

AI AND AR-ENHANCED EMOTION RECOGNITION AND SENTIMENT ANALYSIS APP FOR RELATIONSHIP IMPROVEMENT

TMP-2023-24-133

Project Proposal Report

Ayesh Isuranga Bataduwaarachchi – IT20647414

Supervisor – Dr. Dilshan de Silva.

B.Sc. (Hons) Degree in Information Technology specializing in Information
Technology.

Department of Computer Science and Software Engineering

Sri Lanka Institute of Information Technology

Sri Lanka

August 2023

AI AND AR-ENHANCED EMOTION RECOGNITION AND SENTIMENT ANALYSIS APP FOR RELATIONSHIP IMPROVEMENT

TMP-2023-24-133

Project Proposal Report

B.Sc. (Hons) Degree in Information Technology specializing in Information
Technology.

Department of Computer Science and Software Engineering


Sri Lanka Institute of Information Technology

Sri Lanka

August 2023

DECLARATION

I declare that this is my own work and this proposal does not incorporate without acknowledgment any material previously submitted for a degree or diploma in any other university or Institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgment is made in the text.

Name	Student ID	Signature
Bataduwaarachchi A.I	IT20647414	

Signature of the Supervisor
(Dr. Dilshan de Silva)

Date

.....

.....

Signature of the Co-Supervisor
(Ms. Piyumika Samarasekara)

Date

.....

.....

ABSTRACT

Human relationships are one of the most important elements for the existence of people as well as the existence of the world. The stronger these human relationships are, the more capable anyone can be of social happiness in the world. These human relationships affect each other's happiness, health, and well-being. Also, these relations will help the safety of mankind.

Several human relationships have been identified in the world.

- Family relationships
- Friendship relationships
- Romantic relationships
- Workplace relationships
- Community relations

However, in maintaining any relationship, one has to face various challenges. Especially when starting a new relationship there are several problems to face. If you are afraid of relationships and are an introvert, the problem goes further. Because it is not so easy for such a person to build a proper relationship in the real world. Also, even if you are already in a relationship, sometimes you have to face various difficulties in making decisions. Many relationships are damaged, especially by not being able to communicate properly. It is a very difficult task to maintain a relationship while reducing such situations as much as possible without causing hurt to the other person. For this reason, we are creating a mobile software application with the aim of reducing such relationship breakdowns in the future. The purpose of the research is to identify the feelings and ideas of the person using the application and create a AR character that acts accordingly and thereby prepares the appropriate environment for the relevant person to start such a relationship in the AR environment before starting a relationship in the real world. Then, based on those experiences, one gets the ability to initiate and maintain meaningful relationships in the real world. The advantage of this is the ability to successfully maintain a relationship without hurting anyone's feelings or regrets. Because no one's feelings are disturbed in the AR environment, it is possible to practice the qualities needed to maintain a good relationship by using it several times. Here it is possible to create new characters in the AR environment according to their needs. Here, this AR character is powered by AI technology and the aim is to give better feedback to the user

TABLE OF CONTENTS

Table of Contents

DECLARATION	3
ABSTRACT.....	4
TABLE OF CONTENTS.....	5
LIST OF FIGURES.....	Error! Bookmark not defined.
LIST OF TABLES.....	Error! Bookmark not defined.
LIST OF ABBREVIATIONS	6
1 INTRODUCTION.....	7
1.1 Background & Literature Survey	7
1.2 Research Gap	8
1.3 Research Problem	10
2 OBJECTIVES	12
2.1 Main Objectives	12
2.2 Specific Objectives	12
3 METHODOLOGY	14
3.1 System Architecture.....	14
3.1.1 Software solution	16
• Requirement Gathering and Analysis	16
• Feasibility study (Planning)	17
• Design.....	18
3.1.2 Commercialization	21
4 PROJECT REQUIREMENTS	22
4.1 Functional requirements.....	22
4.2 Non-Functional requirements.....	22
4.3 System requirements.....	23
4.4 User requirements	23
4.5 Wireframe.....	24
5 GANTT CHART	25
5.1 Work Breakdown Structure (WBS)	25
6 BUDGET AND BUDGET JUSTIFICATION	26

LIST OF ABBREVIATIONS

Abbreviation	Description
AI	Artificial Intelligence
AR	Augmented Reality
WBS	Work Breakdown Structure
CDN	Content Delivery Networks
NLP	Natural Language Processing
NER	Named Entity Recognition

1 INTRODUCTION

1.1 Background & Literature Survey

Humans maintain relationships with each other socially for survival and reproduction [4]. The quality of human relationships is directly important for individual well-being and social harmony. But for people who are afraid to start and nurture relationships, and for people who are afraid of rejection, building good relationships will not be easy. However, it is our effort to provide a good opportunity to such people by using technology as well as to bring benefits to anyone who is involved in human relations.

