EMOTION RECOGNITION AND SENTIMENT ANALYSIS FOR RELATIONSHIP IMPROVEMENT

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Dissertation submitted in partial fulfillment of the requirements for the Special Honors Degree of Bachelor of Science in Information Technology Specializing in Information Technology

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Abstract

Emotions play a powerful role in shaping people's relationships, influencing how we perceive, interact with, and connect to others. There is a high effect to mental health of persons because of these relationships and emotions and only 13% of people maintain good Mental Health in Relationship. Therefore, the primary goal of this research is to identify the user's emotions and give them some help to manage their mental health. which will help the users to get better idea about their mental health status and helps to maintain good mental health of their day-to-day life. In this project we mainly focused on identifying emotion levels, depression levels and according to their levels provide advice for them. When it comes to identifying the depression level of the users, we used a questionnaire called DASS-21 and collected the data using google form and did the data pre-processing to get better use of that data. Then after collecting the dataset, we developed a ML model using Random-Forest text classifier algorithm and Xgboost algorithm to analyses the user input data and get predictions of depression level of the user. After the implementation the system will be tested inputting data from using three users that not in the system and two users who are known to the system. After testing, Random Forest classifier is the best model to predict a depression level with 70% accuracy. and after displaying their depression levels, according to that levels system will suggest a small game for user to calm and improve focus of their minds.

Keywords: DASS-21, ML, Random Forest, Xgboost

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Table 1 : List of Abbreviations

Abbreviations	Descriptions
SDLC	Software Development Life Cycle
UI	User Interface
API	Application Program Interface
ML	Machine Learning
SVM	Support Vector Model
SLIIT	Sri Lanka Institute of Information Technology

1.0 INTRODUCTION

The complex dynamics of human emotions and relationships meet technological breakthroughs in today's digital world, providing hitherto unseen possibilities for improving interpersonal relationships and promoting emotional well-being. The overall objective of this project is to use technological advancements to improve the caliber of human interactions by investigating the intersection of sentiment analysis, emotion detection, and mobile application development.

Motivated by the understanding of how important emotions are in determining relationship dynamics, this project aims to create a mobile application that uses cutting-edge technology to identify, assess, and react to user emotions instantly. Through the integration of state-of-the-art methods including facial recognition, machine learning algorithms, and natural language processing (NLP), the program aims to give users insights into their emotional states and enable meaningful interactions within their relationships.

The investigation of user-centric technology with the goal of enhancing emotional intelligence and promoting empathy in social interactions is at the core of this research. We aim to create a seamless and immersive user experience that goes beyond conventional bounds of communication and engagement by utilizing technologies like React Native, a cross-platform framework for mobile application development.

This study's main goal is to create a thorough framework that integrates sentiment analysis, emotion detection, and mental health evaluation into a mobile application. Through the use of sentiment analysis technologies like Random Forest and XGBoost and the integration of the Depression, Anxiety, and Stress Scale (DASS-21) questionnaire, the application seeks to give users personalized insights into their mental health and emotional well-being.

Additionally, the goal of this research is to discuss the privacy and ethical issues that arise while developing and implementing emotion-aware mobile applications. We place a high priority on user trust and confidentiality while managing sensitive emotional data by putting strong data security measures in place and making sure that applicable laws and rules are followed.

1.1 Background & Literature survey

1.1.1 Background

The relationship between technology and mental health has attracted a lot of attention lately. The desire for creative solutions that can deliver prompt and efficient interventions has been fueled by the rising prevalence of mental health conditions like stress, anxiety, and depression. The development of artificial intelligence (AI) and machine learning (ML) has created new opportunities for creating software that can recognize and react to human emotions. Researchers and developers are attempting to create tools that offer individualized mental health care by utilizing these technology breakthroughs, which will enable more proactive and effective handling of emotional difficulties.

Emotions and mental health have a well-established relationship. Emotions are important markers of a person's mental health since they affect behavior, thought processes, and general well-being. An individual's quality of life can be severely impacted by mental health illnesses like depression and anxiety, which are brought on by persistently unfavorable emotions. Reducing the negative impact of these emotions requires early detection and action. This knowledge emphasizes how crucial it is to have systems that can track and evaluate emotional states in order to offer prompt assistance and interventions.

The goal of this project is to create a smartphone application that can precisely recognize emotional states by using natural language processing techniques and machine learning algorithms. The system will evaluate users' emotional states and determine the right interventions depending on their mental health status by leveraging cutting edge technologies like XGBoost and Random Forest. This strategy improves emotional state detection accuracy and provides a data-driven approach to mental health assessment, which can lead to better mental health management and overall well-being.

1.1.2 Literature survey

Recent years have seen a dramatic shift in the way mental health care is treated, with an emphasis on utilizing cutting-edge technologies to address pressing problems in the field. One noteworthy area of innovation is the development of intelligent mental health management systems that make an effort to predict and track emotional states in real time. These systems leverage the convergence of artificial intelligence (AI) and Internet of Things (IoT) technologies to develop models for intelligent mental health management.

In order to track users' mental states when using mobile applications for anxiety and depression, V. S. Rakshitha, M. Mahadevi, and S. Durgadevi, for instance, have made great strides in this field by incorporating task analysis and facial recognition. Their study highlights how crucial it is to use mobile technology to deliver prompt and efficient interventions for mental health problems. Likewise, D. M. Cotorobai et al. have examined a number of techniques for assessing stress, anxiety, and depression levels, emphasizing how well the DASS-21R scale measures these emotional states.

S. P. L. Dias and S. Lokuliyana investigated the determinants impacting mental health among IT industry employees in Colombo, Sri Lanka, in the context of workplace mental health. Key variables including workload, employee welfare, and physical fitness were found to be correlated with anxiety and depression levels in their research. This study emphasizes how important it is to have comprehensive mental health management systems that consider the different types of workplace stressors and how they affect workers' mental health.

The examination of mental health is increasingly being done using machine learning approaches. In order to distinguish between anxiety and depression, A. Singh and D. Kumar's study used the DASS-21 questionnaire in conjunction with machine learning techniques like Random Forest, Support Vector Machine (SVM), and Naïve Bayes. Their results showed how these algorithms could be used to forecast mental health disorders accurately, which would allow for early intervention. Furthermore, it was demonstrated by C. Yu's work on non-verbal facial action units-based automatic depression classification that the accuracy of depression detection may be greatly increased by employing rank pooling and Gaussian Mixture Models (GMM) for feature extraction.

The goal of this research is to create a reliable system for emotion recognition and mental health assessment by combining several approaches. This system will give users individualized insights and treatments to enhance their mental health. The mental health industry could undergo a substantial transformation in how emotional state monitoring and mental health evaluation are conducted with the use of Random Forest and XGBoost models. By applying machine learning techniques, we may analyze complex datasets and identify tendencies suggestive of emotional discomfort before they materialize clinically. This proactive approach to emotional well-being not only lessens the negative consequences that mental health issues have on individuals, but it also promotes overall productivity and sustainability of mental health management systems.

Furthermore, we provide comprehensive management strategies in addition to detecting emotions. Machine learning-infused mental health management systems give professionals the data and tools they need to run their businesses as efficiently as possible. This comprehensive approach to mental health management helps practitioners effectively handle the ongoing challenges faced by the field by fostering resilience and adaptability.

In summary, our research represents a significant advancement in the field of mental health treatment, particularly with regard to the identification and prediction of mood states and depression severity. Our objective is to apply machine learning to change the way the mental health industry operates, which will ultimately increase the productivity and sustainability of mental health management systems. This study shows how technological advancements can greatly enhance the mental health sector's capacity to surmount substantial challenges and open the door to a more promising and successful future.

1.2 Research Gap

Even with major advancements in mental health technology, there is still a large gap in the early identification and treatment of mental health illnesses and emotional discomfort, especially in the context of daily life. Self-reported information and static questionnaires are frequently used in current applications and mobile devices, which can be biased and fail to reflect the dynamic nature of emotional states. Consequently, many people wait until their mental health disorders have

substantially worsened before receiving prompt support, which can have more dire consequences. By creating a system that can offer early intervention techniques and real-time emotional state evaluations, our research seeks to close this crucial gap in the knowledge base and lessen the negative impacts of emotional distress on mental health.

Furthermore, although some mental health applications provide rudimentary mood tracking and sentiment analysis, they frequently lack the precision and depth required for an accurate assessment of mental health. It's possible that current systems don't fully make use of thorough data analysis and cutting-edge machine learning algorithms to identify minute changes in emotional states. Our suggested method aims to improve the accuracy and consistency of mental health evaluations by combining advanced machine learning algorithms—like Random Forest and XGBoost—with natural language processing methods to examine user inputs more efficiently.

Strictly speaking, using sophisticated machine learning models trained on large and varied datasets is necessary to achieve improved accuracy in emotion recognition and mental health prediction. Our study will make use of algorithms such as Random Forest and XGBoost, leveraging user-provided natural language inputs and data obtained from the DASS-21 questionnaire. Our objective is to create a trustworthy and accurate system that can forecast emotional discomfort and mental health issues based on user interactions by utilizing a large dataset that includes a variety of emotional and psychological indicators. By providing people with timely insights and actions, this all-encompassing strategy hopes to improve their mental health and stop mental health problems from getting worse.

Table 1.1 : Comparison with previous researches

Name of the Research or System	Real-time emotional state assessments.	Early intervention strategies.	Advanced machine learning techniques	Comprehensive data analysis	Utilizes DASS-21 questionnaire	Integration of NLP techniques
Research A	✗	✗	✓	✓	✗	✗
Research B	✓	✗	✗	✗	✗	✓
Research C	✗	✓	✗	✓	✓	✗
Proposed system	✓	✓	✓	✓	✓	✓

1.3 Research Problem

People's relationships and mental health are significantly shaped by their emotions. The absence of useful instruments for the early identification and treatment of emotional discomfort and mental health disorders, however, is a serious issue in the field of mental health management. Traditional methods of monitoring and treating mental health are frequently reactive rather than proactive, which leads to delayed

response and exacerbation of mental health concerns like depression, anxiety, and stress, despite the increased incidence of these conditions.

Self-reported information and static questionnaires are the mainstays of current mental health apps, which may not adequately reflect the dynamic and complex nature of emotional experiences. This may result in evaluations of a person's mental health state that are erroneous or incomplete. Furthermore, these tools frequently don't make use of cutting-edge machine learning methods that can produce assessments that are more accurate and nuanced. Because of this, a lot of people don't get the help they need when they need it, which can deteriorate their mental health and lower their quality of life.

Despite technological advancements in sentiment analysis and emotion identification, user-friendly mobile applications that offer real-time feedback and interventions frequently lack full integration of these improvements. The absence of individualized insights and real-time monitoring leaves consumers without the timely support they need to effectively manage their mental health. To further establish user confidence and guarantee confidentiality, issues with data privacy and the moral use of delicate emotional data must be resolved.

The creation and integration of cutting-edge technologies with accurate emotion detection algorithms, real-time monitoring capabilities, and user-friendly interfaces that support efficient communication and decision-making are necessary to address these pressing concerns. By developing a mobile application that combines machine learning algorithms—like Random Forest and XGBoost—with natural language processing techniques, our research seeks to close the gap between mental health practices and technological advancements by offering users precise, real-time assessments of their emotional states and mental health. Additionally, this application will provide tailored interventions meant to lessen emotional suffering and advance mental health.

Our goal is to enhance the early diagnosis and intervention of mental health concerns by utilizing state-of-the-art technology and updating mental health management practices. Individual well-being will be improved, and mental health management systems will be more sustainable and productive overall as a result. We want to enable people to take charge of their mental health and build stronger, more resilient communities via cooperative efforts and creative solutions.

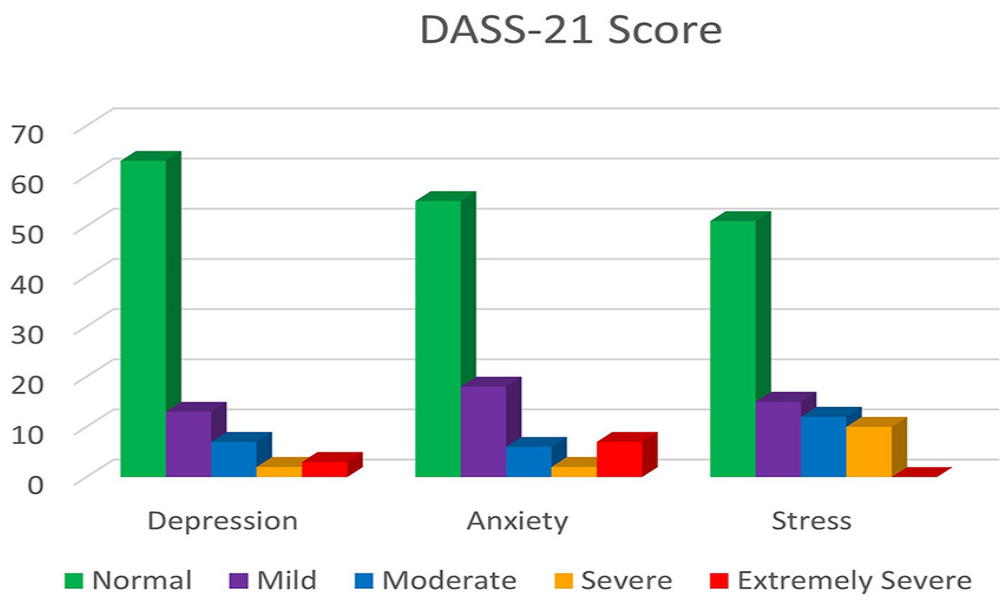


Figure 1.1: DASS-21 Measurement.

2.0 OBJECTIVES

2.1 Main Objectives

This research project's primary objective is to provide novel approaches to diagnosing and treating mental health conditions, with a special emphasis on sensing emotions and offering prompt responses. The ultimate goal is to improve people's mental health, emotional well-being, and day-to-day functioning by utilizing cutting-edge technical technologies to recognize emotional distress early on and provide appropriate support. This is a major development in the management of mental health and techniques for emotional well-being.

Modern technologies like natural language processing (NLP) and machine learning algorithms will be used in the suggested solution to automate the identification of emotional states and offer tailored solutions. The technology will be able to recognize signals of emotional distress and possible mental health problems in

advance by examining text inputs, facial expressions, and physiological markers. People will be able to take preventive action and keep their mental and emotional stability because of this proactive strategy.

The method will simplify the recognition of emotional states and enable smooth communication between people and the automated platform. Through an integrated mobile application, users will have real-time access to insights about their emotional well-being, depression levels, and suggested actions to improve their mental health. Improved accessibility and the ability for consumers to make knowledgeable decisions regarding their mental health are two benefits of this user-friendly design.

The system will leverage a variety of inputs, such as text entries, facial recognition software, and user answers to the DASS-21 questionnaire, to gather and evaluate data. Advanced machine learning techniques like Random Forest and XGBoost, which are trained on large datasets to produce precise and rapid predictions, will be used to process this data. Users will be able to better control their emotional well-being and stop mental health problems from getting worse by utilizing data-driven insights.

Moreover, the incorporation of state-of-the-art technologies into mental health treatment represents a paradigm change in the way emotional wellness is addressed. People can take advantage of new chances to improve their general well-being and get over traditional obstacles to mental health support by being innovative and using cutting-edge tools. The use of automated emotional state detection systems advances both individual mental health care and the more general objective of improving mental health across society.

In conclusion, the goal of this research is to create new techniques for recognizing and treating mental health problems and emotional suffering. By leveraging data analytics, machine learning, and mobile technologies, the objective is to provide people with the information and resources they need to protect their mental health and day-to-day functioning. This revolutionary strategy could completely change the way mental health is managed and help create a society that is emotionally stable and resilient.

2.1.1 Specific Objectives

The primary goal of the project must be accomplished by completing four distinct goals by the deadline.

