be able to go to the website and enter the url link to the political speech they want to get fact-checked from YouTube. The link will be sent to the backend which will extract the YouTube video and process it using the machine learning model. In the process it will generate transcriptions which can include tags and captions flagging misinformation that will be inserted into the video. The processed video will then be rendered in the website UI and the user will be able to play it and inform themselves better regarding the truthfulness of statements made in American political speeches.

3.2 Functional Requirements

- The user would be able to copy the link of a political speech video or livestream on YouTube and paste it into our website to watch the video.
- Generate captions in real-time by transcribing the speaker's speech.
- Get feedback about possible misinformation in real-time.
- Have the ability to verify claims the website classifies as a lie with a click of a button that takes the user to a reliable site with the information.

3.3 Non-Functional Requirements

3.3.1 Accessibility

- The website and its constituent services should be accessible by anyone on the internet. The website will be in the English language.

3.3.2 Usability

- The website should have a simple and intuitive interface with a minimalistic design.
- The website should be stable without interruptions and responsive enough to support *near* real-time feedback (5 minutes).

3.3.3 Compatibility

- The website should be compatible with different browsers and should work on both mobile and computer.

3.3.4 Scalability

- The website should be able to scale and handle upwards of 1000 users at a given time.
- The backend should be scalable in the sense that it should be able to run prediction models on 50 videos at a given time.

3.3.5 Performance

- Performance should be good and results should be obtained within 5 minutes.
- Overall response time of a website must also be instantaneous (less than 1 second).

3.3.6 Extendability

- The website should be extendable so that in future it could accept videos from sources other than YouTube.

3.3.7 Accuracy

- The machine learning classifier's "accuracy" would be measured using Macro-F1, Micro-F1 and Accuracy metrics to ensure the reliability of the model.

3.3.8 Reliability

- The website should be reliable to users and by being available all the time especially during live-streamed presidential speeches where traffic would increase substantially.

3.3.9 Testing and Error-Handling

- It should be easily testable for any errors and bugs that might occur. After that writing of code should be such that any bugs found should be easily traceable and handled.

3.4 Pseudo Requirements

- Veritas will be a web application.
- The system backend will be mainly coded using the Python programming language. JavaScript and other languages/libraries may be used for the front-end section.
- GitHub will be used as the version control, source code management and CI/CD tool.

- The fake news detection model will be built upon the latest research in the field of machine learning. The machine learning models will be built using open-source APIs and libraries.
- Any external research, programming libraries, and APIs will be checked for Licensing and Copyright and the necessary permissions will be obtained before using them.
- The system will be required to pass certain testing and validation criteria before deployment.
- The project will follow a data-driven programming paradigm.
- The language of the website will be English.

3.5 System Models

3.5.1 Scenarios

Using Veritas is extremely straightforward. Once the user opens the website, he is presented with a screen that awaits URL input. If the user is not logged in, they can login if they wish to save and view their saved facts. If they do not wish to log in, then they can continue without saving facts. If they are logged in, they will see their name and picture at the top right and a button that displays the previously saved facts. Once a URL is entered, the website checks if it is a valid URL. If the URL is invalid, an error is displayed prompting the user to enter a new URL. If the URL is valid, the video player page opens. The video then plays and facts are checked as soon as they are said in the video. If the user is logged in, the user can save the facts on the right (see Figure 7). If the user is not logged in, the facts are displayed without a save button. In the end, the user can generate a report that contains all the facts checked in the video as a summary. The user then can return home, and enter a new URL if they wish to again.

The user is also able to change the account details and upload a new picture. If the user is not logged in, they need to log in or sign up to use this scenario. If the user is logged in, the user can click on the top right picture to display the account page (see Figure 6). From that page, the user can change their profile picture, name, or their password. Once

they are done, or if they wish to not change anything, the user can go back to the home page.