Augmented reality (AR) technology has gained considerable attention nowadays. In particular, the creation of AR systems powered by the integration of AI and the application of those techniques has been seen recently [6]. This is because anyone can practice in an AR environment without harm. These systems are used to create safety in highway work zones [7], for learning activities in schools [8], to practice airplane skills, and to practice surgery in hospitals [9] in some such cases. At present, this VR environment is used for many fields and it has been able to overcome many obstacles. Here we go beyond the traditional method and use this technology to protect, improve, and initiate new relationships.

In any relationship, certain problems and issues can arise. For example, it is common to have problems in a relationship. But we need to make sure that they are resolved and that the problems do not reoccur. But there is no successful method that we can take to eliminate and reduce those problems. Differences in personality levels of individuals and cultural levels, religions, lack of commitment, logical inconsistency, avoidance styles, etc.[5] must be considered here. In the fast-paced world, it is difficult to take the time to even think about these matters and carelessness can cause these relationships to fall apart very quickly. Also, research has found that single teens with past dating experience show more depressive symptoms than teens who are currently dating or have never dated. It can provide insight into the health breakdown caused by relationship breakdown.

Personality disorders have been identified as a major problem for a good relationship. The reactions of people high in these traits in such relationships have a strong impact on those

relationships. Such situations can occur especially due to the social change from childhood, cultural influences as well as depending on the living environment. But in moving forward with the world, we have to interact with each other and we must be able to make those connections non-toxic [5]. However, many people are afraid of relationships because they can't handle rejection from others and are too shy to talk to another person. Also, another group of people see the breakdown of relationships due to their unbounded love for each other. It is because of lack of proper interaction and good communication.

Here we create the application so that it can be used by those who have or do not have such personality disorders. First, information is taken as input from the user and a character is created in the AR environment. After that, the user will be able to learn how to start a relationship with that AR character. Here are opportunities to learn how to improve the qualities a relationship needs, and how to use those qualities. Then he himself can get an assessment of the situation and no one gets hurt. As this can be done any time through the app, this gives the user the opportunity to gain mental awareness through frequent practice. At the end of the training, the user is provided with training evaluation reports through the application and thus can gain further insight.

According to the research background discussed above, it has been possible to provide a modern solution to several reasons for the breakdown of a relationship. This will help the user to get the desired self-confidence through this application. Finally, users are enabled to start and maintain a more flexible and optimal relationship in the real world using the trained attributes.





















1.2 Research Gap

According to the above background and literature survey, it seems that maintaining a good interpersonal relationship is important to maintain social well-being as well as human health. It helps to reduce the problems in life as well as to be able to live well in the society and maintain mental happiness. In the busy world, it is not possible to dedicate time for relationships, and in an age where the world is developing technologically, the need to use technology to build relationships is shown here.

Here, Research “A” using artificial intelligence, deep learning methods can be used to prevent the effects on health and mental health. VR/AR/MR are used together as a tool to maintain astronaut mental health and well-being uniformly and create an appropriate environment for it. Their aim here is to prevent long-term psychological effects on astronauts' health. Here you can practice in an AR environment using AR technology, [1] but there is no mobile application that can be used frequently. Also, there is no contribution of AI technology to power the VR character.