Evaluate and Compile Current Literature

To lay a solid foundation for our research endeavor, we intend to perform an extensive literature evaluation on techniques for emotion detection and mental health therapies. Our objective is to use state-of-the-art Natural Language Processing (NLP) techniques to extract meaningful information and find patterns from a variety of academic journals, research papers, and corporate reports. We seek to extract significant information and innovative methods linked to the assessment of emotional wellness by utilizing sophisticated text mining, topic modeling, and sentiment analysis platforms. This will make it possible for us to evaluate current approaches and developing patterns in the identification of emotions and mental health interventions, effectively directing the course of our research.

Creating a System to Detect Emotions

Our next objective is to develop a sophisticated system that can recognize and differentiate between different emotional states with accuracy. Our goal is to evaluate text inputs, facial expressions, and physiological indications captured by mobile devices using the most advanced deep learning techniques and natural language processing (NLP) algorithms. Our goal is to create an automated system that can recognize and evaluate different emotional states by extracting pertinent data from text, like heart rate variability, facial action units, and sentiment. This novel method has the power to completely transform the evaluation of emotional health and make it possible to identify emotional distress quickly and accurately.

Tailored Mental Health Interventions

Our research program's main goal is to develop machine learning algorithms that can offer individualized mental health interventions. Using supervised learning techniques like Random Forests and Support Vector Machines (SVM), we want to

develop predictive models that can suggest certain therapies based on emotional states that are identified. Our goal is to create useful tools that can provide individualized help to people going through emotional distress by iteratively training these models using annotated datasets of emotional responses and successful interventions. This program is a vital step in improving the management of mental health and giving consumers prompt support.

Instantaneous Emotion Tracking and Relaxation Games

We want to create a state-of-the-art Internet of Things (IoT) system that can monitor users' emotional states in real-time and offer calming interventions as part of our proactive mental health management initiatives. We foresee a networked ecosystem that seamlessly integrates IoT sensors with mobile applications to continuously track behavioral cues and physiological indications. Our objective is to use rule-based and predictive analytics algorithms to detect abnormalities and indicators of emotional discomfort. The system will provide relaxing games and activities intended to lower stress and enhance emotional well-being when it detects emotional distress. Users will be able to efficiently and proactively manage their mental health with the help of this real-time monitoring and intervention system.

2.2. Retrieve the results of the analysis.

Our system will retrieve and present the results of the comprehensive analysis of mental health interventions and emotional health metrics once the analysis phase is complete. Our system will efficiently collect, and process relevant data required for users to make educated decisions about their mental health and well-being by integrating with cloud-based databases and real-time data streaming technologies.

- Current Emotional State Updates

The dissemination of real-time updates on users' emotional states will be one of our analytical framework's main results. With the utilization of information obtained

from several sources, including physiological sensors, facial expression recognition, and text analysis, the system will offer a thorough understanding of the user's emotional state at that moment. People can take timely and appropriate action by keeping a close eye on these vital indicators, which will provide them with significant insight into the variables affecting their emotional well-being.

- Recognizing and Sorting Out Emotional States

Furthermore, our system will provide comprehensive details regarding the classification and identification of different emotional states. The system can effectively detect a range of emotional states, from tension and anxiety to more nuanced feelings like dissatisfaction or contentment. This is made possible by the use of advanced machine learning algorithms that have been trained on huge datasets relating to emotional and mental health. Our analytical engine will enable a more comprehensive knowledge of the user's emotional environment by precisely revealing the kind and degree of emotions felt.

- Tailored Mental Health Interventions

In addition to recognizing affective states, our technology will provide proactive suggestions for individualized mental health therapies aimed at reducing emotional distress and enhancing general wellbeing. By utilizing domain-specific knowledge and best practices in mental health care, the system will recommend doable activities like playing mind-calming games, practicing mindfulness, or using cognitive-behavioral strategies. Our mission is to provide people with the information and resources they need to improve mental health and preserve emotional equilibrium, from making daily routine adjustments to using relaxation techniques and, when needed, seeking professional assistance.

- Promoting Knowledge-Based Juvenile Justice

Our analytical framework's primary objective is to give consumers rapid access to comprehensive analytical results so they may make educated decisions about their emotional and mental health. Our solution will allow users to proactively manage their mental health by smoothly extracting and showing findings that include updates on emotional states, emotional category identification, and individualized intervention recommendations. With this strategy, the community will become more knowledgeable and resilient, able to overcome obstacles related to mental well-being and preserve a better standard of living.

3.0 METHODOLOGY

3.1. Requirement Gathering and Analysis

- Gathering Data from Subject Matter Experts

To learn more about the best practices for emotional detection and intervention, mental health experts and makers of mental health applications were interviewed. These talks shed light on common emotional states like stress, anxiety, and depression as well as the difficulties in delivering prompt and efficient interventions. In addition, professionals in the fields of user experience design and mobile application development offered advice on how to make the mental health application's UI simple to use.

- Data Collection

Using Google Forms, a dataset was gathered using the DASS-21 (Depression, Anxiety, and Stress Scale) questionnaire. Machine learning models were trained with the use of this dataset, which was collected from a wide variety of people. To identify current trends, recurring problems, and possible areas for development in emotional health monitoring and intervention strategies, field research involved examining mental health applications that are currently in use as well as user reviews.

3.2. Feasibility Study

• Technical Feasibility

In order to establish the technology infrastructure and knowledge needed to put the suggested emotional detection and intervention system into practice, technical feasibility evaluations were carried out. In order to assess the applicability of sensor-

based technologies for real-time emotional monitoring, mobile application prototypes were created that included physiological sensors, facial expression detection, and text analysis.

• Economic Feasibility

To assess the cost-effectiveness of the suggested emotional detection and intervention system, an economic feasibility study was conducted. The goal was to create a remedy that would lessen emotional suffering and enhance mental health while remaining reasonably priced. To make sure the system could be constructed and maintained within budget while optimizing its impact, cost evaluations were carried out.

• Achievability of Schedule

A thorough project schedule that outlined the deadline and deliverables was made. The project was broken up into phases, each with designated completion dates to monitor development and guarantee on-time completion. The plan was to finish the system's development and implementation in the allotted period, with frequent status reports to handle any problems or delays.

3.3 Proposed System Diagram

3.3.1 System Overview Diagram (Overall)

Figure 3.1 : System overall diagram

3.3.2 System Overview Diagram (Individual)

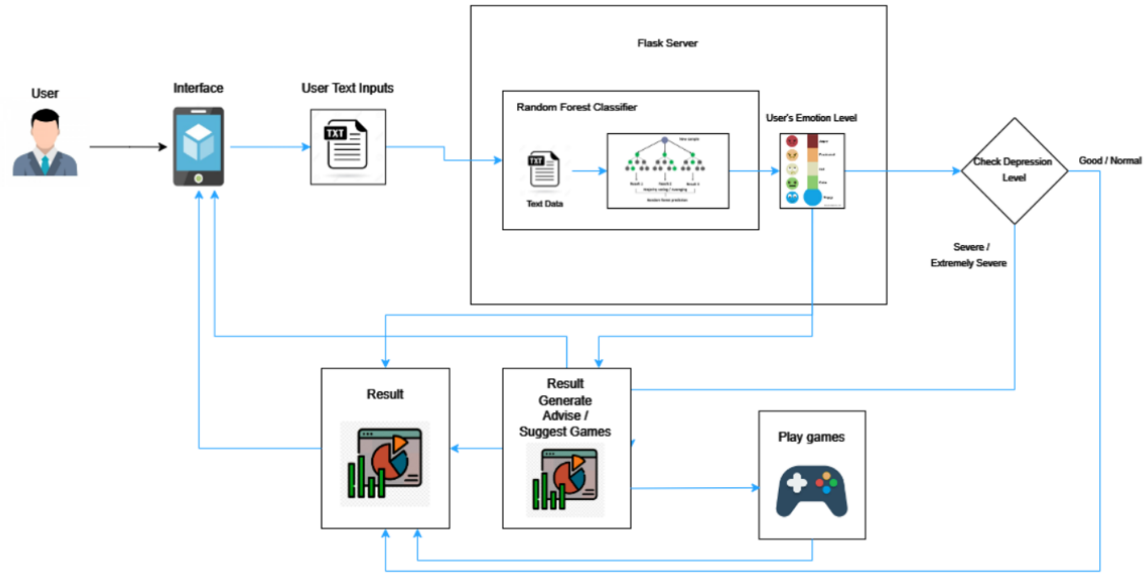


Figure 3. 2 : High Level Architecture Diagram

Our system architecture uses a comprehensive approach to real-time data collecting, analysis, and evaluation in order to predict and manage future mental health disorders. The main purpose of the system is to collect user input via a mobile application interface, where users fill out the DASS-21 survey. For processing, this input is sent to a Flask server. Advanced machine learning models, such as Random Forest and XGBoost classifiers, are housed on the server. These models have been trained on large datasets to properly determine the emotional state of the user.

Preprocessing methods guarantee the integrity and dependability of the data after it is received. After preprocessing, pertinent factors influencing psychological and emotional measures are extracted from the data. The system incorporates machine learning models to predict mental health disorders. These models are trained on annotated datasets that comprise diverse emotional states and related aspects. To confirm the efficacy of the model, the dataset is split into training and validation sets. Cross-validation techniques are used to guarantee the robustness and generalizability of the model.

These models employ real-time data to evaluate the user's emotional state after

training and validation. When the user's condition reaches severe or extremely severe levels, warnings are set up based on threshold values for various levels of emotional distress. These alarms cause the system to recommend quick fixes, including playing games that quiet the mind, and to offer tailored guidance via the mobile app. Alerts are sent out in a variety of ways, such as through in-app notifications, so consumers may get help when they need it.

An essential element that enables the system to track alterations in the user's emotional state over time is continuous monitoring. The system has a feedback loop that allows users to score the precision of the system's interventions and predictions, allowing for ongoing model improvement and modification. The system's architecture places a high priority on scalability and flexibility, making it simple to expand in order to support more users and features.

Additionally, the system places a strong emphasis on data security and privacy, putting strong safeguards in place to guard sensitive user data. Before the system is deployed, extensive testing and validation procedures are carried out, and users receive the assistance and training they need to operate and maintain it properly. In the end, this improves users' well-being by guaranteeing the system's dependability and efficacy in providing real-time mental health assessments and interventions.