3.5.2 Use Case Model

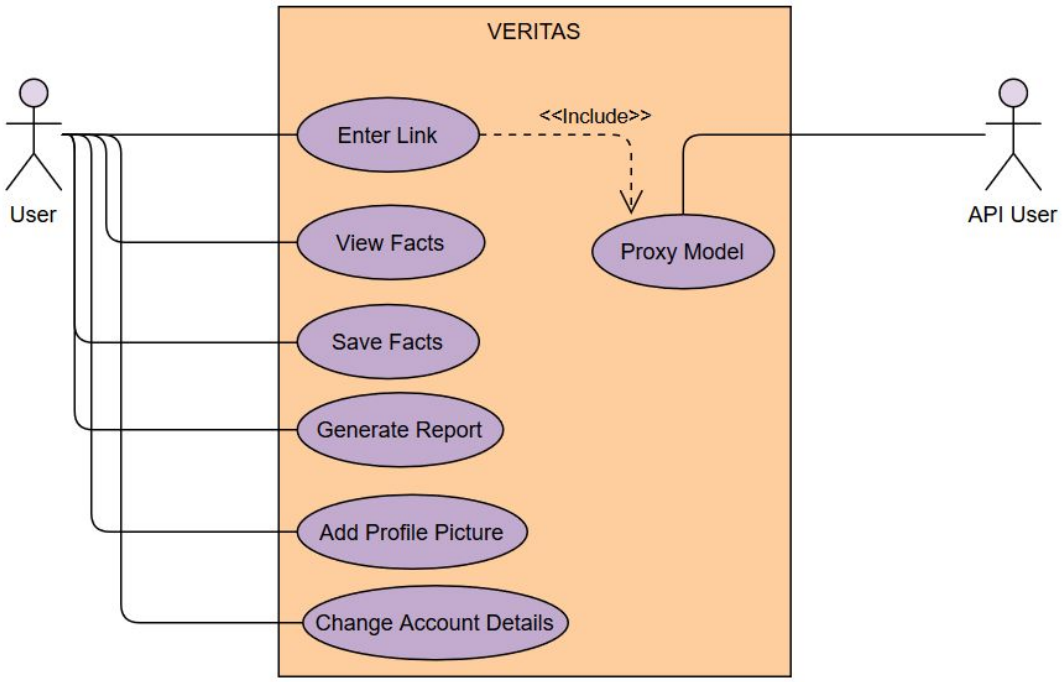

Figure 1: User use case

3.5.3 Object and Class Model

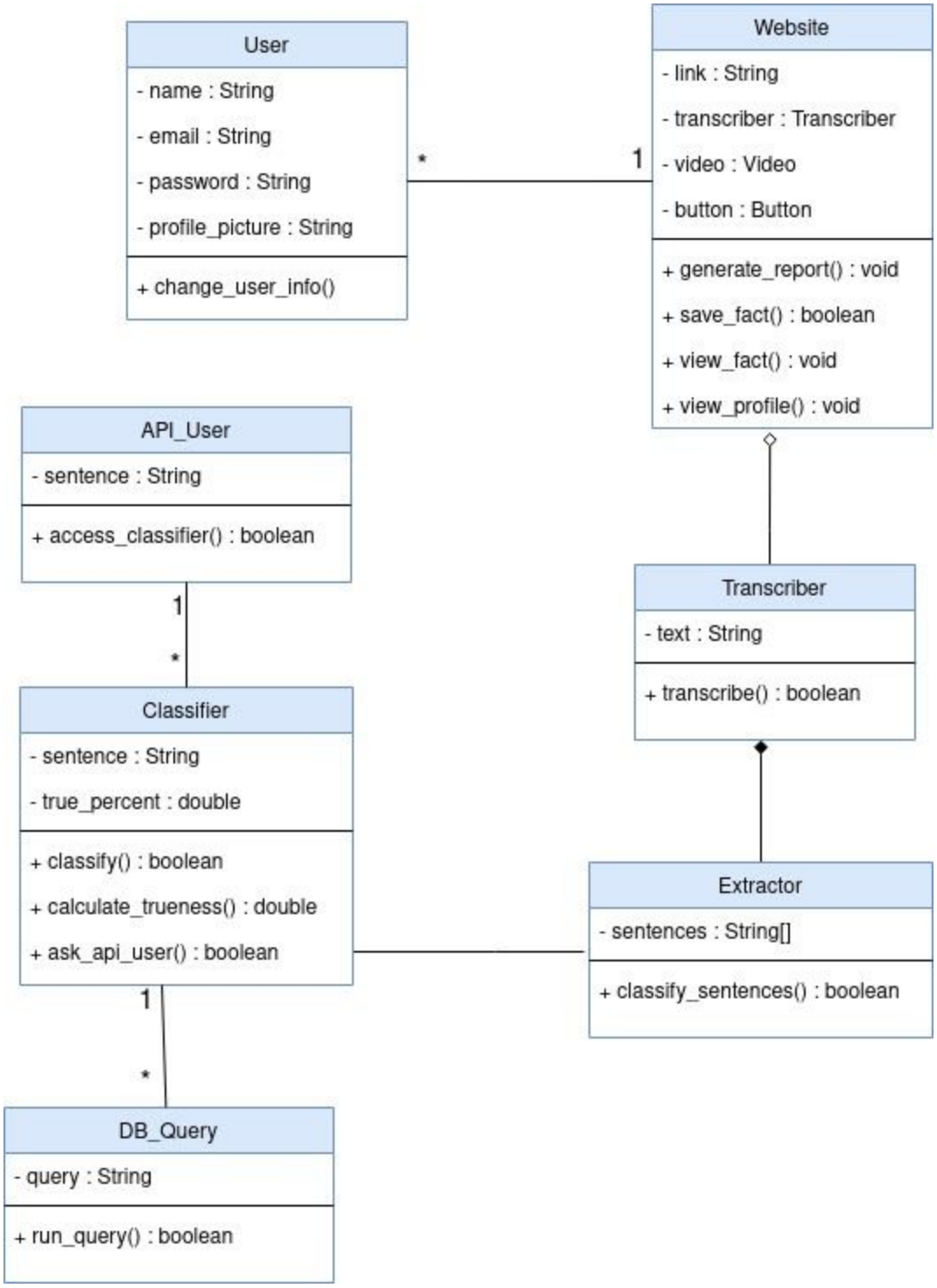

Figure 2: Object and Class Model

3.5.4 Dynamic Model

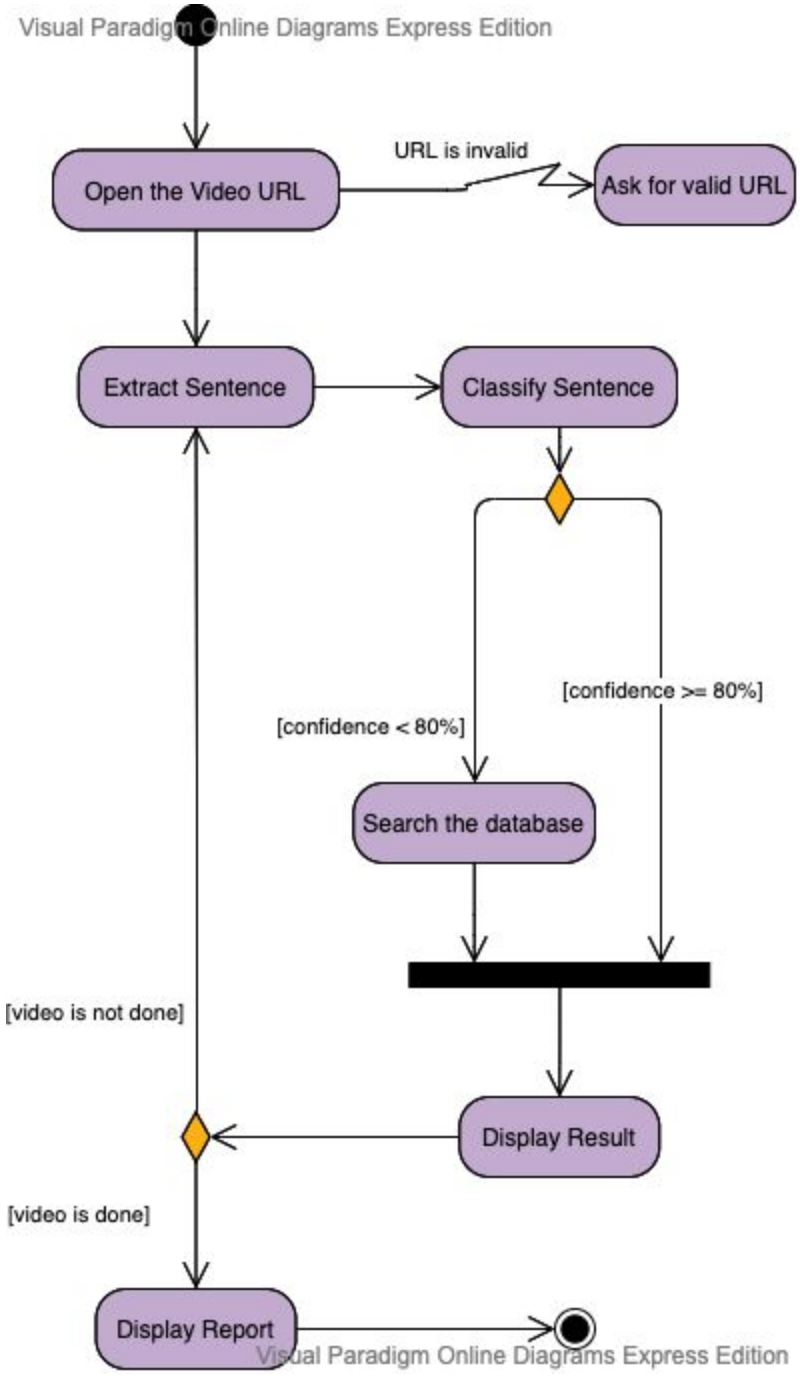

Figure 3: Main system behavior

3.5.4 User Interface - Navigational Paths and Screen Mock-ups

Sign-In page for users to login to the system using his/her credentials. Email