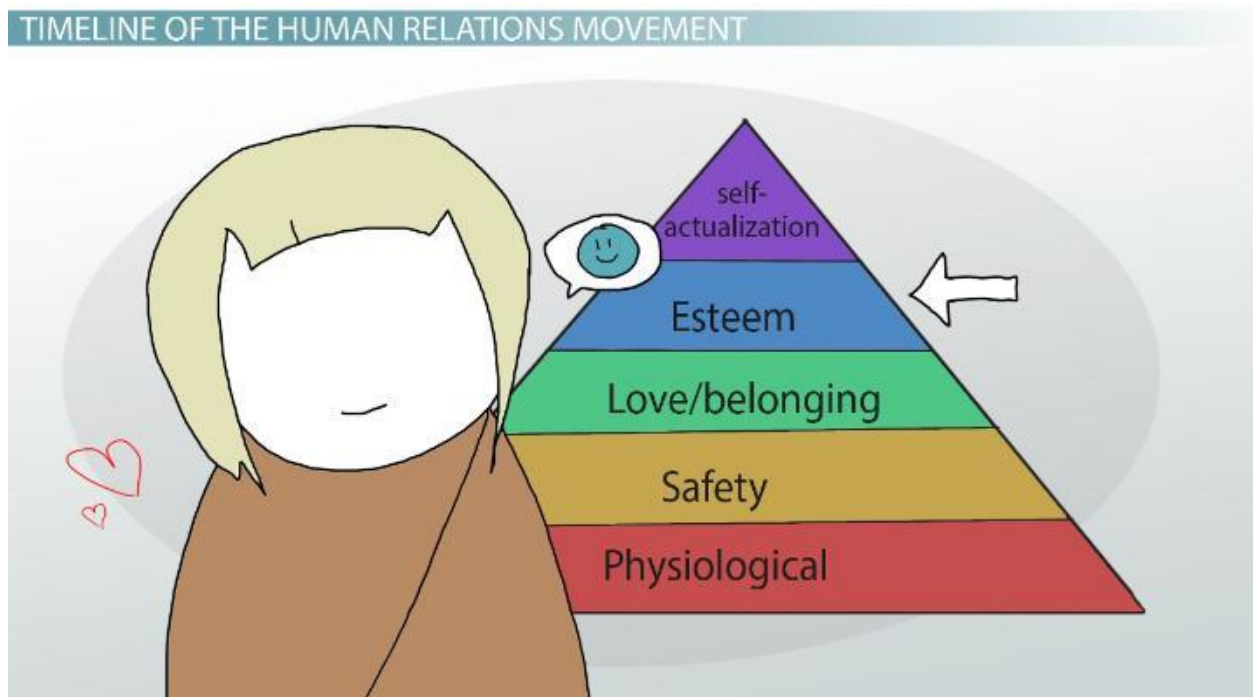
Here, customer relationships are built using AR technology. Here it has been shown that AR technology can be used to maintain these relationships well. [2] But here it is not possible to identify the feelings and opinions of the user.

An emotion recognition method using algorithms based on artificial intelligence and deep learning is shown here. Here, emotion recognition is done through a facial image, speech and non-verbal communication. [3] But here there is no telecommunication input or any other input for this process. And here only a process of emotional identification takes place.

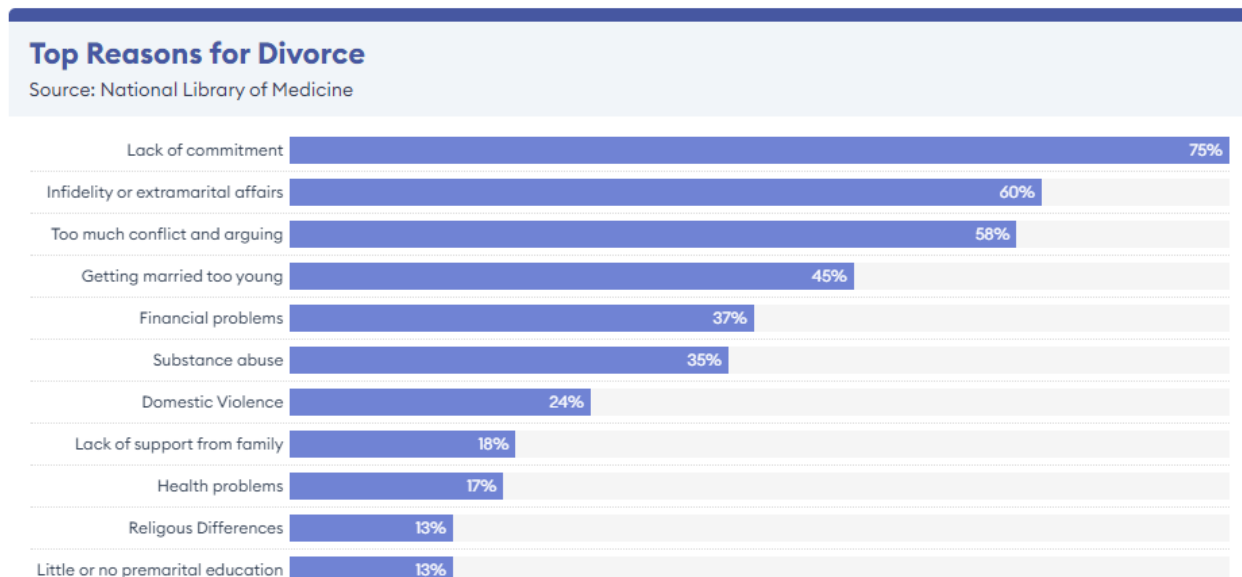
Reference	Have a mobile app	Identifying the user's thoughts and feelings	Being able to practice in an AR environment.	Provide a report on the training at the end	Secure storage of training data
Research A					
Research B					
Research C					
Proposed System					