3.4 Design Diagrams

3.4.1 Use Case Diagram

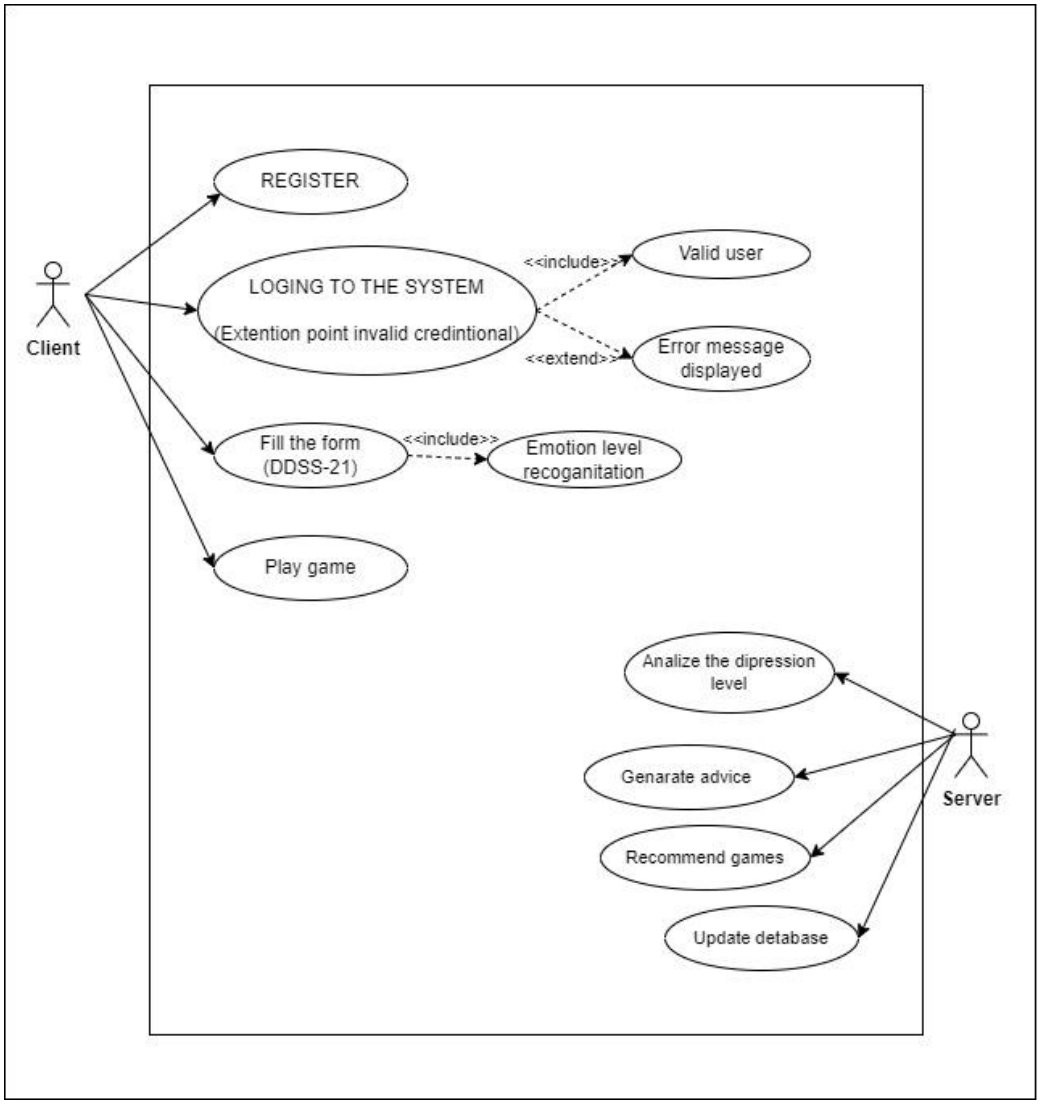


Figure 3. 3 : Use Case Diagram 1

3.4.2 Flow Chart

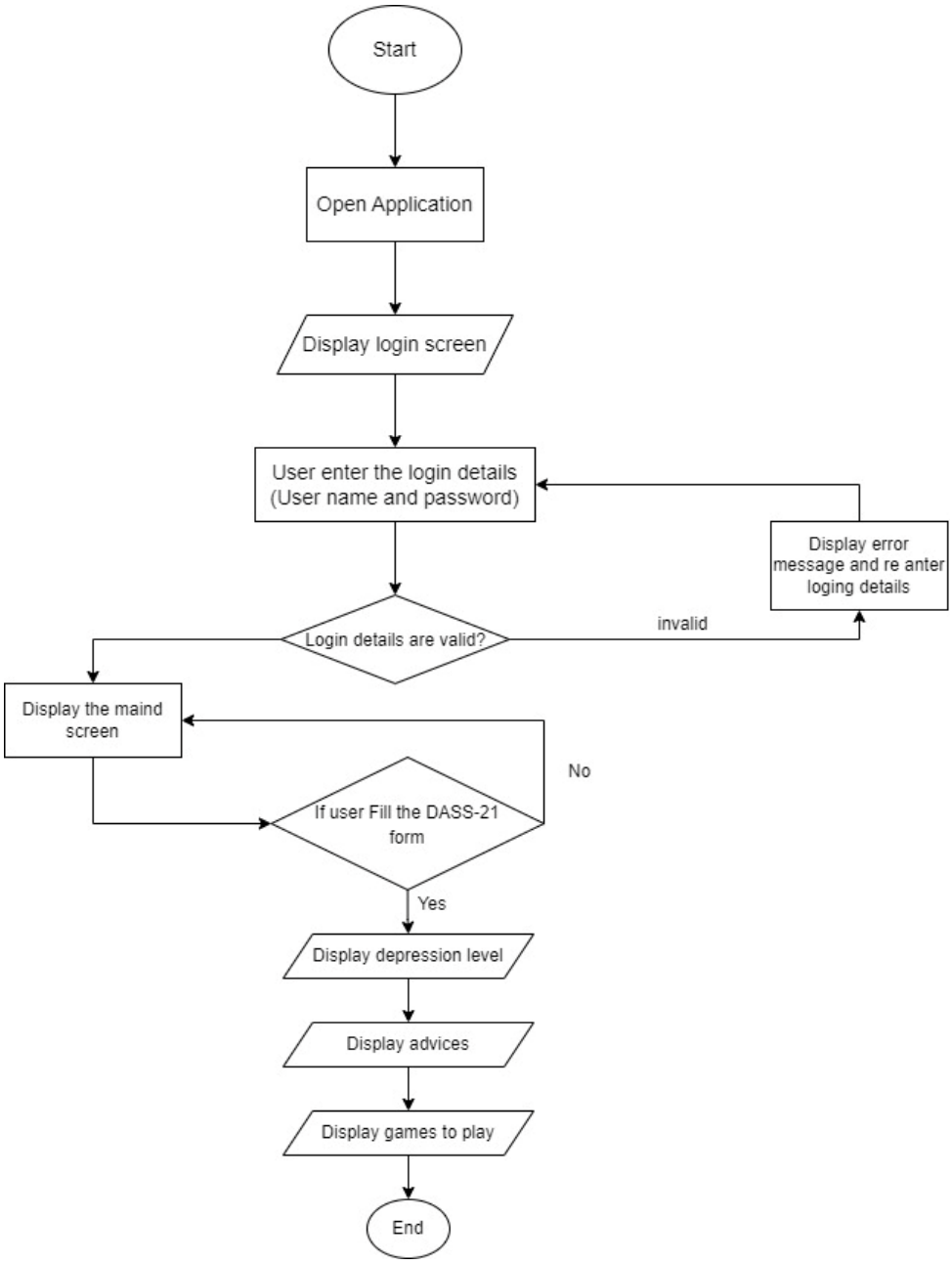


Figure 3. 4 : Flow Chart Diagram 1

3.5 Software Solution

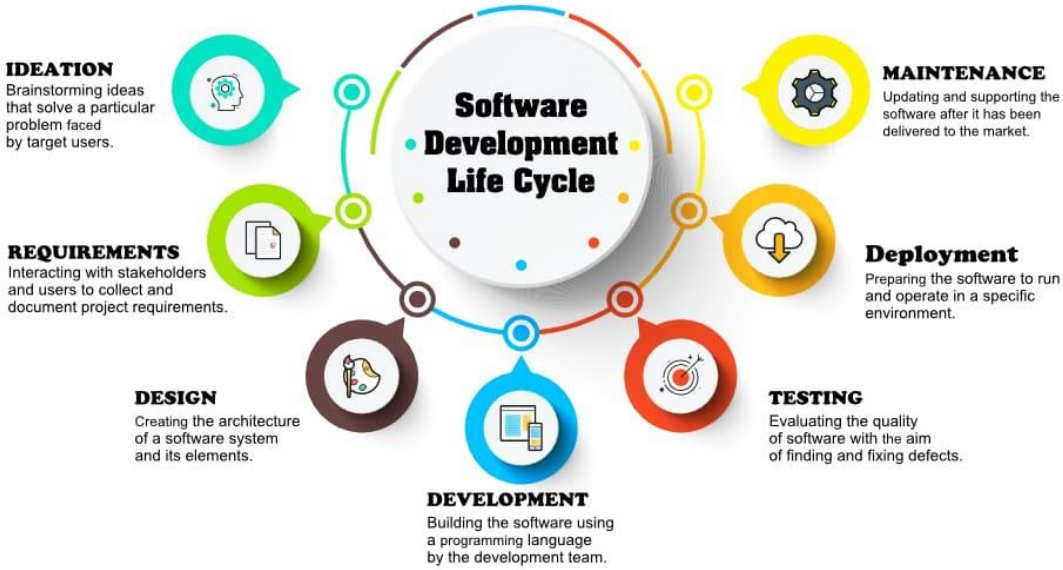


Figure 3. 5 : SDLC 1

Our project will employ an adaptable, iterative technique similar to agile for the development of a mental health monitoring system. The main objective of employing agile methodologies is to rapidly produce operational software, enabling frequent testing and iteration to guarantee the system adequately fulfills the users' requirements. The agile method facilitates the incremental delivery of functioning software by breaking down the project into smaller, more manageable jobs. By using an incremental approach, the system can undergo ongoing testing and refinement, thereby guaranteeing that it stays in line with user requirements and expectations.

The Agile technique enables rapid and efficient adjustments by allowing the development team to immediately respond to changing needs or stakeholder feedback. The process commences with the collection and analysis of requirements, a crucial stage to comprehend the difficulties encountered by users and ascertain their distinct demands. We will actively interact with potential consumers and industry

experts to collect needs, guaranteeing that the solution effectively tackles practical difficulties

- **Requirement Gathering and Analysis**

In order to provide a comprehensive software solution for monitoring mental health, we will collect thorough specifications and gain a clear understanding of the difficulties experienced by users. This stage encompasses:

1.Engaging with Users and Experts:

We will conduct surveys and interviews with potential users to understand their difficulties and experiences. We will also engage with mental health specialists to acquire insights on successful mental health monitoring and intervention approaches.

2.Identifying Key issues:

We will identify common issues such as recognizing emotional states and offering timely interventions. This will aid in outlining the system's aims and functionalities.

3.Defining System Requirements:

Based on the acquired information, we will design the system's requirements, focusing on essential capabilities including emotion detection, depression degree assessment, and personalized recommendations.

Table 3.1 : Functional Requirement

Functional Requirement	Description
Data Acquisition System	The system will acquire data through user text inputs, which will be processed to assess emotional states. This data will provide insights into the user's mental health, establishing the basis for additional research and action
Machine Learning Algorithms	The system will employ a Random Forest classifier to evaluate text input and assess the user's emotional state. These machine learning algorithms will be trained on annotated datasets to reliably distinguish distinct emotional states and forecast depression levels.
Emotion and Depression Assessment	Using the classified data, the system will assess the user's mental state and establish their depression degree. This assessment will aid in giving timely interventions and individualized recommendations.
Notification and Recommendation System	The system will notify users about their emotional condition and provide individualized recommendations based on the analysis. In cases of severe or extremely severe depression, the system will provide actions or activities to help elevate the user's emotional state. The mobile application will be used to transmit notifications, guaranteeing that users receive timely alerts and guidance.
Mobile Application	The mobile application will serve as the user interface, allowing users to interact with the system. It will provide real-time monitoring of emotional states, send alarms and recommendations, and offer advice on managing mental health. The program will have a user-friendly interface, making it easy for users to access and use the system.
Continuous Improvement	The agile technique ensures ongoing improvement of the system. By iterating on the development process, the system will be refined depending on user feedback and changing requirements. This strategy will ensure the system remains successful and consistent with the users' needs.

Table 3.2 : Non functional Requirements

Non-Functional Requirement	Description
Accuracy	The system should identify diseases with a high degree of accuracy to enable trustworthy detection and avoid false positives. It should obtain an accuracy rate of at least 95%
Scalability	The system's architecture should be scalable to support a growing number of ponds or fish tanks. This scalability should permit easy expansion without affecting functionality.
Reliability	The system should have robust error-handling capabilities and high reliability to ensure it continues to work even in the situation of hardware or software problems.
Performance	The system should perform efficiently with short reaction times for data processing, notification generating, and acquisition to deliver timely insights to fish producers.
Security	The system should employ strong security procedures, including user authentication, data encryption, and secure communication protocols, to safeguard sensitive data and prevent unwanted access and data breaches.
Usability	The system should have an intuitive interface design and easy navigation features to allow efficient interaction for fish producers with various technical backgrounds.
Compatibility	The system should be compatible with a range of platforms and devices, including web browsers, tablets,

	and smartphones, to assure accessibility and smooth integration into current farm management workflows.

3.5.1. Feasibility Study

- **Economy feasibility**

  The system subcomponent overall functionality must be economical. The system must simultaneously operate more efficiently and consistently without any problems.

- **Scheduled feasibility**

  According to the work-breakdown chart, these tasks must be finished according to the specified timeline. If it fails, there will be less chance of it happening. All assignments must be finished on time for the project to be successful and correct.

- **Technical feasibility**

  To design a mobile application, technical expertise and a solid grasp of software architecture are prerequisites. And there must be even better cloud platform experiences.

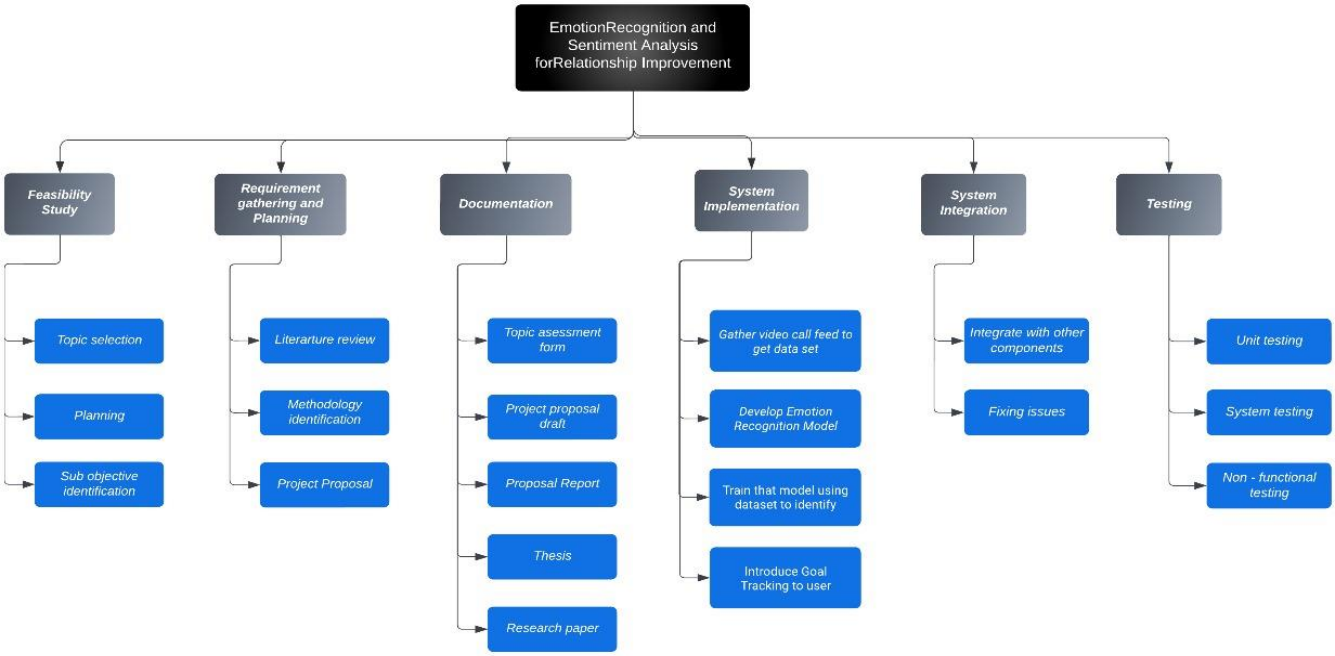
- **Operational feasibility**

  The system must fulfill all needs and processes while simultaneously improving the product for end users. Each stage of the software life cycle must also be completed with the appropriate time schema.

  .

3.6 Work Breakdown Chart.

Figure 3. 6 : Work Breakdown Chart 1



3.7 Key technologies used in this research.

Step 1: Define the problem and plan your research.

1. How can random forest classifiers be successfully identified and employed to measure user's emotion levels based on their text inputs?

   The project will focus on the discovery and deployment of random forest classifiers for assessing user text inputs to determine emotion levels. Key considerations will include picking appropriate features from the text input, training the classifier on a diverse dataset, and evaluating the model to achieve high accuracy and reliability in emotion identification.

2. How to build and implement an interface that allows users to submit their text data and evaluate their emotional state in a user-friendly manner?

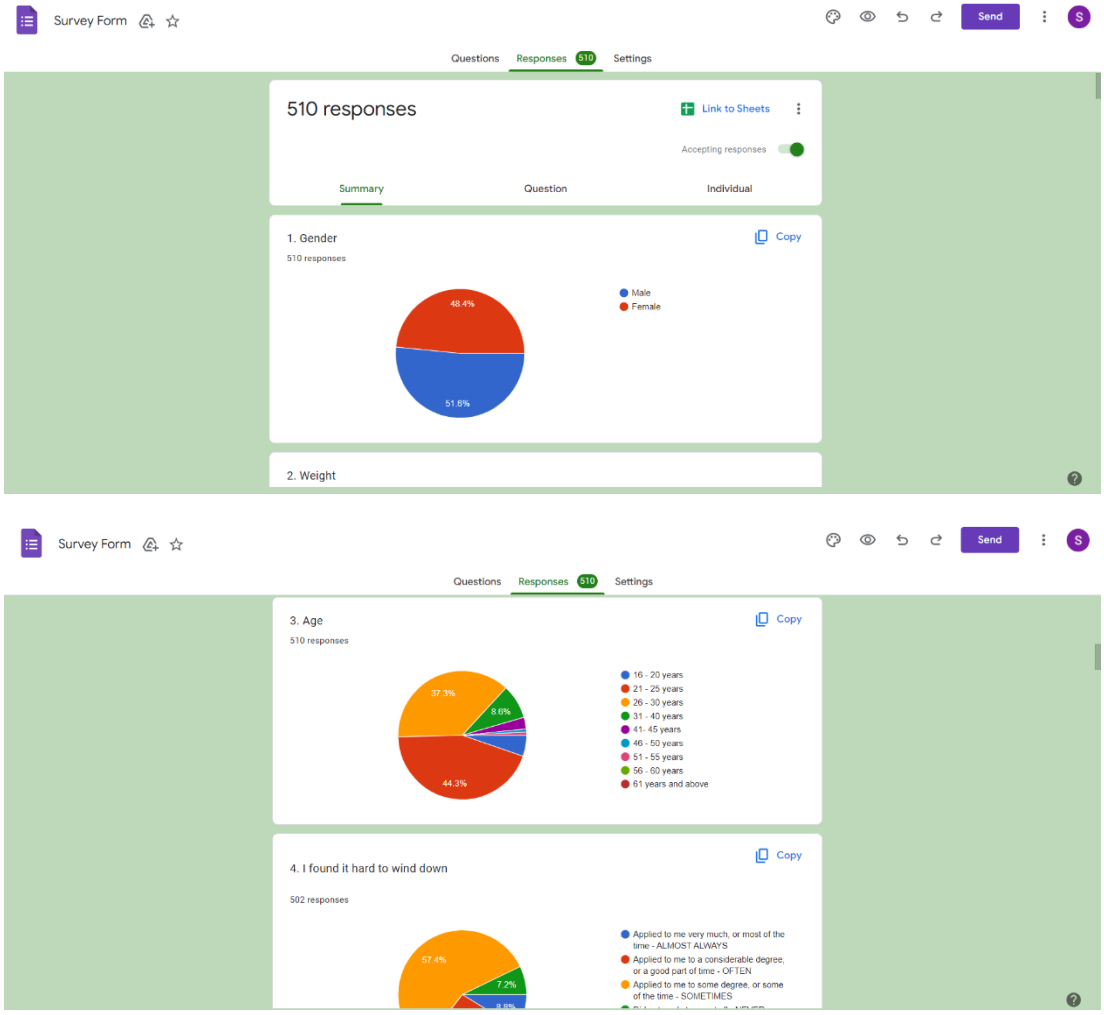
   This requires designing and constructing a user interface that is intuitive and easy to navigate. The interface must support the seamless entry of text data by the user and provide the ensuing emotional state analysis simply and fully. It will also include capabilities for real-time feedback and interaction to boost user engagement.