and Password needed only. If the user does not have an account yet, there is a “Sign Up” button at the bottom of the screen, user will be redirected to Sign Up page (Figure 5).

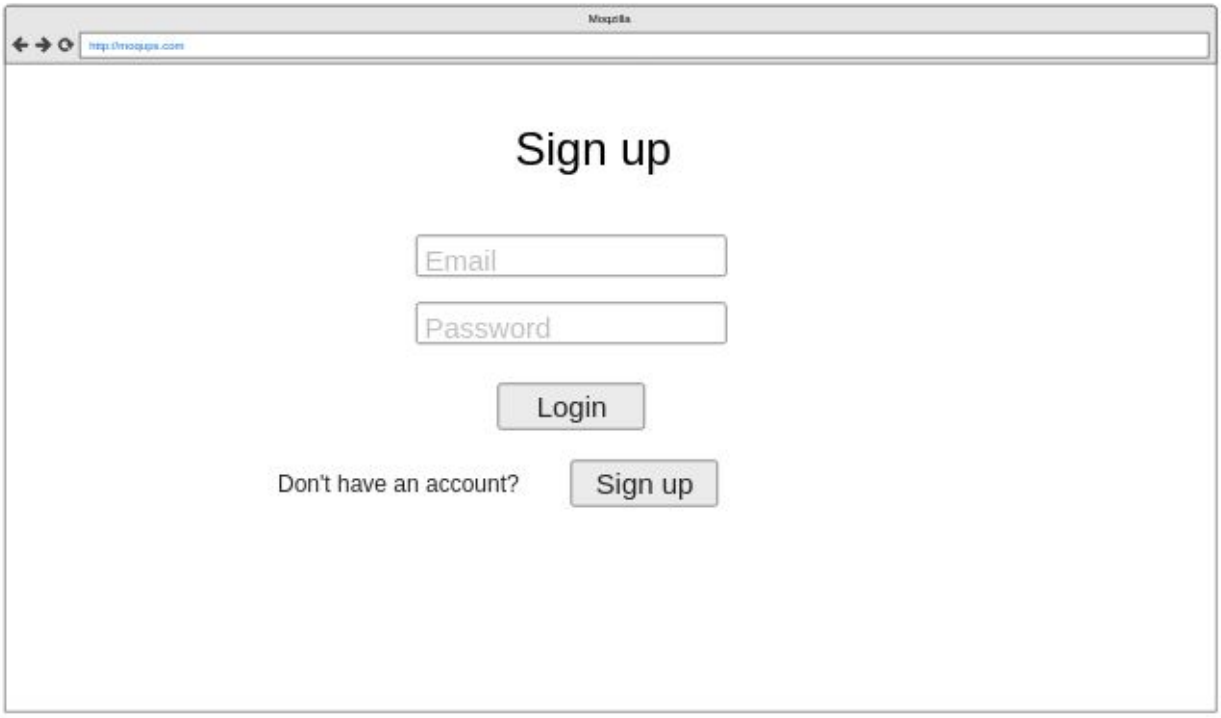

Figure 4: Login page

If the user does not possess an account already, this page helps the user to create a new account (Figure 5). Email, Password and Username is enough to create a new account in the system.