1.3 Research Problem

With the beginning of human history, the building of human relationships began. As a result of those relationships, the social environment we live in today has emerged. These human relationships have several parts and the responsibilities to be performed are different according to each relationship. These relationships should be maintained at a productive level and thus social harmony, mental freedom, and the existence of the human race will be confirmed. Maintaining relationships in a busy society in the new world has to some extent faced a crisis. This is due to the fact that the time that can be allocated for relationships is becoming limited in the competitive world. Also, maintaining these relationships is somewhat problematic for people who are afraid of social relationships and are less inclined. For example, maintaining healthy romantic relationships requires skills. But many may lack such skills. In many cases, there is a chance that such relationships will fail due to reasons such as reacting in a reactive manner, not understanding the other



On the other hand, certain personality traits can cause the breakdown of healthy intimate relationships. In globalization and competitive lifestyles, people's interpersonal skills are weak. For this reason, aggressive relationships are less likely to occur in relationships, which can directly lead to relationship dissatisfaction. If aggression is not handled properly in an interspecies relationship, it can create a wide range of problems and there is a high chance of suffering from distressing tendencies. According to Google 70% of straight couples break up in the first year of their relationship. Once they reach the five-year milestone, the breakup rate drops to 20%. Such situations should not be allowed to go on for long and should be given an optimal answer at the initial stages and protect the relationship. Also, if people of different personality levels are not given the environment to maintain and protect their relationships effectively, they may even take pleasure in the suffering of others



Our aim here is to control the current human relationship breakdown using a mobile application. By taking users' opinions and studying them through AI technology, they can use the app to suggest them to start and maintain a productive and satisfying relationship. Here, if a person is afraid of relationships but willing to start a relationship, as well as a person who is already maintaining a relationship but does not have proper understanding, an AR environment will be created to improve the skills required to maintain a relationship properly. This helps to control the quick breakup of relationships seen today.

2 OBJECTIVES

2.1 Main Objectives

The grant goal of this process is to create a mobile application that can practice coping skills as a flexible new approach for people who are eager to start new relationships and those who struggle with different personalities and fear relationships. The aim here is to build and maintain a relationship without causing hurt or regret to the other person. By taking the user's feelings and ideas as well as talking things as inputs and analyzing them through AI technology, the environment that the user wants to start a relationship with is prepared and good training can be obtained in this AR environment.

2.2 Specific Objectives

There are 3 grant levels to complete. By completing the 3 levels, it is possible to achieve the above-mentioned grant objective.

Identification User status.

- Getting an idea about the user's current status and relationship status is done here. Here the user has to answer some questions. It enables one to get an idea about him or her. Then, using those details, a comprehensive analysis of the user is done. Use AI technology for that and it can provide more accurate assumptions.

Allowing to enter the AR environment.

- Here, the user is given the opportunity to create a character that suits him in the AR environment and practice the basic things needed for a relationship with that character. The AR character uses the information obtained from the previous situation to create the environment necessary for the user to make correct decisions, express ideas, and improve communication.

Provide status reports on training.

- The status reports obtained about the user's behavior in the AR environment are received here and the AI provides the best report and its important points to the user here. Based on those facts and practice, the user can get a better understanding.

3 METHODOLOGY

The proposed AI-powered Virtual Reality (AR) character system incorporates advanced technologies and psychological intelligence to create a structured system. First, information about the relevant relationship is obtained from the user as input, and based on that information, the AR character and AR environment are prepared. The user is then allowed to practice and finally, a review of the progress is provided to the user at the end.