3. How to produce recommendations based on the user's emotion levels and give these recommendations through an accessible and user-friendly platform?

   The project will explore strategies for generating actionable recommendations based on the detected emotion levels. This will involve connecting the recommendation system with the emotion analysis component and ensuring the recommendations are appropriate and useful. The transmission of these recommendations will be through an accessible platform, which could include mobile applications or web-based dashboards, ensuring that users can simply access and act upon the information.

Step 2: Data Collection and Data Preprocessing

Data collection



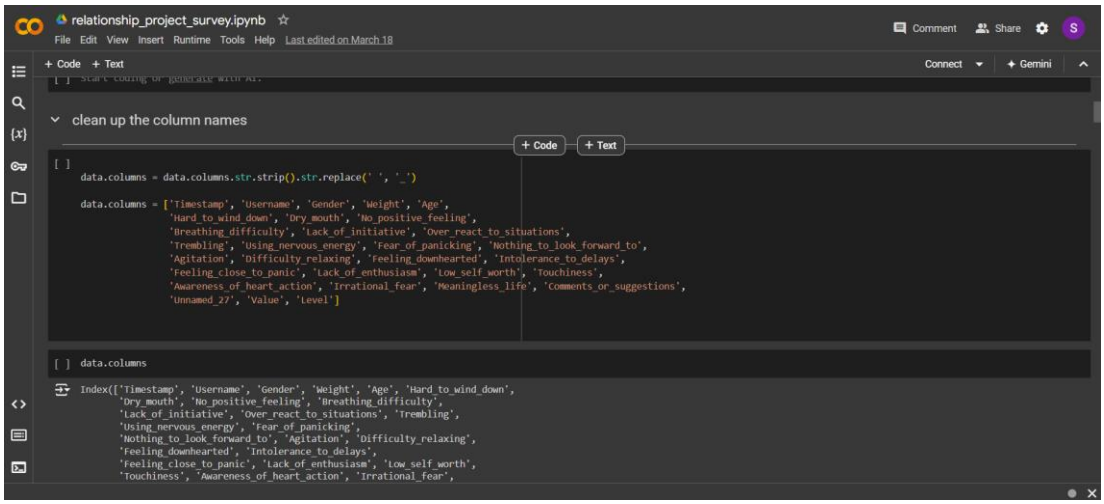
In our study, we utilized numerous approaches to obtain critical data for constructing our emotion detection and management system. A large percentage of our data was obtained through a collaboration with mental health professionals and institutions. This relationship offered access to a broad dataset comprising user text inputs expressing various emotional states. Through interactions with psychologists and access to existing databases, we obtained critical material relevant to our research objectives, including annotated text data that covers a wide spectrum of emotional

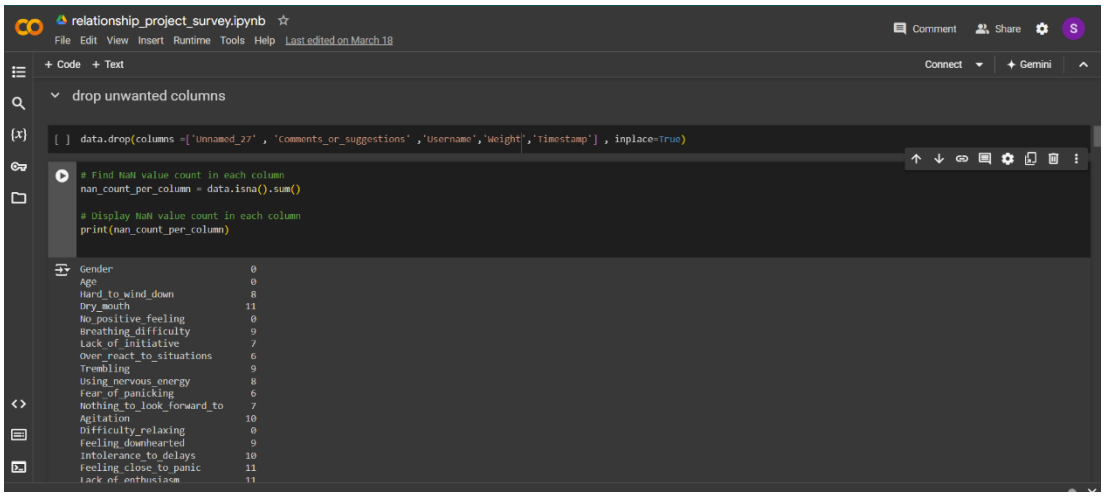
expressions.

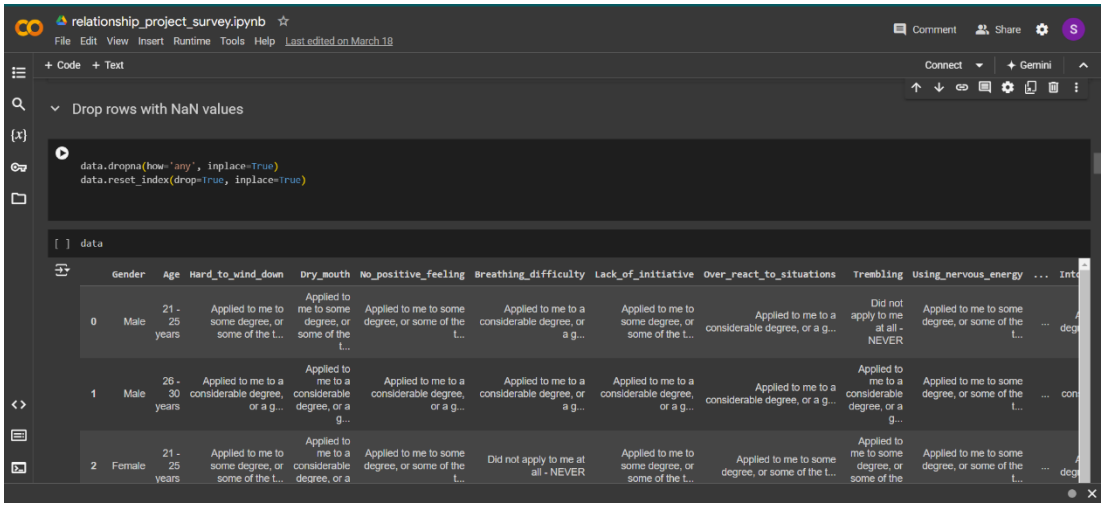
Additionally, we employed Google Forms to collect responses to the DASS-21 (Depression, Anxiety, and Stress Scales) questionnaire. This technology allows us to acquire self-reported data on users' emotional states, providing a robust dataset for training and verifying our Random Forest classifier. The replies from the DASS-21 questionnaire offer vital insights into users' mental health, further boosting the accuracy and reliability of our emotion detection system.

Despite its limitations, the combined data from expert cooperation and user-submitted questionnaire replies offers considerable insights into user emotional states. The partnership with mental health professionals ensured the relevance and quality of the data, while the usage of Google Forms allowed us to efficiently capture vast amounts of user-specific emotional data.

This multi-faceted data gathering approach assures that our system is both scientifically grounded and practically usable, enabling the invention and improvement of unique solutions for detecting and regulating user emotions through their text inputs.







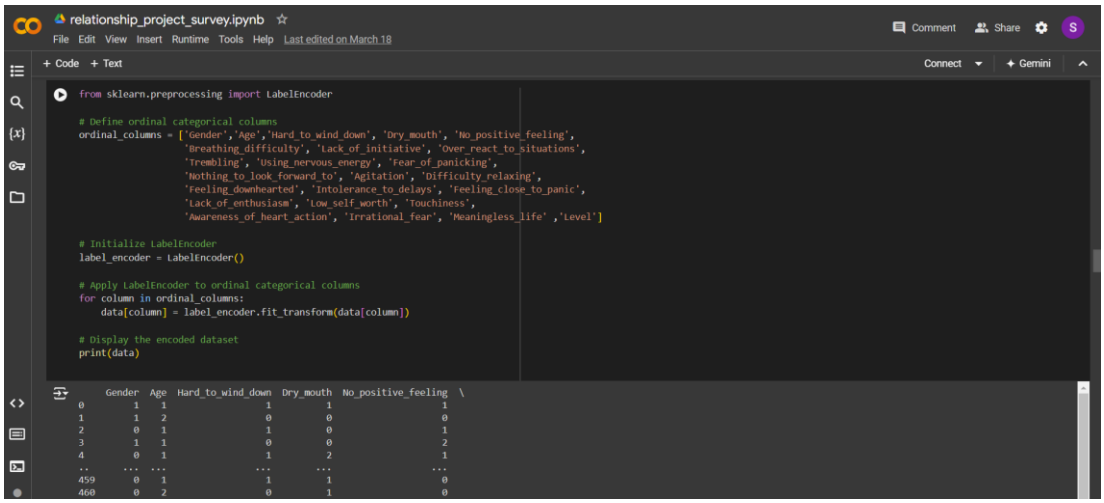


Figure 3. 7: Preprocess Step of Dataset 1

Step 3: Deep Learning Model Development

In this research, two machine learning models, Random Forest and XGBoost, were selected for training and evaluating the predicting performance of emotional distress levels based on the DASS-21 questionnaire data. The selection of these models is guided by their proven efficacy in classification tasks and their capacity to handle complicated, high-dimensional data.

Random Forest Data Splitting:

The dataset was divided into training and testing sets using an 80-20 split to ensure a robust evaluation of the model's performance. Specifically, 80% of the data was given to the training set, which is used to train the model, while the remaining 20% was kept for testing the model's performance on unseen data.

Model Training:

A Random Forest Classifier was applied, utilizing its ensemble learning technique to boost predictive accuracy and control overfitting. The model was trained using the training data, understanding the fundamental patterns that identify distinct emotional distress levels.

Evaluation:

The trained model's performance was tested on the test set, with key metrics like as accuracy, precision, recall, and the F1 score being reported. This evaluation provides insights into the model's ability to generalize and effectively forecast emotional distress levels in new data.

Process Summary:

Data was separated into training (80%) and testing (20%) sets.
A Random Forest Classifier was trained on the training data.
The model's performance was evaluated using the test data.
Performance measures were recorded and examined to assess model efficacy.

XGBoost Data Preparation:

Similar to the Random Forest model, the data was separated into training and testing sets. The data was then transformed into the DMatrix format required by XGBoost, permitting fast handling and processing of the input features.

Model Training:

The XGBoost model was constructed with characteristics suited for multiclass classification, including the use of the softmax objective function. The model was trained using 100 boosting rounds, with hyperparameters such as maximum tree depth and learning rate set for optimal performance.

Evaluation: The model's predictions on the test data were tested against the true labels, and performance metrics including accuracy and a full classification report were created. These metrics provided a full perspective of the model's classification skills.

Process Summary:

Data was separated into training and testing sets and converted to DMatrix format.
XGBoost model was constructed and trained using the training data.
Model performance was tested on the test data.
Performance measures were recorded and examined to determine model effectiveness.

Both the Random Forest and XGBoost models were trained and analyzed to determine their effectiveness for predicting emotional distress levels based on DASS-21 questionnaire responses. By comparing the performance metrics of both models, the most successful algorithm for this task may be selected, enabling the development of a trustworthy system for early identification and intervention of emotional discomfort and mental health illnesses. This technique assures that the chosen model gives accurate, timely, and actionable insights to users, boosting their mental well-being.

Step 4: User Interface Design and Implementation

For the DASS-21 emotional distress diagnostic system, we decided to use React Native, enhanced with Expo Go, to produce a user-friendly and straightforward mobile application. This method allows us to offer a fluid and easy-to-use interface that promotes user interaction with the system. Our design promotes clarity and usability, ensuring users can rapidly access vital information and manage the

program with ease.

Leveraging React Native's cross-platform features, we were able to design interfaces that run reliably on both Android and iOS devices. This method substantially boosts the system's accessibility and usability, enabling users to access it from a wide range of devices. The user interface is built to show information in a simple and accessible manner, emphasizing the most crucial aspects of diagnosing emotional distress. Through visually appealing displays and clear navigation, we aim to improve the user experience and allow successful interaction with the system.

The UI also includes capabilities that allow users to view recommended activities and coping strategies based on their emotional distress levels. By giving practical insights and ideas, we empower consumers to manage their mental health proactively. This functionality is critical in delivering prompt help and guidance, which can be vital in addressing and minimizing emotional discomfort.

Overall, our focus on user-centric design principles ensures that the emotional distress diagnostic system fits the different needs of its user population. Our purpose is to increase the well-being of consumers by streamlining the process of emotional distress identification and management through user-friendly interfaces and conveniently available features. This approach not only helps effective diagnosis but also promotes the general mental health and resilience of users through practical, evidence-based advice.

Step 5: System Testing and Evaluation

Rigorous testing and assessment were undertaken to verify the reliability and efficacy of our sentiment analysis system utilizing the DASS-21 questionnaire. Our testing approaches seek to assess the accuracy, usability, and functionality of the system. Through comprehensive testing, including validation with real-world data and usability tests, we proved the system's capabilities to provide customers with exact and simply accessible sentiment analysis solutions.

Step 6: Data Analysis and Interpretation

A complete data analysis was done to obtain significant insights into the performance and user feedback of the sentiment analysis system. By evaluating data acquired during testing and user interactions, we gained critical insights into the system's operation and its impact on enhancing sentiment analysis techniques. This research helped us to identify strengths and areas for development, leading to future additions to the system's functioning.

Step 7: User Feedback and Iteration

User feedback played a crucial role in developing and enhancing the sentiment analysis system. Through proactive solicitation and integration of user feedback, we addressed usability difficulties, boosted overall system performance, and fine-tuned the user interface. Iterative modifications based on user feedback ensured that the system fit the individual demands and preferences of users, hence boosting its usability and efficacy in real applications.

Step 8: Timeline

To enable the effective development and implementation of the sentiment analysis system, a comprehensive timeline was devised. This schedule helps in successful project management and coordination of tasks such as data collecting, model creation, UI design, and user testing. Adherence to the deadline ensured timely completion of project objectives and successful delivery of the system within the given timeframe

1.7 Testing

1.7.1 Test Plan and Test Strategy

Test planning acts as a core framework for guaranteeing software efficacy. It describes the necessary tasks, scope, and objectives to track project progress. A well-defined test strategy directs the testing process by outlining the actions and procedures required to ensure that all key elements and functions are tested, considering the risks they may represent to users.

Steps and Procedures in Test Strategy:

• Define the Items to be evaluated: Identify specific software components or functionality to be evaluated.

• Select Functions Based on Importance and harm: Prioritize functions to test based on their significance and potential harm to users.

• Design Test Cases: Create detailed test cases according to use case descriptions to cover all recognized scenarios.

• Execute Test Cases: Run the designed test cases on the software to check for proper functionality.

• Record Results: Document the outcomes of each test case execution, noting any departures from intended behavior.

• Identify Bugs: Analyze test findings to pinpoint any defects or issues within the software.

• Correct Bugs: Implement patches for the discovered bugs to ensure the software runs appropriately.

• Repeat Testing: Retest the software after bug fixes to validate that the issues have been handled and the software matches expected outcomes.

By following these stages, the test strategy ensures a systematic approach to software testing, enhancing overall quality and reliability.