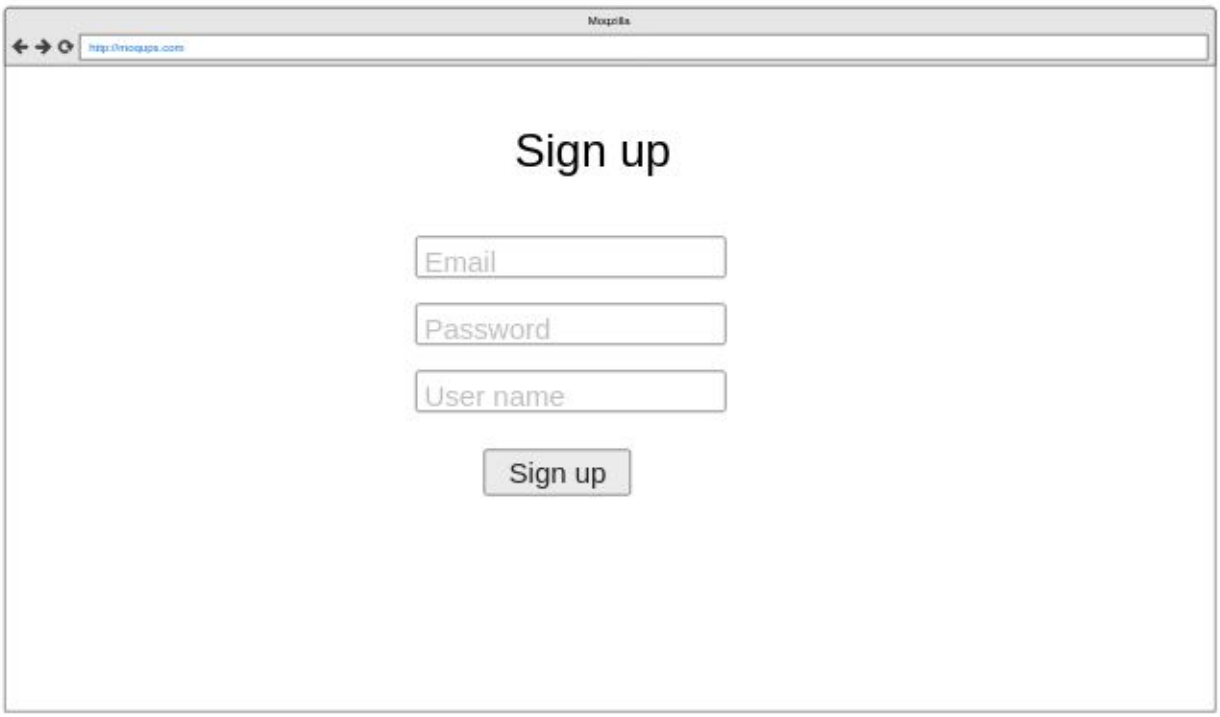

Figure 5: Sign up page

This is the Home Screen where the user lands after logging in. The user can paste a video link and press the Search button to begin the process of analyzing fake news.

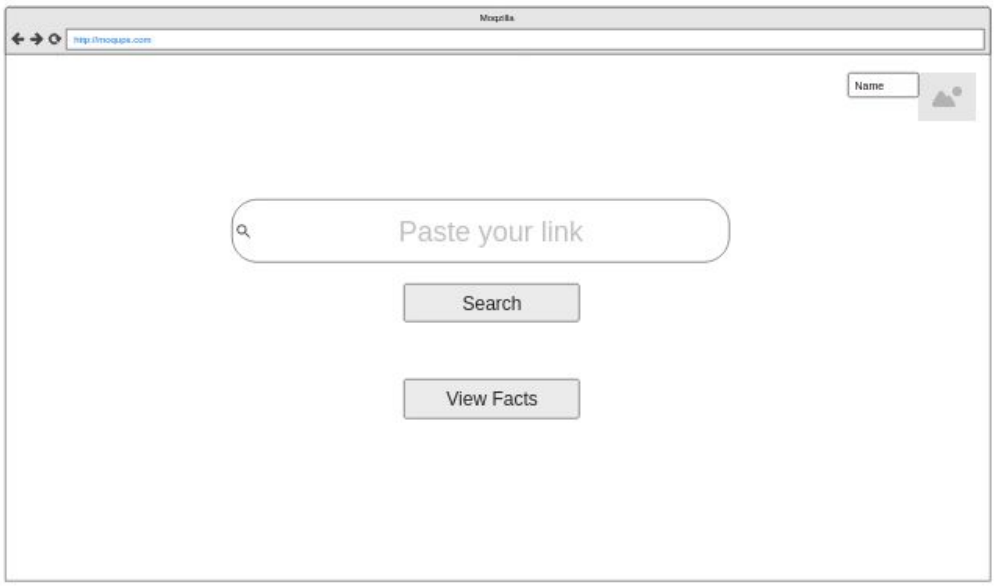

Figure 6: Home Page

After the video is loaded and transcribed (Figure 7), each statement will be shown on the right of the screen along with its labels, whether True or False, and can be saved.