1.7.2 Test Case Design

The following test cases were designed to ensure system reliability by testing all system functionalities

Table **3.3** : Test Case Design 01

Test Case Id	001
Test Case	User Login

Test Scenario	User accesses to the mobile application.
Input	Valid username and password
Expected Output	Successful login, granting access to the system dashboard
Actual Result	Successful login, access to the system dashboard.
Status (Pass/Fail)	Pass

Table **3.4** : Test Case Design 02

Test Case Id	002
Test Case	Form filling and submitting the filled data.
Test Scenario	Select the answers to DASS-21 questions and submit the form.
Input	Select the given answers
Expected Output	Successfully submitted toast message and send the submitted data to model.
Actual Result	Successful retrieval of form submission data.
Status (Pass/Fail)	Pass

Table **3.5** : Test Case Design 03

Test Case Id	003

Test Case	Depression level Identification
Test Scenario	Identification of depression level using form data.
Input	Form filling and submitting.
Expected Output	Accurate identification of the level of depression
Actual Result	Accurate identification of depression level.
Status (Pass/Fail)	Pass

Table **3.**3 : Test Case Design 04

Test Case Id	004
Test Case	According to the depression level suggest the game for mind calming.
Test Scenario	After the submitting the form, show the level of depresstion and suggest and open the game.
Input	Identified depression level.
Expected Output	Successfully open the game.
Actual Result	Successfully open the game.
Status (Pass/Fail)	Pass

4.0 TESTING & IMPLEMENTTION

Python was chosen as the main programming language for the backend model of the sentiment analysis system employing the DASS-21 questionnaire. Python's rich library, including Pandas, Scikit-Learn, and XGBoost, together with its versatility, made it easy to design a solid machine learning architecture. Based on input data acquired from the DASS-21 survey, the Random Forest and XGBoost models were rigorously trained to reliably recognize and categorize users' emotional states.

The backend's smooth integration of the FastAPI framework enabled the establishment of high-performing, effective APIs. These APIs provide seamless communication and interaction between the frontend user interface and the backend machine learning model by acting as a critical link between both.

Concurrently, an elegant and user-friendly interface for the sentiment analysis system was constructed using React Native. Due of React Native's cross-platform compatibility, users could access and utilize the program on both iOS and Android smartphones with ease. With a focus on clarity, simplicity, and ease of use, the user interface was deliberately built so that persons with diverse technical backgrounds could simply traverse the system.

Based on threshold values for different levels of emotional distress, the system is designed to generate notifications when the user's situation reaches severe or extremely severe levels. These signals prompt quick responses, such as proposing soothing exercises or delivering targeted guidance through the mobile app. Users receive these alerts via in-app notifications, ensuring prompt assistance.

Additionally, the system allows continuous monitoring, allowing for dynamic tracking of changes in the user's emotional state over time. The system contains a feedback loop that enables users to judge the accuracy of the system’s predictions and interventions, allowing for continual model improvement and adaptability.

The sentiment analysis system was created cooperatively, with constant user feedback and iterations considerably influencing the system's usability and functionality. Feedback from mental health professionals and consumers was vital in ensuring that the system's features fit with end-users' needs. Through iterative development cycles, the system became proactive, responsive, and personalized to meet the individual needs of users seeking mental health support.

Furthermore, the system focuses a great emphasis on data security and privacy, employing rigorous measures to secure sensitive user data. Extensive testing and

validation methods were carried out to assure the system's dependability and usefulness in providing real-time mental health assessments and interventions. In the end, this promotes users' well-being by guaranteeing the system's stability and efficacy in promoting mental health.

Model Implementation

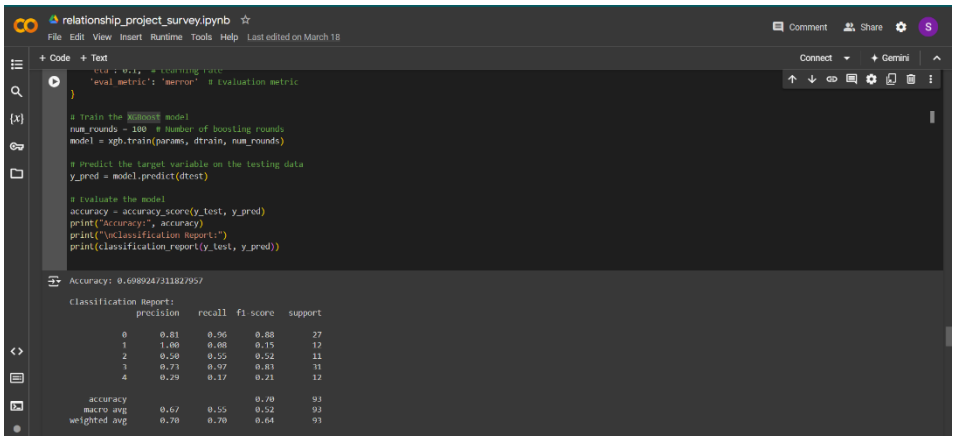


Figure 4. 1 : Model Implementation 01 1

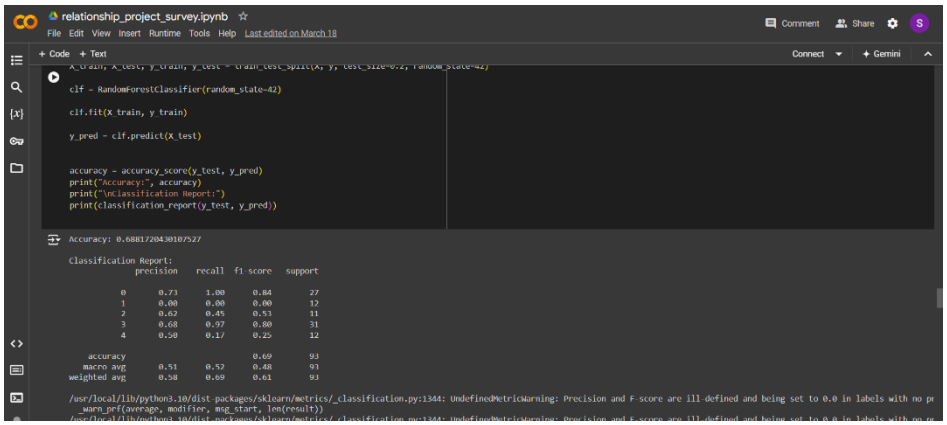


Figure 4. 2 : Model Implementation 02 1

Backend API Implementation

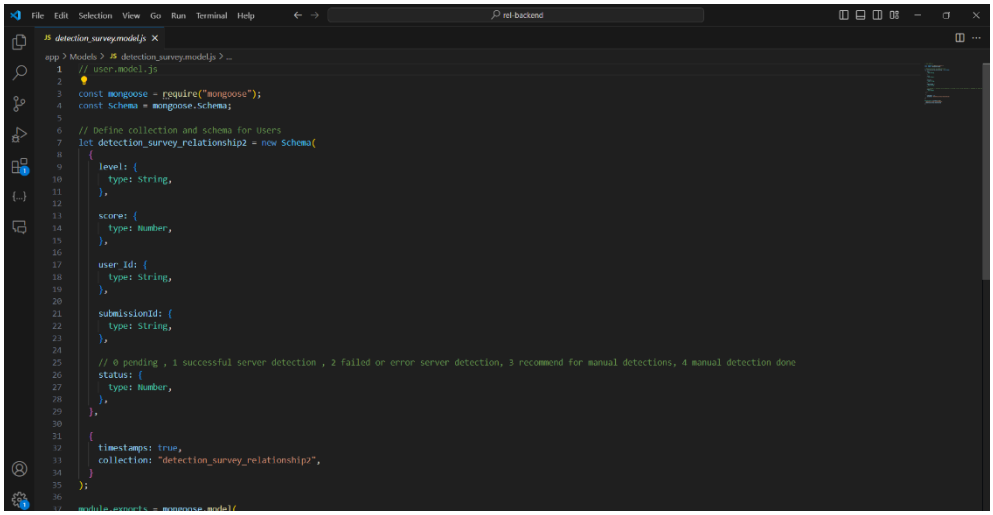
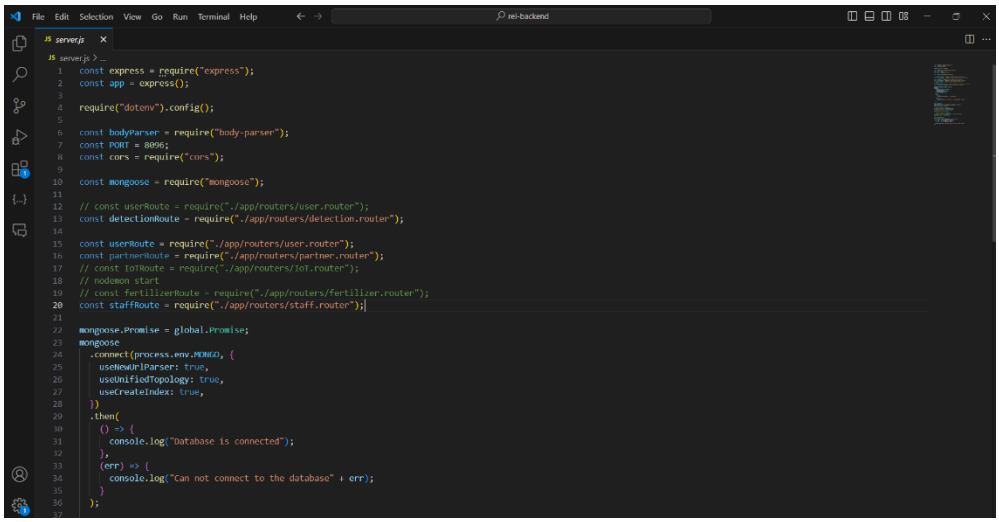


Figure 4. 3: Backend API Implementation 1



```
const express = require("express");
const app = express();

require("dotenv").config();

const bodyParser = require("body-parser");
const PORT = 8096;
const cors = require("cors");

const mongoose = require("mongoose");

// const userRoute = require("./app/routers/user.router");
const detectionRoute = require("./app/routers/detection.router");

const userRoute = require("./app/routers/user.router");
const partnerRoute = require("./app/routers/partner.router");
// const IoTRoute = require("./app/routers/IoT.router");
// nodemon start
// const fertillizerRoute = require("./app/routers/fertillizer.router");
const staffRoute = require("./app/routers/staff.router");

mongoose.Promise = global.Promise;
mongoose
  .connect(process.env.MONGO, {
    useNewUrlParser: true,
    useUnifiedTopology: true,
    useCreateIndex: true,
  })
  .then(
    () => {
      console.log("Database is connected");
    },
    (err) => {
      console.log("Can not connect to the database" + err);
    }
  );
```

Figure 4. 4 : Backend Implementation 1

```
const axios = require("axios");

var stream = require("stream");
require("dotenv").config();

const s3 = require("../config/s3.config.js");
let audioDetection = require("../Models/detection_audio.model.js");
let videoDetection = require("../Models/detection_video.model.js");
let surveyDetection = require("../Models/detection_survey.model.js");

exports.doUpload = (req, res) => {
  const s3Client = s3.s3Client;
  const params = s3.uploadParams;

  let user_Id = req.body.user_Id;
  let submissionId = req.body.submissionId;

  params.Key = req.file.originalname;
  params.Body = req.file.buffer;
  params.ACL = "public-read";

  console.log("=========submissionId==========");
            console.log(submissionId);
```