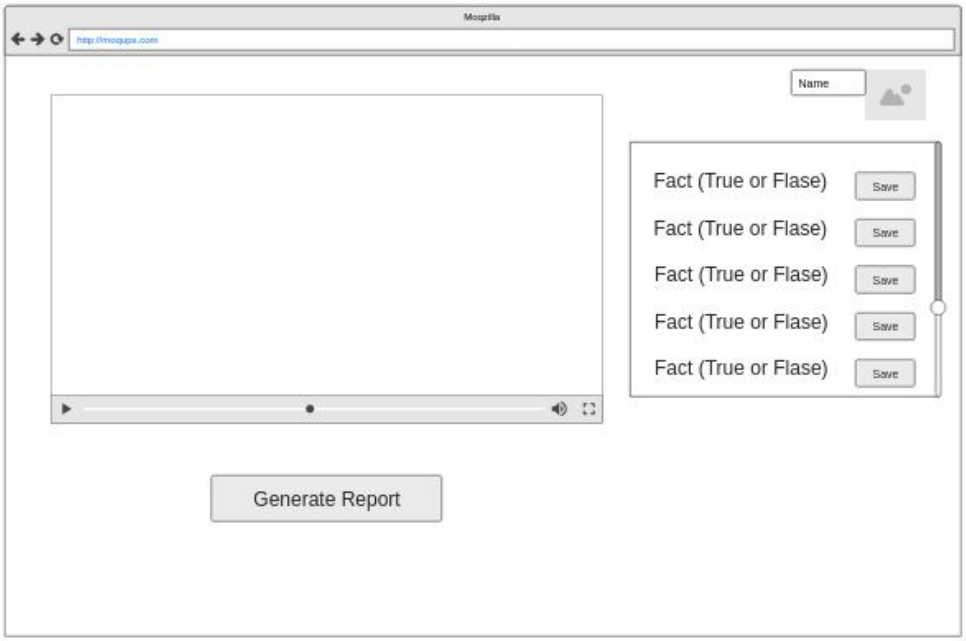

Figure 7: Video player page

This screen shows the facts which were saved previously by the user.

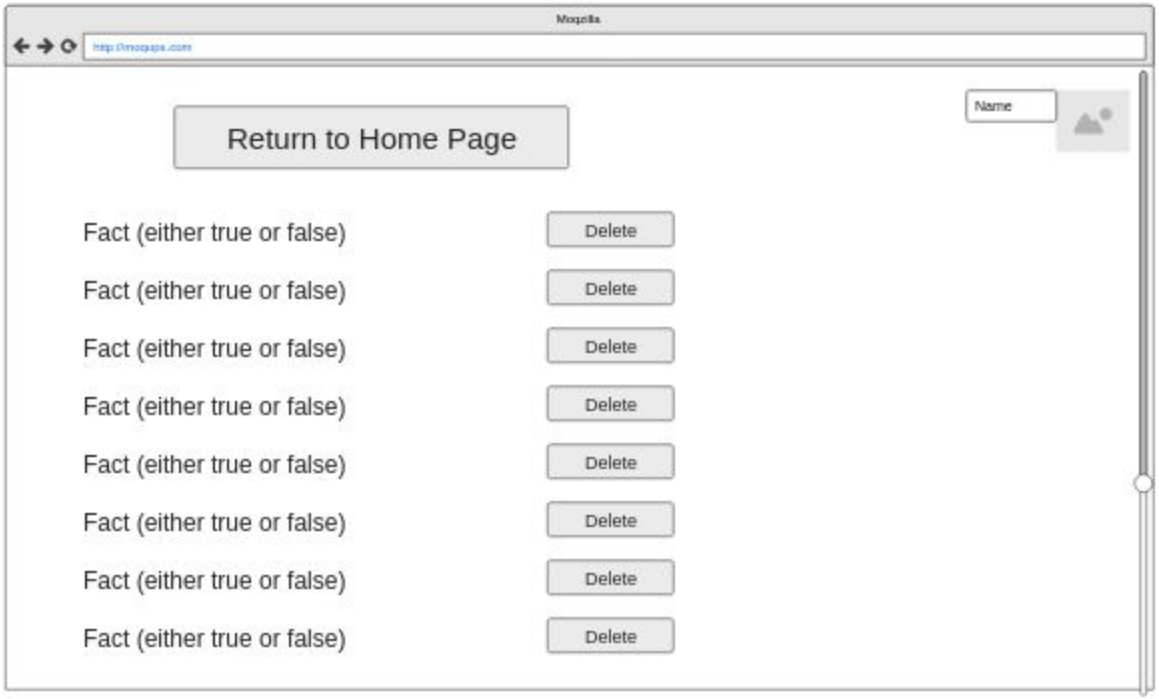

Figure 8: Previously saved facts page

Report generated after the video containing everything labelled true or false.