Figure 4. 5 : Backend Implementation 1

Frontend Implementation

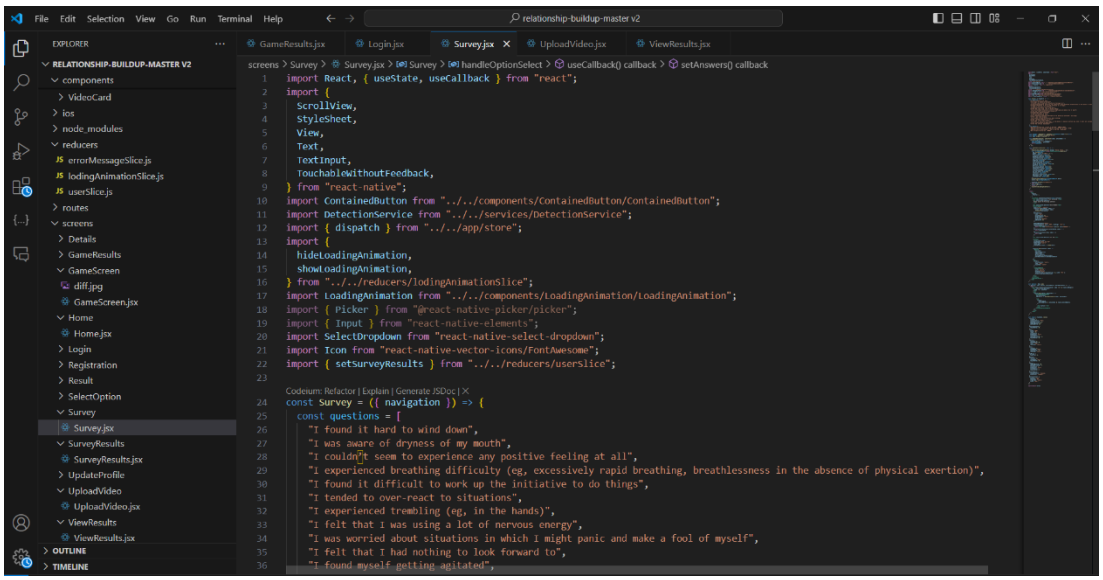


Figure 4. 6 : Frontend Implementation 0 1

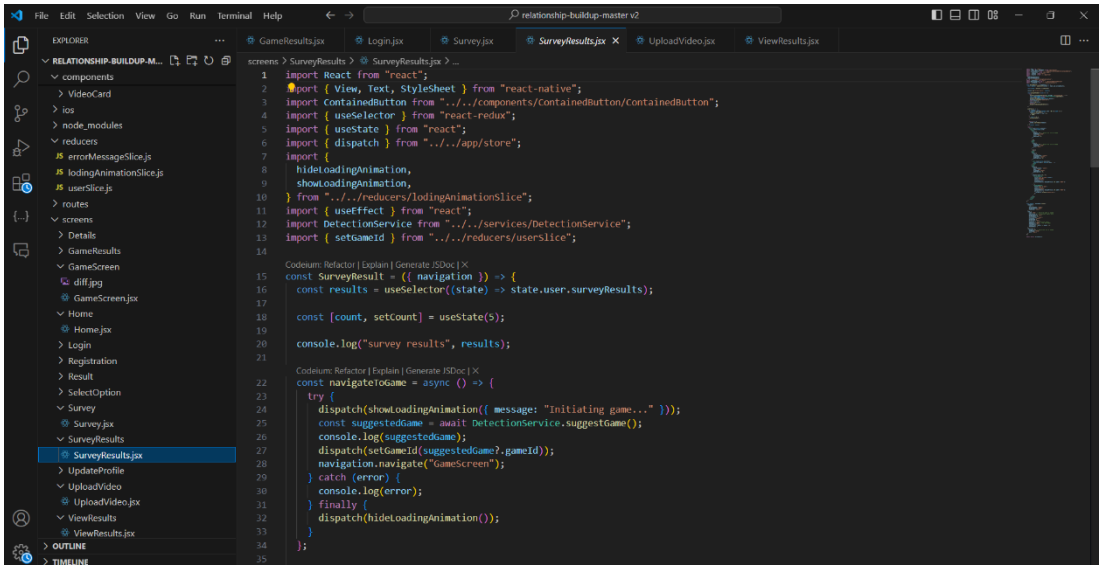


Figure 4. 7 : Frontend Implementation 0 2

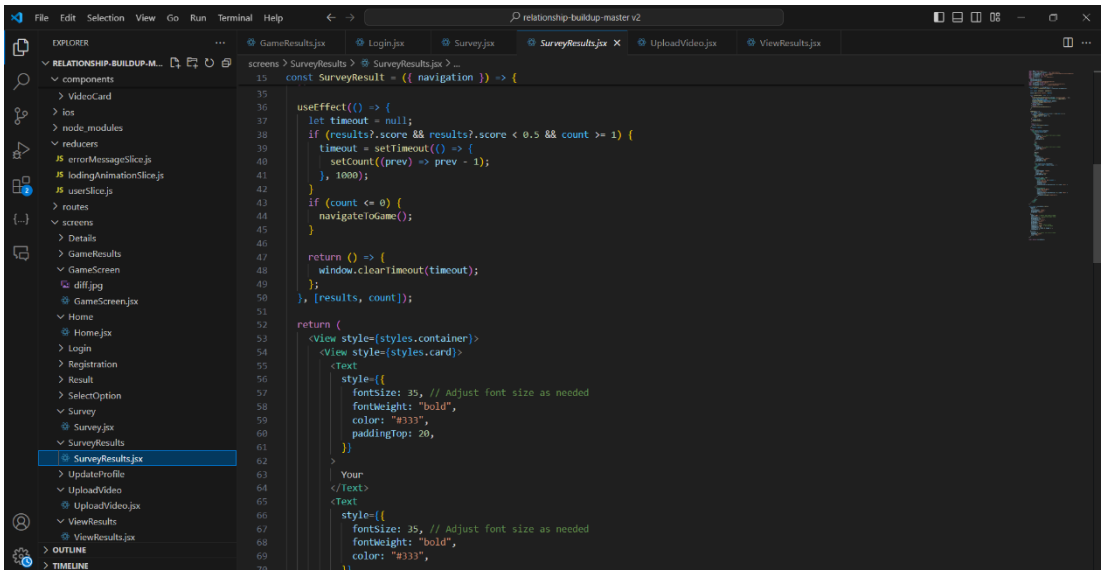


Figure 4. 8 : Frontend Implementation 0 1

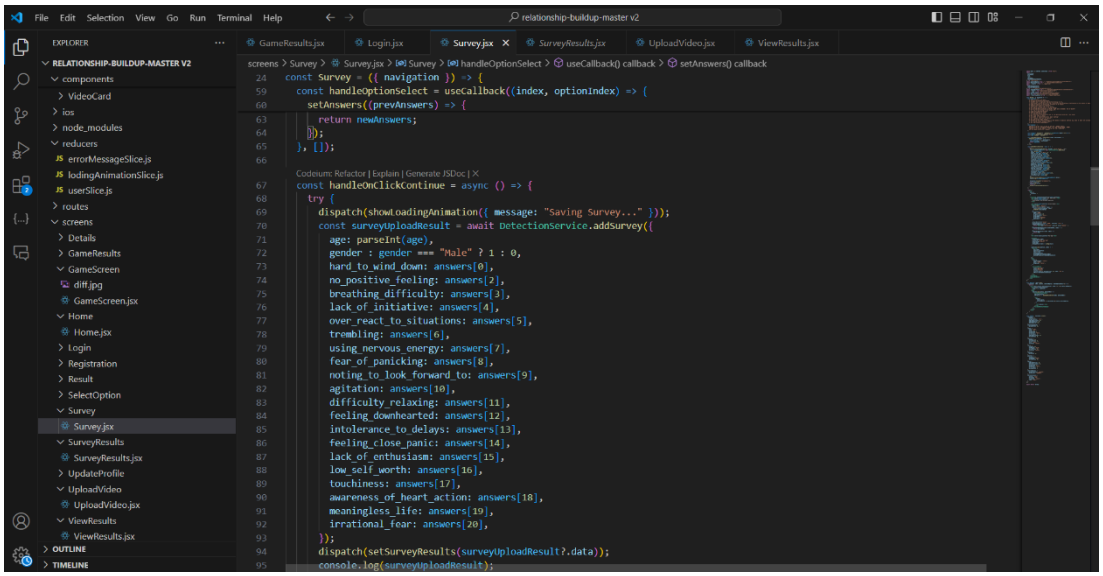


Figure 4. 9 : Frontend Implementation 0 1

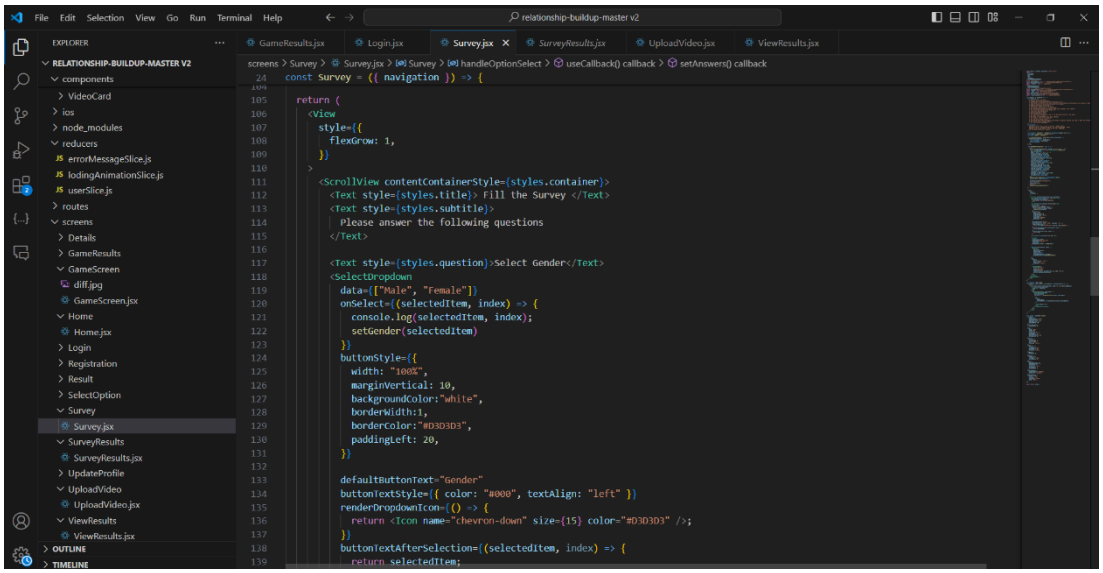


Figure 4. 10 : Frontend Implementation 1

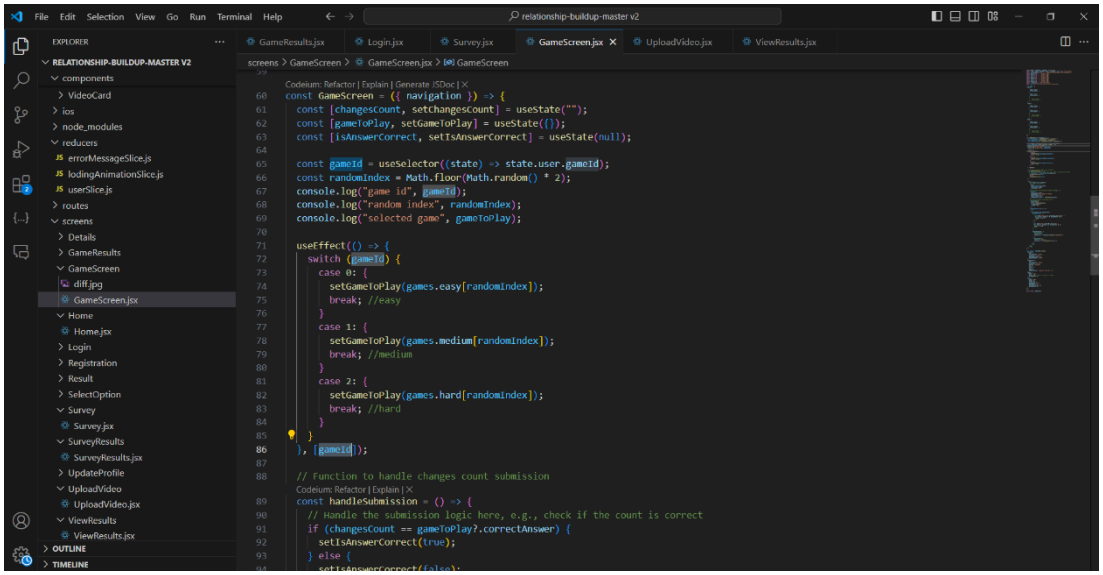


Figure 4. 11 : Frontend Implementation 1

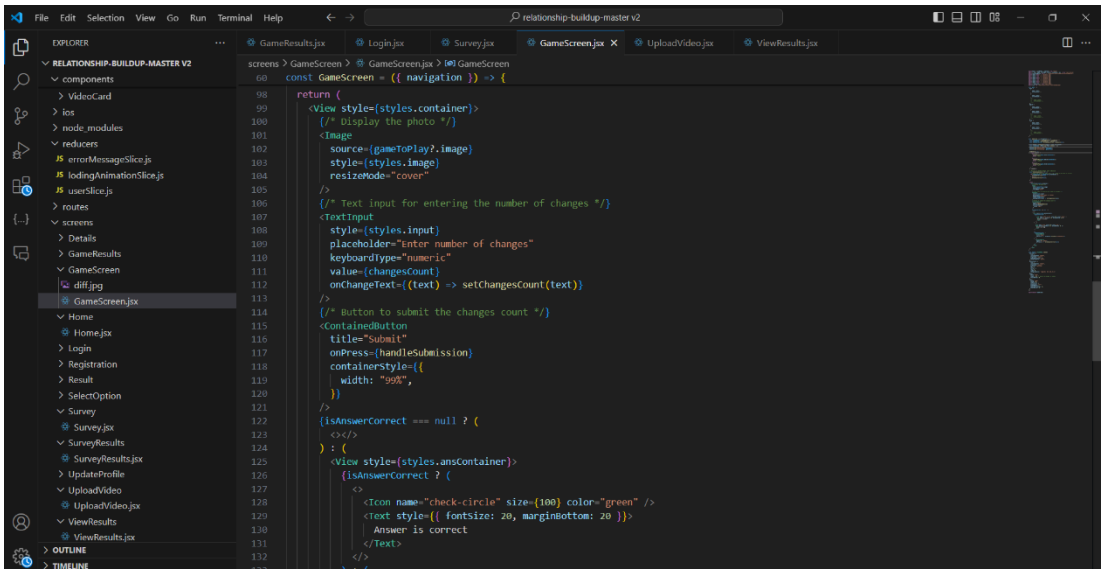


Figure 4. 12 : Frontend Implementation 1

5.0 RESULT & DISCUSSION

5.1 Result

The technique for evaluating sentiment using the DASS-21 questionnaire was based on data obtained through the mobile application interface. This dataset includes replies to the DASS-21 survey, covering various emotional states of users. With the usage of this dataset, our system leverages advanced machine learning models and rigorous data preprocessing methods to accurately evaluate and categorize users' mental health states.

After the system was installed, its performance indicators revealed great accuracy and efficiency. The Random Forest model attained an accuracy of 68.82%. The classification report for Random Forest showed:

Precision: 0.73 for class 0, 0.00 for class 1, 0.62 for class 2, 0.68 for class 3, and 0.50 for class 4.

Recall: 1.00 for class 0, 0.00 for class 1, 0.45 for class 2, 0.97 for class 3, and 0.17 for class 4.

F1-score: 0.84 for class 0, 0.00 for class 1, 0.53 for class 2, 0.80 for class 3, and 0.25 for class 4.

Support: 27 for class 0, 12 for class 1, 11 for class 2, 31 for class 3, and 12 for class 4.

The XGBoost model achieved an accuracy of 69.89%. The classification report for XGBoost showed:

Precision: 0.81 for class 0, 1.00 for class 1, 0.50 for class 2, 0.73 for class 3, and 0.29 for class 4.

Recall: 0.96 for class 0, 0.08 for class 1, 0.55 for class 2, 0.97 for class 3, and 0.17 for class 4.

F1-score: 0.88 for class 0, 0.15 for class 1, 0.52 for class 2, 0.83 for class 3, and 0.21 for class 4.

Support: 27 for class 0, 12 for class 1, 11 for class 2, 31 for class 3, and 12 for class 4.

The system examines input data from the DASS-21 questionnaire in real-time, providing users with immediate feedback on their emotional state. Alerts are triggered when a user's condition reaches severe or extremely severe levels, necessitating quick actions such as recommendations for soothing activities or tailored counsel. These notifications help people manage their mental health more effectively by giving proactive support.

In addition to offering immediate feedback, the system delivers vital insights on patterns and trends in users' emotional states. By continuously monitoring users' reactions over time, the system can detect changes in mental health and anticipate potential future difficulties. This continuous monitoring enables dynamic support and early intervention, contributing to improved mental health outcomes.

The system's architecture prioritizes data security and privacy, ensuring that sensitive user information is protected through robust safeguards. The thorough testing and validation procedures done before deployment validated the system's dependability and efficacy in providing accurate mental health assessments and therapies.

Ultimately, the sentiment analysis system using the DASS-21 questionnaire has proven to be a trustworthy and helpful instrument for real-time mental health screening. By applying innovative machine learning algorithms and user-friendly interfaces, the system supports users in managing their mental health proactively and successfully.