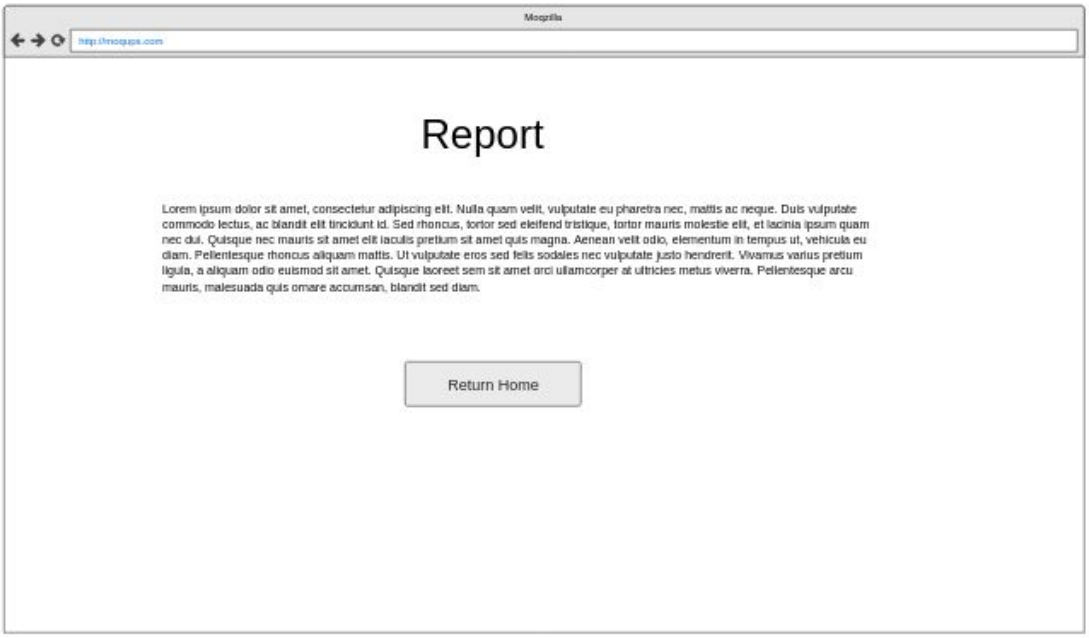

Figure 9: Report page

Every user has an account details page in which they can change their profile picture, name, email, username, or even password.

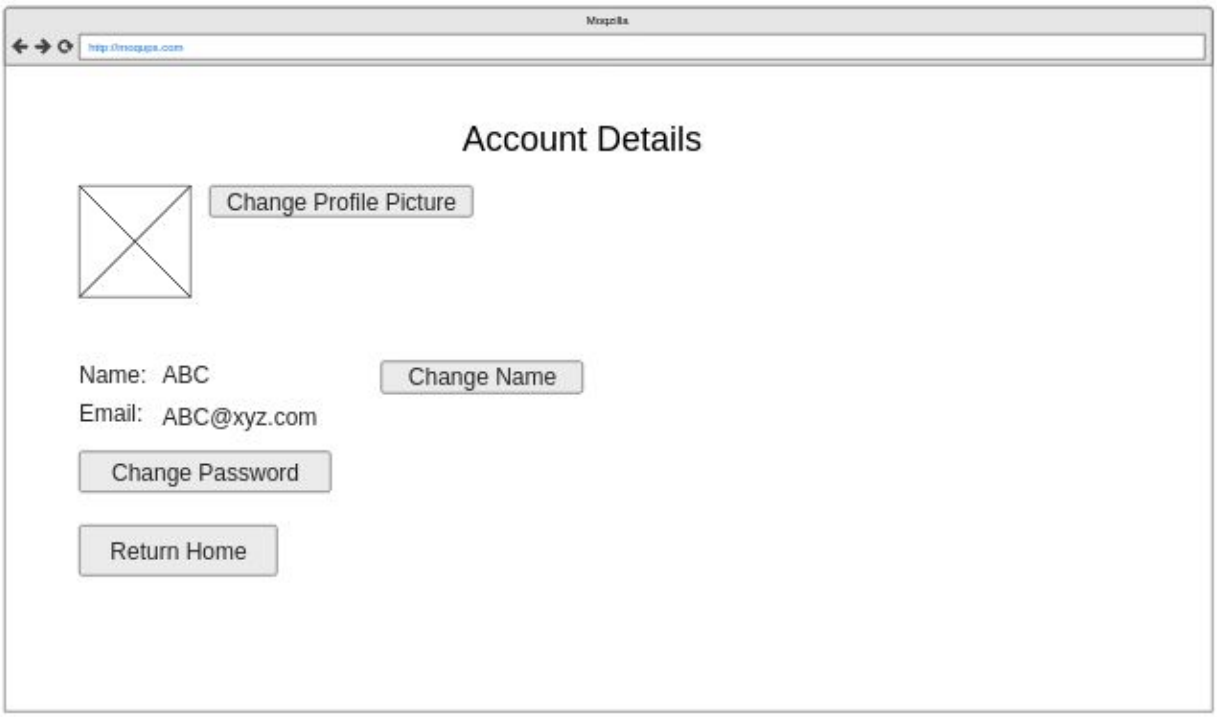

Figure 10: Account page

4.0 Other Analysis Elements

4.1. Consideration of Various Factors in Engineering Design

- **Public Health:** Veritas does not directly affect the health of its users.
- **Public Safety:** Veritas does not directly affect the health of its users.
- **Public Welfare:** The US presidential elections affect not only the United States, but the entire world. Hence, people from all countries follow the elections. Veritas is able to fact-check the claims that are being made in pseudo-real time, which in turn allows the public to base their judgements on facts, not claims. This obviously increases the people's confidence in their judgements, which in turn increases the public welfare.