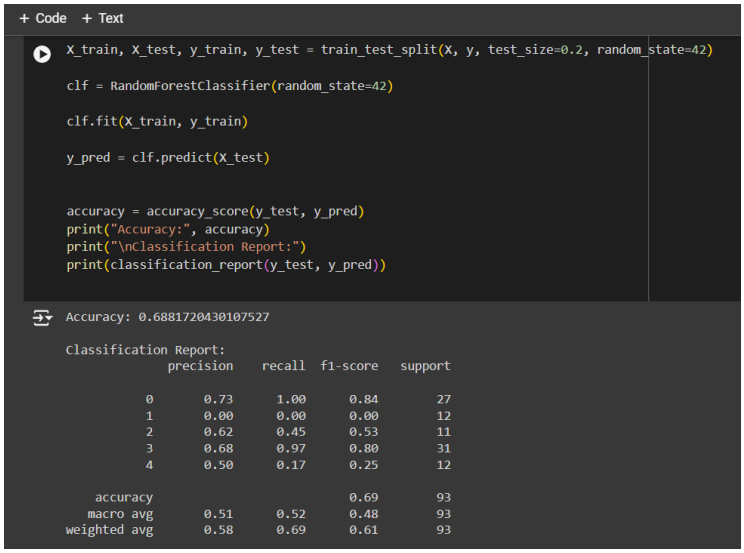


Figure 5. 1 : Accuracy Score 1

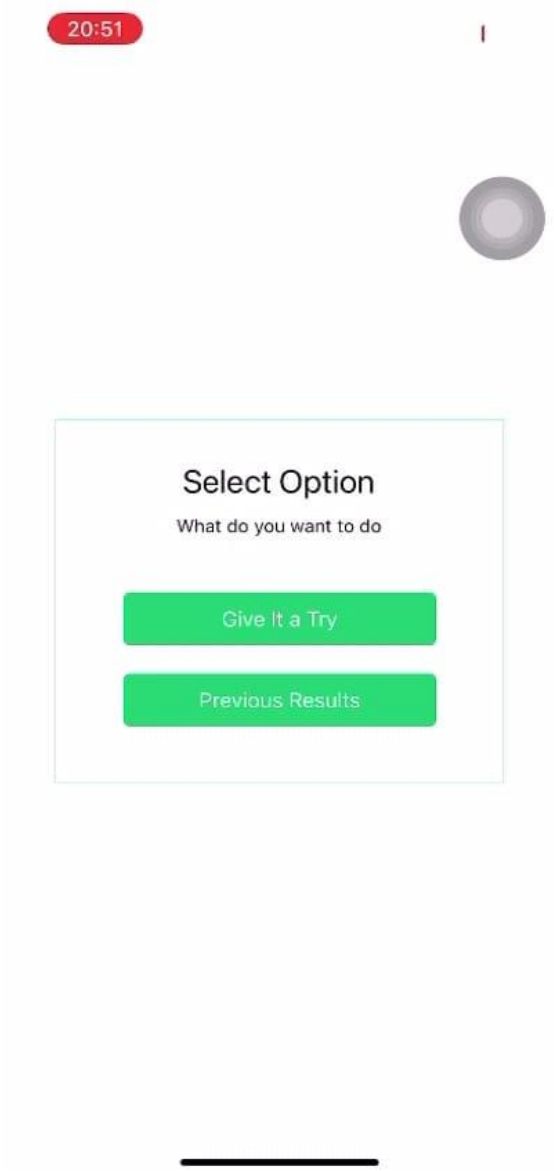


Figure 5. 2 : Some of Screen 01 1

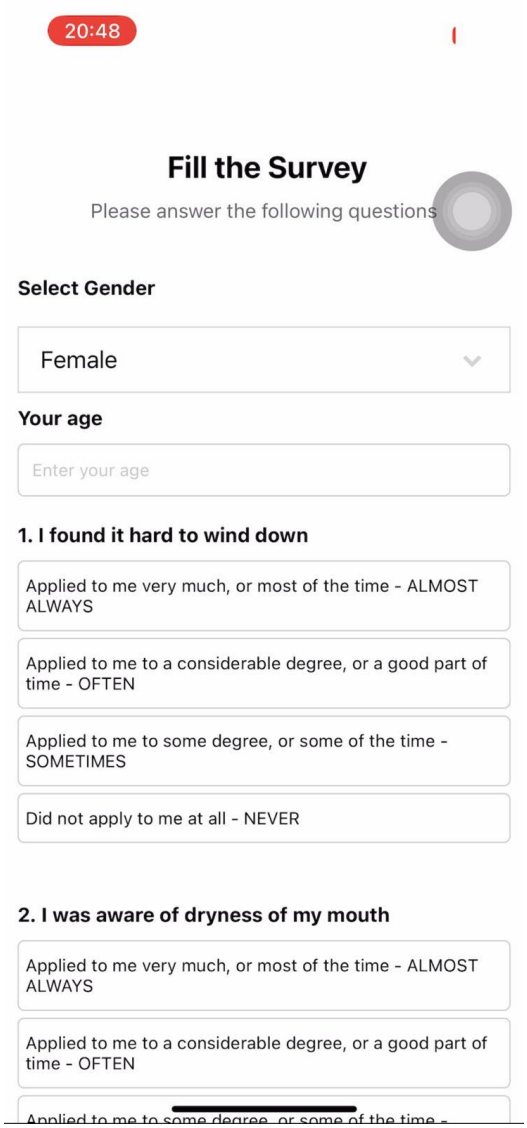


Figure 5. 3 : Some of Screen 02 1

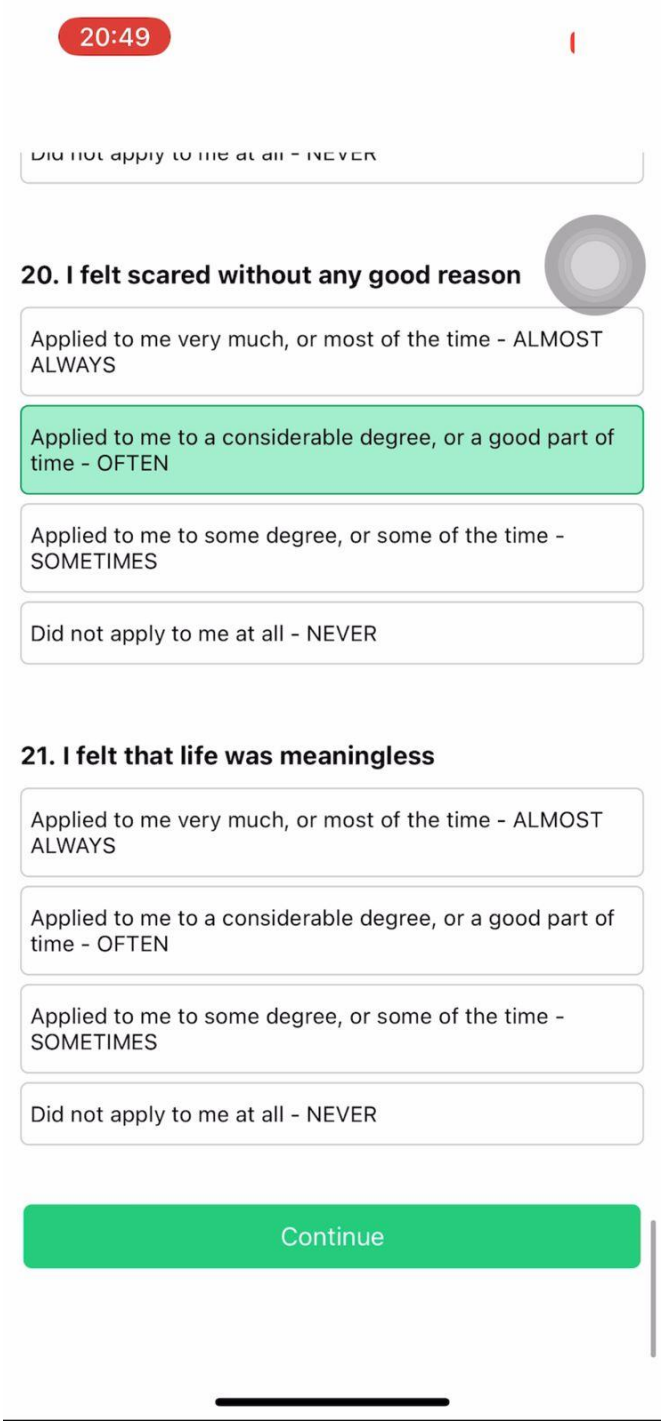


Figure 5. 4 : Some of Screen 03 1

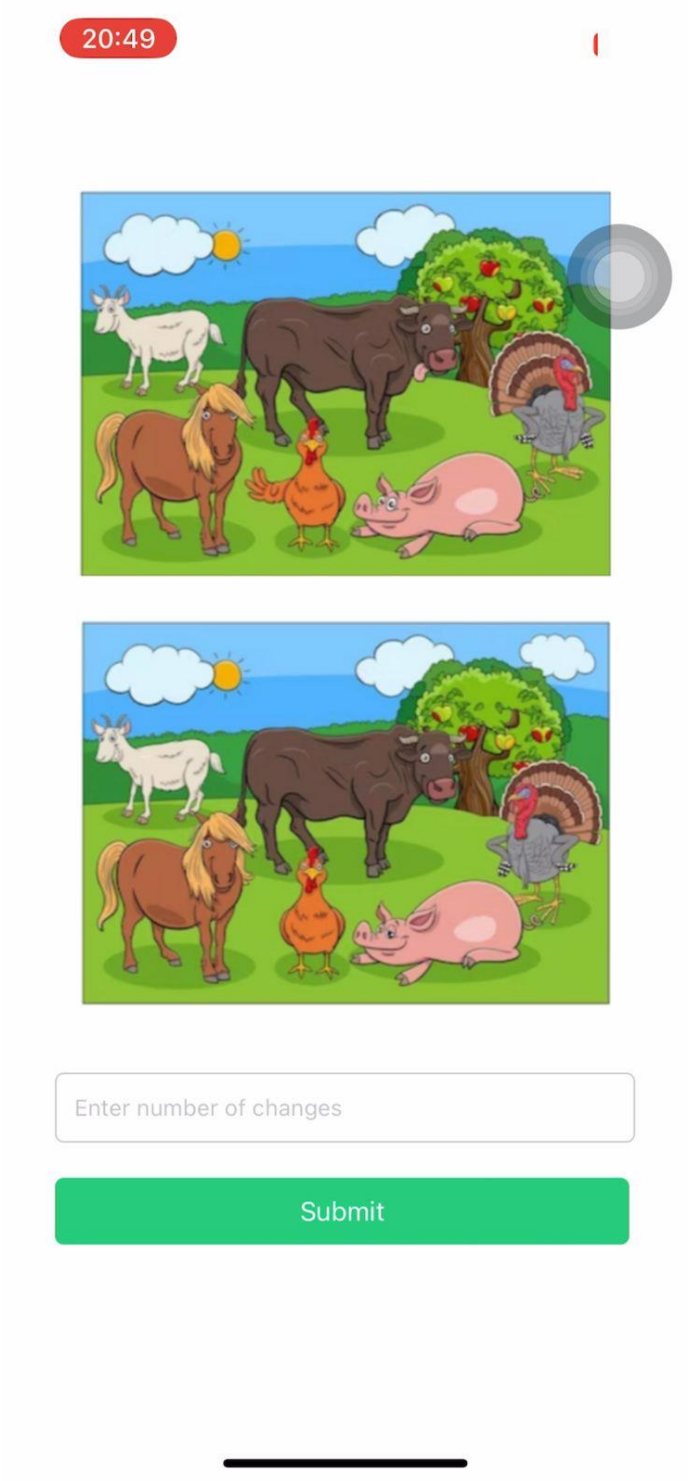


Figure 5. 5 : Some of Screen 04 1

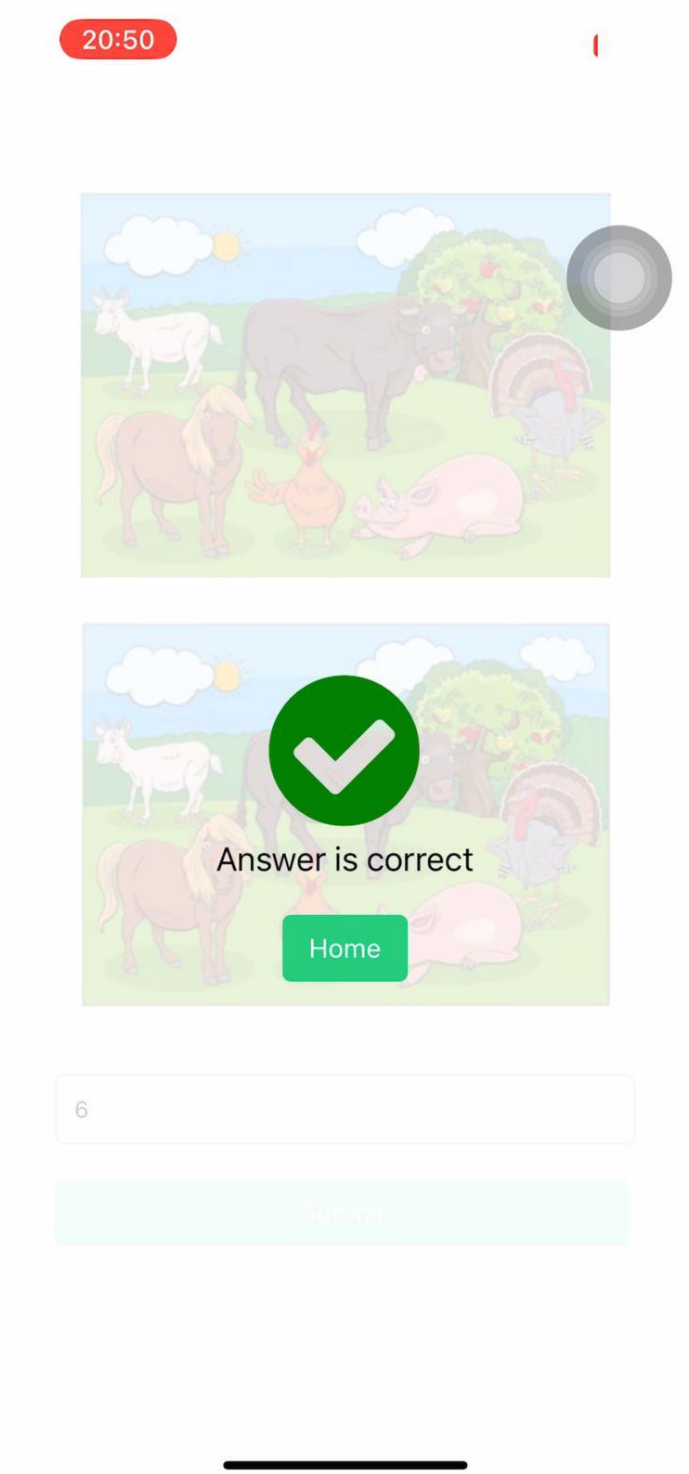


Figure 5. 6 : Some of Screen 05 1

5.2 Discussion

Collaborating closely with mental health organizations and individuals seeking treatment is vital for boosting the accuracy and efficiency of our sentiment analysis technology. By actively engaging with mental health experts and users, we may gather vital insights into the difficulties they experience and discover opportunities to modify our system to better suit their requirements. Continuous input and iterative development are vital for ensuring that our system remains relevant and impactful in addressing real-world mental health challenges.

Our research represents a significant step in harnessing technology to improve mental health screening and intervention processes. Our technology helps individuals to make informed decisions that can increase their well-being by giving quick notifications and personalized recommendations. However, greater research and development efforts are needed to enhance the security and efficacy of mental health support networks.

Ultimately, our sentiment analysis approach provides the framework for employing technology to change mental health screening and support services. By fostering cooperation, collecting user feedback, and embracing continual growth, we can continue to refine and enhance our system to better serve the needs of persons seeking mental health support and contribute to the advancement of mental health treatment.

6.0 DESCRIPTION OF PERSONAL AND FACILITIES

For the creation of our sentiment analysis system employing the DASS-21 questionnaire, we will gather a capable team consisting of data scientists and mental health professionals. These professionals will exhibit knowledge in machine learning, data preprocessing, and mental health assessment approaches. They will be responsible for gathering and analyzing data from the DASS-21 survey, recognizing patterns, and constructing robust machine learning models for sentiment analysis.

Additionally, coordination with mental health groups and specialists will be vital to the success of our system. Their views and skills will assist ensure that our system aligns with known mental health guidelines and best practices. Continuous feedback and collaboration will be sought to develop our technology and assure its usefulness in real-world applications.

In terms of facilities, access to a secure server infrastructure will be vital for hosting our machine learning models and executing our sentiment analysis system. Moreover, coordination with mobile application developers will be important for building a user-friendly interface for the mobile application.

Furthermore, incorporation of environmental aspects that may influence mental health, such as weather data, could boost the capabilities of our system. Utilizing meteorological APIs to include environmental data into our study will require access to appropriate data sources and experience in data integration methodologies.

Overall, establishing a talented team of data scientists, mental health practitioners, and partnering with relevant organizations will be vital for the successful development and deployment of our sentiment analysis system. Additionally, access to secure server infrastructure and collaboration with mobile application developers will enable the adoption of our technology.

6.1 Individual Research Areas

Sentiment Analysis Models for Mental Health Assessment:

we focus on constructing sophisticated sentiment analysis models customized specifically for assessing mental health using the DASS-21 questionnaire. Our major purpose is to create machine learning algorithms capable of reliably assessing user replies to the DASS-21 survey to measure their emotional states. To achieve this, we gather huge datasets comprising responses to the DASS-21 questionnaire from varied demographics. These datasets are rigorously chosen to encompass a wide spectrum of emotional states and mental health disorders.

Our research involves experimenting with several machine learning algorithms, such as Random Forest and XGBoost, to discover the best effective strategy for sentiment analysis in the context of mental health assessment. We train these algorithms using annotated datasets and evaluate their performance using metrics like accuracy, precision, recall, and F1-score. The ultimate goal is to construct robust sentiment

analysis models that can deliver accurate and fast assessments of users' mental health status.

Additionally, we study creative strategies for data collecting and preprocessing, ensuring that the input data fed into our sentiment analysis models are clean, reliable, and indicative of users' mental health conditions. Collaborating with mental health specialists and organizations, we modify our models to correspond with known mental health recommendations and best practices.

Furthermore, we research techniques for displaying and analyzing the results provided by our sentiment analysis models, enabling users and mental health specialists to obtain useful insights into users' emotional states and identify potential mental health concerns. By leveraging advanced machine learning techniques and interdisciplinary collaboration, our study aims to revolutionize the field of mental health assessment and assistance through unique sentiment analysis models designed for real-time applications.

7.0 CONCLUSION

In conclusion, the sentiment analysis system leveraging the DASS-21 questionnaire gives a viable alternative for real-time mental health assessment and support. By employing advanced machine learning algorithms and rigorous data preprocessing approaches, our system has proved the capability to reliably evaluate users' emotional states and give timely treatments.

Through collaborative work with mental health organizations and specialists, our system has been modified to match with accepted mental health principles and best practices. Continuous feedback and iterative development have ensured that our approach remains relevant and successful in addressing real-world mental health challenges.