- **Cultural Factors:** Many topics that are popular in presidential debates are related to cultural factors. A recent article shows that few of the most popular debate topics are inequality, gender, education and gun laws [6]. All of these articles are of cultural importance to the public. The debaters usually state many claims regarding these topics, and unsuspecting viewers might accept these claims without fact checking. By fact checking, Veritas provides the users with the ground truth, which helps in decreasing the false claims which are to be made in discussion of these topics.
- **Social Factors:** As discussed earlier, Veritas is capable of decreasing the amount of fake news and fake claims that spread as a result of the presidential elections. A recent study shows that fake news can lead people to create false memories especially if these fake news align with their beliefs [5]. This can strengthen prejudices in the society. By fact checking, Vertas can help in decreasing these false memories, in hope to improve the society as a whole.
- **Economic:** According to an article by Kenneth Rapoza, fake news can affect the stock markets heavily [6]. Veritas can decrease the amount of fake news, which can positively affect the stock market.
- **Environmental:** Veritas is served as a web application, and hence has no direct effect on the environment.

4.2. Risks and Alternatives

4.2.1. Schedule Risks

All of our group members are taking many technical electives and some are even working on work and graduate school applications. Managing these responsibilities while developing a complex application such as Veritas is rather risky. It is very easy to slack and be behind schedule. That is why we prepared an in-depth project plan (which is found in 4.3).

Risk	Affects	Probability	Response Strategy
Underestimating required time for project completion.	Project	Medium	Work closely with our supervisor early on to have a proper estimate of required time for subparts of project and following agile methods.
Failure to recognize complex functionalities and the time they require to complete.	Project	Low	Identify all functional requirements in the Analysis Report early on.

Table 1: Schedule Risks

4.2.2. Budget Risks

Risk	Affects	Probability	Response Strategy
Failure to estimate project cost.	Business	Medium	Make a list of all technologies and services required to fulfill the functional requirements and identify potential financial costs.

Table 2: Budget Risks

4.2.3. Operational Risks

Risk	Affects	Probability	Response Strategy
Lack of proper team communication.	Project	Low	As by Agile development guidelines, scrum meetings will be held regularly. Any disagreements will be solved by a team effort.
Key team members might be unavailable at critical times due to family issues, health complications or schoolwork.	Project/ Product	Medium	Having a form of transparency to ensure that others can take over in case of such emergency and following agile scheduling to minimize big delays.

Table 3: Operational Risks

4.2.4. Technical Risks

Risk	Affects	Probability	Strategy
Personal computers acting as servers fail under load or unfortunate circumstances.	Product	Low	Building on a cloud-based, highly scalable solution like Amazon Web Services or Google Cloud.
Lack of advanced technologies (libraries, frameworks, research) availability for complex functionality.	Product	Low	Account for such probability into the schedule and expect to have to develop some of the non-existent yet needed technologies such as reliable transcription.

Table 4: Technical Risks

4.2.5. Programmatic Risks

Risk	Affects	Probability	Strategy
Laws, regulations and legislations that might limit the product's use in some countries.	Product	Low	Assessing laws early on and launching with required terms and conditions for assuming no responsibility or liability.

Table 5: Programmatic Risks

4.3. Project Plan

To ensure the success of this project, proper software project management techniques were and will be used. Below, a Work Breakdown Structure (WBS) is provided that defines all work packages and respective responsible team member(s). Also, an accurate gantt chart shows exactly how the project plan flows and how different items will be completed in parallel to ensure the minimization of the critical path and maximization of utility each member can provide based on their particular skill set.

Type	Title	Start date	End date	Duration (in days)	% Complete	Assignee name
Task	Documentation	09/28/2020	04/30/2021	155	30	Full Team
Milestone	Project Kickoff	09/28/2020	09/28/2020	-	-	
Task	Requirements	10/01/2020	10/09/2020	7	100	Full Team
Task	Spec Report	10/10/2020	10/12/2020	1	100	Full Team
Task	Analysis Report	11/14/2020	11/21/2020	5	100	Full Team
Task	Prototyping I	11/22/2020	01/10/2021	35	0	Full Team
Task	Data Preprocessing I	11/22/2020	12/21/2020	21	0	Hanzallah & Hassan
Task	Develop Preliminary Classifier	11/22/2020	12/21/2020	21	0	Abdul Hamid & Mohamad
Task	Develop Website	11/22/2020	12/21/2020	21	0	Abdullah
Task	High-Level Design Report	12/13/2020	12/20/2020	5	0	Full Team
Task	Link Classifier to Website	12/22/2020	01/01/2021	9	0	Abdullah
Milestone	Demo 1	01/07/2021	01/07/2021	-	-	Full Team
Task	Prototyping II	02/01/2021	04/23/2021	60	0	Full Team
Task	Low-Level Design Report	02/01/2021	02/08/2021	6	0	Full Team
Task	Backend Development	02/09/2021	04/02/2021	39	0	Full Team
Task	Build Classifier	02/09/2021	02/22/2021	10	0	Abdul Hamid & Mohamad
Task	Build Transcriber	02/16/2021	02/22/2021	5	0	Hanzallah
Task	Train and Test Classifier	02/23/2021	03/25/2021	23	0	Abdul Hamid & Mohamad
Task	Build Query Engine	03/08/2021	03/25/2021	14	0	Abdullah & Hassan
Task	Write API	03/26/2021	04/02/2021	6	0	Hanzallah
Task	Connect Services to Frontend	04/03/2021	04/11/2021	5	0	Abdullah
Task	Deploy to Cloud and Test	04/12/2021	04/23/2021	10	0	Hassan
Task	Final Report	04/23/2021	04/29/2021	5	0	Full Team
Milestone	Demo 2	05/24/2021	05/24/2021	-	-	Full Team
Milestone	Project Launch	06/01/2021	06/01/2021	-	-	

Table 6: Work Breakdown Structure

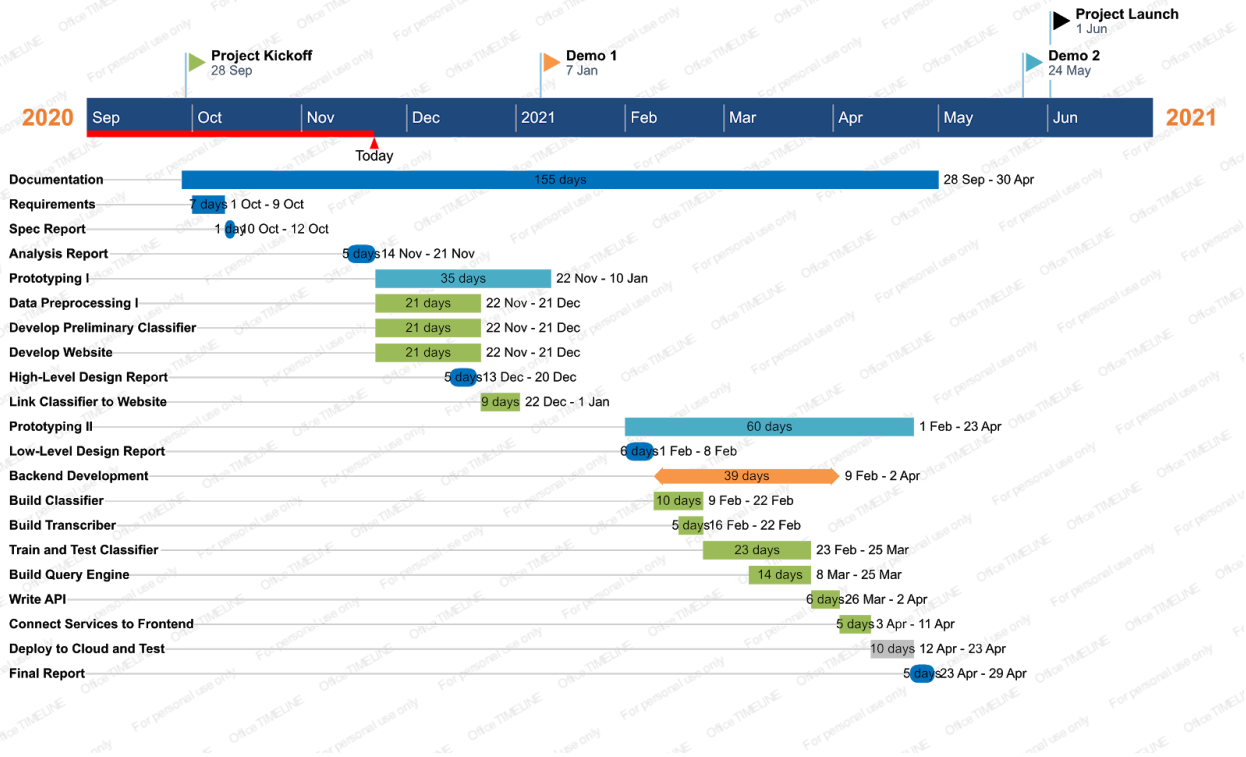

Figure 11: Gantt Chart

4.4. Ensuring Proper Teamwork

Teamwork is extremely important in such a complicated project. To ensure that, we follow a few basic guidelines:

- Working in pairs: to ensure accountability, we prefer to distribute tasks to groups of two or more members. The aim of this is to decrease the probability of not working properly by assigning the work in small groups; the members of these subgroups are more likely to monitor each other closely.
- Holding weekly meetings: we hold weekly meetings to discuss the progress done in that week and the problems that emerged during it. Usually these problems are presented with a possible solution, and the solutions are discussed further.

- Ensuring instant-communication: we set up a group on Whatsapp that enables us to reach each other instantly in case of emergencies. We might move to Slack if we need a more professional method of communication.
- Collaborative development: we will use Github for version control and to keep track of each member's contribution.

4.5. Ethics and Professional Responsibilities

With the research we conducted, we understood that following are our responsibilities regarding ethical and professional issues:

- One of the major ethical issues is that our system should not label someone a liar falsely. This is because this wrong information can affect the mind-set of voters and they might not vote for that person who was actually telling the truth. Moreover, labelling someone a liar falsely in itself is ethically wrong.
- We will try our best to work according to the IEEE code of ethics. While using different libraries, algorithms and Machine learning techniques that we will look up from the internet we would make sure to cite them properly and give the credits to web sites from where we are taking these things avoiding copyrights infringements.
- It would be made sure that we are not storing the videos from youtube and using them elsewhere, because even though youtube is open to the public, we cannot store these videos locally.
- We will work professionally creating all the paperwork and reports needed during the development of the project and then sticking to these things we have decided.
- We will do the proper licencing of our system and the product will be documented in a professional way, assuring legal requirements are met before it is made public in a country.

4.6. Planning for New Knowledge and Learning Strategies

In this project we will be learning about the machine learning models, as we are going to apply these models like neural networks in our project. Moreover we are going to have to learn about Natural Language Processing (NLP) techniques, because we are taking the speech of someone and checking what they are speaking and after that we are applying machine learning models on this.

We will have to learn about wrapping another website as well. Extracting the content from that site and putting it in our website. Moreover we will have to maintain our database where all the trained models will be kept.

For learning these things our main source will be the internet. We would mainly use stack overflow and w3schools for learning our stuff while working on the project. Youtube would also be used as it has detailed videos about multiple topics. After all that books might also be used as they are a constant and a good source of knowledge giving you detailed information.

5.0 References

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