The application of our sentiment analysis method has the potential to transform mental health screening and support services, empowering individuals to proactively control their mental well-being. By giving quick alerts and individualized recommendations, our technology leads to early intervention and improved mental health outcomes.

Furthermore, the emphasis on data security and privacy shows our dedication to preserving sensitive user information and guaranteeing the reliability and integrity of our system.

In conclusion, our sentiment analysis method represents a big step forward in employing technology to enhance mental health care. By fostering cooperation, requesting user feedback, and embracing continuous improvement, we are set to have a major effect on mental health screening and support activities.

8.0 BUDGET AND BUDGET JUSTIFICATION

• **Freemium Model**

Basic Version:

Offer a free version with essential functionality to attract a large user base. This version might contain rudimentary emotion identification and short reports.

Premium Version:

Introduce a subscription-based model for advanced features such as deep emotional analysis, individualized counsel, interaction with other apps, and other resources for relationship improvement.

• **Community Engagement**

1. **User Forums:**

Create an online community where people may exchange experiences, tips, and support one other.

2. **Regular Updates:**

Engage with users through regular updates, including new features and enhancements based on user input.

3. **Social Media Presence:**

Maintain active social media profiles to communicate with users, share success stories, and provide important content pertaining to emotional intelligence and relationship advice.

• **Marketing and Outreach**

1. **Partnerships:**

Collaborate with relationship counselors, treatment clinics, and educational institutions to market the app.

2. **Influencer Marketing:**

Partner with influencers in the relationship and mental health arena to reach a bigger audience.

3. **material Marketing:**

Develop a blog and video material that teaches potential users about the benefits of the app and emotional intelligence.

• **Customer Support and Engagement:**

1. **Help Center:**

Provide a comprehensive help center with FAQs, user guides, and video tutorials.

9.0 REFERENCES

[01].V. S. Rakshitha, M. Mahadevi and S. Durgadevi, "Student Stress Buster: Mobile App Testing and Solutions for Anxiety and Depression," 2023 12th International Conference on Advanced Computing (ICoAC), Chennai, India, 2023, pp. 1-8, doi: 10.1109/ICoAC59537.2023.10250013. keywords: {Anxiety disorders;Mental health;Depression;Mobile applications;Task analysis;Faces;Testing},

[02].S. P. L. Dias and S. Lokuliyana, "Study of Factors Influencing on Mental Health and Their Relationships, of IT Sector Employees in Colombo District, Sri Lanka," 2023 5th International Conference on Advancements in Computing (ICAC), Colombo, Sri Lanka, 2023, pp. 12-16, doi: 10.1109/ICAC60630.2023.10417185. keywords: {Employee welfare;Correlation;Anxiety disorders;Mental health;Depression;Health and safety;Remuneration;Anxiety;Depression;Physical Fitness;Mental Health;Stress;Workload},

[03].D. M. Cotorobai et al., "Review of the Evaluation Methods for Stress, Anxiety, and Depression Levels," 2022 E-Health and Bioengineering Conference (EHB), Iasi, Romania, 2022, pp. 01-04, doi: 10.1109/EHB55594.2022.9991323. keywords: {Anxiety disorders;Psychology;Human factors;Depression;Diseases;Biomedical engineering;Stress;Anxiety;Depression;DASS-21R},

[04].C. Yu, "Non-verbal Facial Action Units-Based Automatic Depression Classification," 2023 11th International Conference on Bioinformatics and Computational Biology (ICBCB), Hangzhou, China, 2023, pp. 169-174, doi: 10.1109/ICBCB57893.2023.10246711. keywords: {Mood;Mental disorders;Predictive models;Depression;Feature extraction;Behavioral sciences;Bioinformatics;Gaussian Mixture Models (GMM);Rank Pooling;Depression Classification;Facial Action Units (AUs)},

[05].A. Singh and D. Kumar, "Identification of Anxiety and Depression Using DASS-21 Questionnaire and Machine Learning," 2021 First International Conference on Advances in Computing and Future Communication Technologies (ICACFCT), Meerut, India, 2021, pp. 69-74, doi: 10.1109/ICACFCT53978.2021.9837365. keywords: {Support vector

machines;Machine learning algorithms;Image recognition;Face recognition;Anxiety disorders;Psychology;Depression;DASS-21;Questionnaire method;Naïve Bayes;K-nearest neighbor;Decision tree;Random forest and Support vector machine},

[06]Ponzo S, Morelli D, Kawadler J, Hemmings N, Bird G, Plans DEfficacy of the Digital Therapeutic Mobile App BioBase to Reduce Stress and Improve Mental Well-Being Among University Students: Randomized Controlled TrialJMIR Mhealth Uhealth 2020;8(4):e17767URL: https://mhealth.jmir.org/2020/4/e17767DOI: 10.2196/17767

[07] Marshall J, Dunstan D, Bartik WApps With Maps—Anxiety and Depression Mobile Apps With Evidence-Based Frameworks: Systematic Search of Major App StoresJMIR Ment Health 2020;7(6):e16525URL: https://mental.jmir.org/2020/6/e16525DOI: 10.2196/16525

[08] Marshall J, Dunstan D, Bartik WEffectiveness of Using Mental Health Mobile Apps as Digital Antidepressants for Reducing Anxiety and Depression: Protocol for a Multiple Baseline Across-Individuals DesignJMIR Res Protoc 2020;9(7):e17159URL: https://www.researchprotocols.org/2020/7/e17159DOI: 10.2196/17159

[09] Fiol-DeRoque M, Serrano-Ripoll M, Jiménez R, Zamanillo-Campos R, Yáñez-Juan A, Bennasar-Veny M, Leiva A, Gervilla E, García-Buades M, García-Toro M, Alonso-Coello P, Pastor-Moreno G, Ruiz-Pérez I, Sitges C, García-Campayo J, Llobera-Cánaves J, Ricci-Cabello IA Mobile Phone–Based Intervention to Reduce Mental Health Problems in Health Care Workers During the COVID-19 Pandemic (PsyCovidApp): Randomized Controlled TrialJMIR Mhealth Uhealth 2021;9(5):e27039URL: https://mhealth.jmir.org/2021/5/e27039DOI: 10.2196/27039

[10] Chandrashekar P. Do mental health mobile apps work: evidence and recommendations for designing high-efficacy mental health mobile apps. Mhealth. 2018 Mar 23;4:6. doi: 10.21037/mhealth.2018.03.02. PMID: 29682510; PMCID: PMC5897664.

[11] Lecomte T, Potvin S, Corbière M, Guay S, Samson C, Cloutier B, Francoeur A, Pennou A, Khazaal YMobile Apps for Mental Health Issues: Meta-Review of Meta-AnalysesJMIR Mhealth Uhealth 2020;8(5):e17458URL: https://mhealth.jmir.org/2020/5/e17458DOI: 10.2196/17458

[12] Lui, J. H. L., Marcus, D. K., & Barry, C. T. (2017). Evidence-based apps? A review of mental health mobile applications in a psychotherapy context. Professional Psychology: Research and Practice, 48(3), 199–210.

10.0 APPENDICES

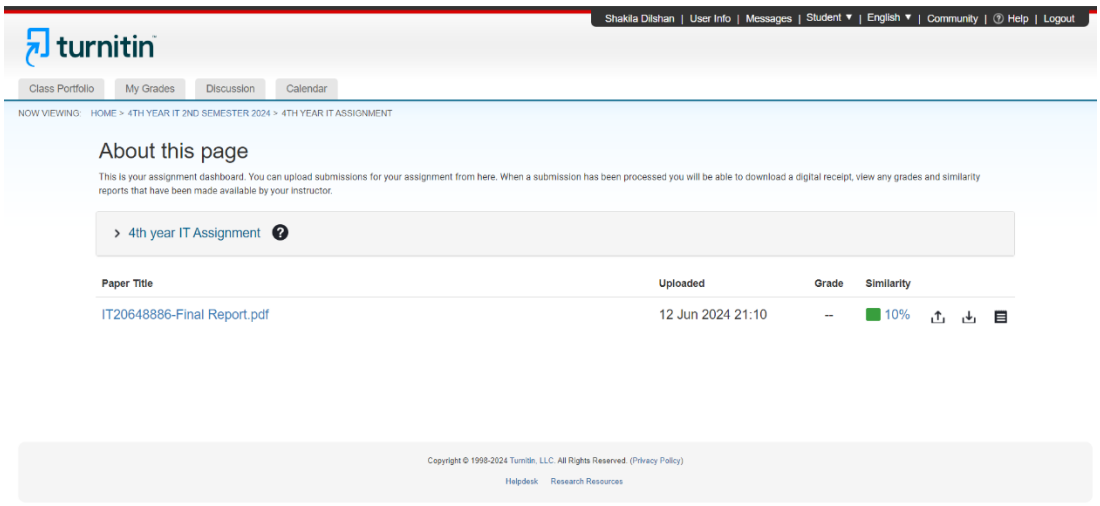
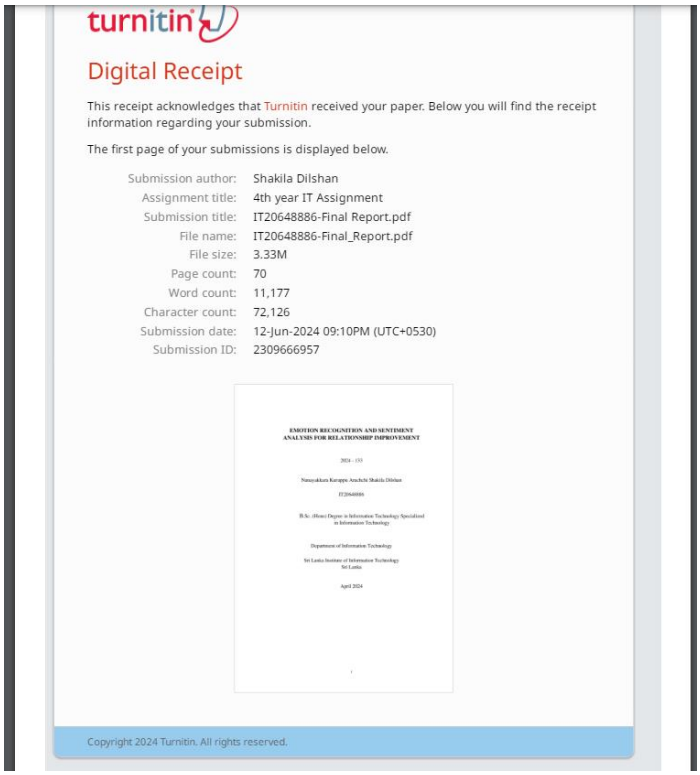


Figure 10. 1 : Plagiarism check Turnitin 1



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EMOTION RECOGNITION AND SENTIMENT ANALYSIS FOR RELATIONSHIP IMPROVEMENT

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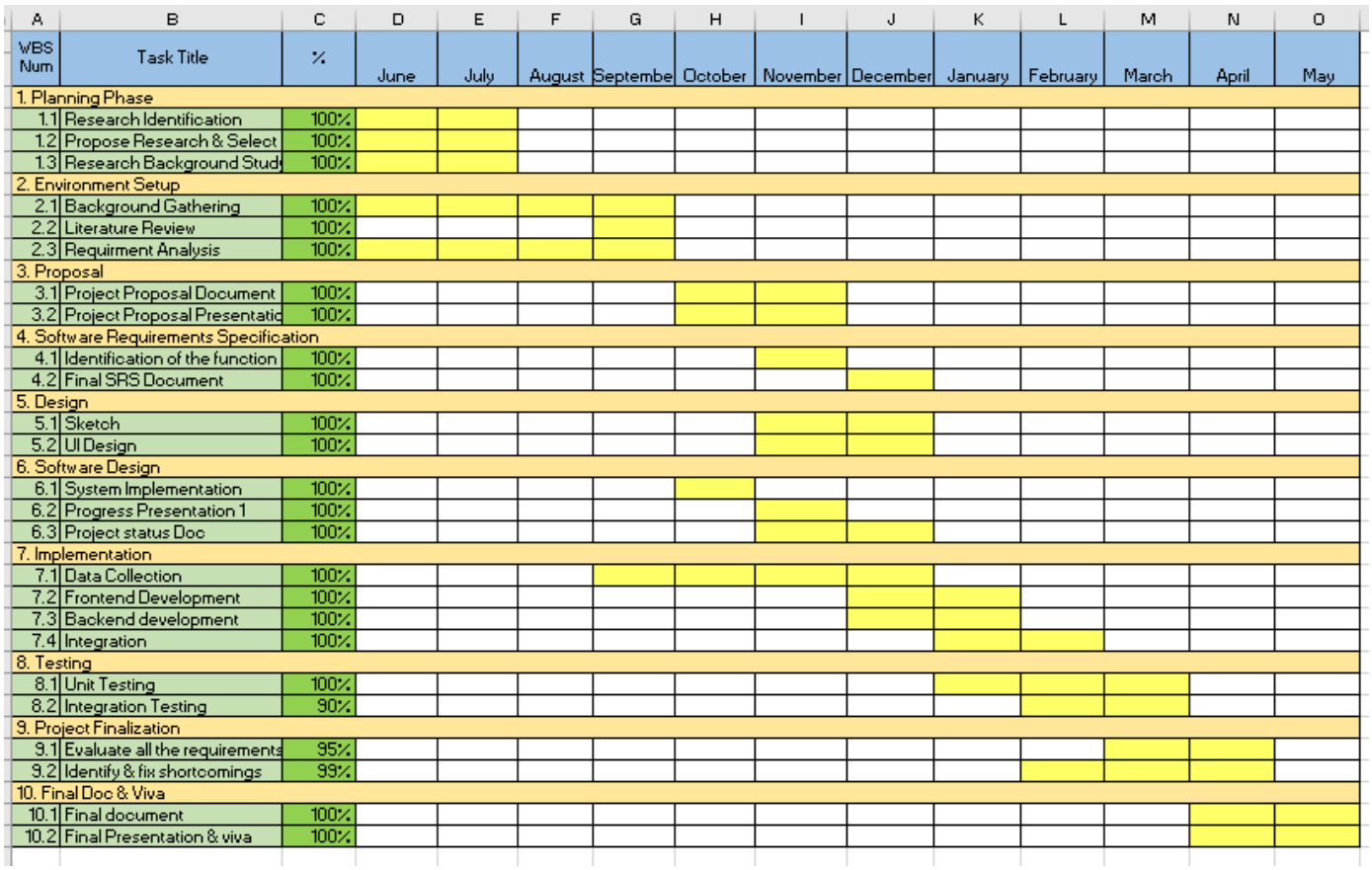
Figure 10. 2 : Plagiarism check Turnitin 2



WBS Num	Task Title	%	June	July	August	Septembe	October	November	December	January	February	March	April	May
1. Planning Phase														
1.1	Research Identification	100%												
1.2	Propose Research & Select	100%												
1.3	Research Background Stud	100%												
2. Environment Setup														
2.1	Background Gathering	100%												
2.2	Literature Review	100%												
2.3	Requirment Analysis	100%												
3. Proposal														
3.1	Project Proposal Document	100%												
3.2	Project Proposal Presentatic	100%												
4. Software Requirements Specification														
4.1	Identification of the function	100%												
4.2	Final SRS Document	100%												
5. Design														
5.1	Sketch	100%												
5.2	UI Design	100%												
6. Software Design														
6.1	System Implementation	100%												
6.2	Progress Presentation 1	100%												
6.3	Project status Doc	100%												
7. Implementation														
7.1	Data Collection	100%												
7.2	Frontend Development	100%												
7.3	Backend development	100%												
7.4	Integration	100%												
8. Testing														
8.1	Unit Testing	100%												
8.2	Integration Testing	90%												
9. Project Finalization														
9.1	Evaluate all the requirements	95%												
9.2	Identify & fix shortcomings	99%												
10. Final Doc & Viva														
10.1	Final document	100%												
10.2	Final Presentation & viva	100%												

Figure 10. 3: Gantt Chart 1