3.1 System Architecture

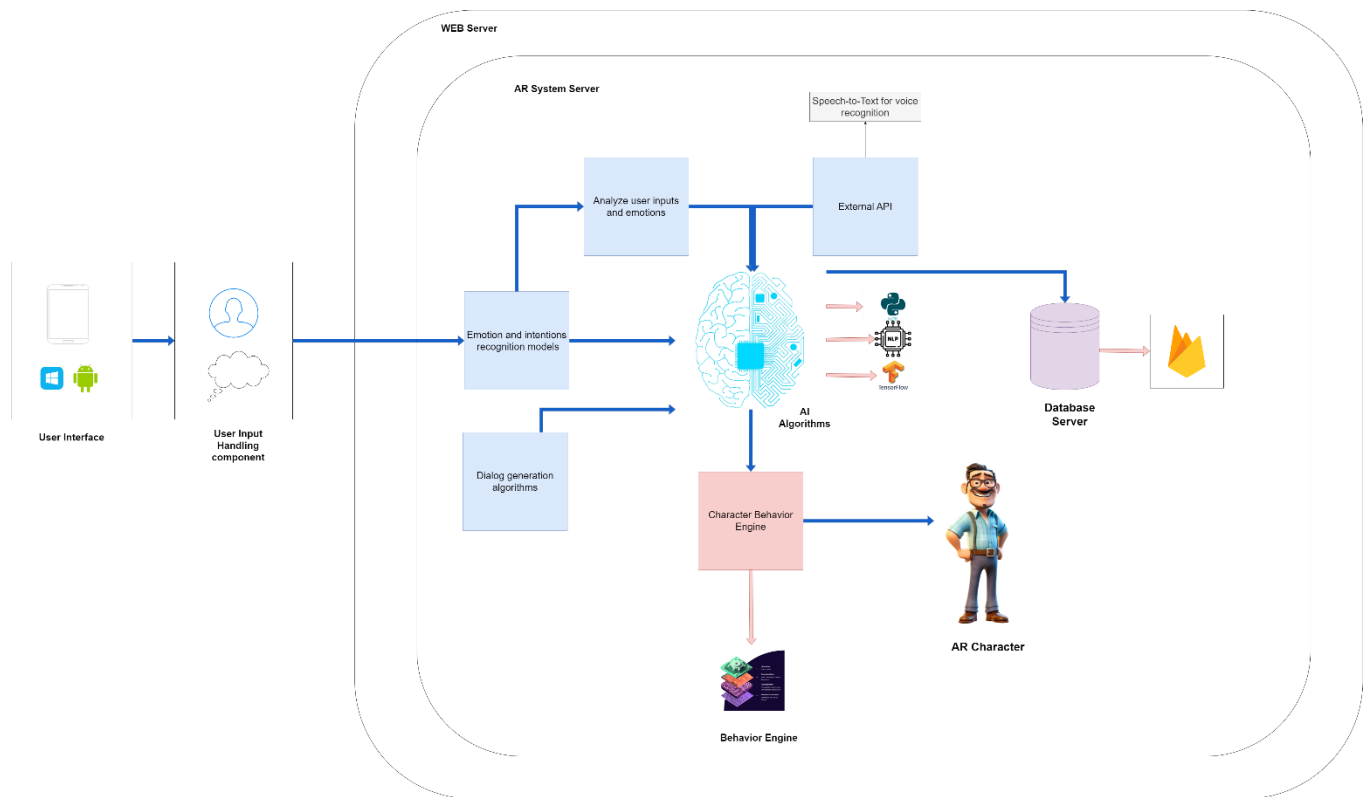


Figure 3: High-level Architecture diagram

Figure 3.1 shows the high-level architectural diagram of how the AR character powered by AI technology works in the proposed segment.

Here, the AR character is assigned under 3 grant scenarios. First of all, data is obtained from the user and an understanding of the VR character to be created based on that data is obtained.

There, using the user's emotion data and opinions, an update on the current state of the relationship is created. For this, user inputs and emotions are analyzed using deep learning models through AI algorithms using a library like NLTK.

The next step determines the AR character to be created with the previously identified data. Here, the AR character's behavior is prepared using machine learning libraries like TensorFlow. The AR character behavior logic can be executed based on the AI-generated responses using Python or JavaScript. For this, techniques like Develop decision trees can be used to guide the relevant AR character. Also, APIs such as Speech-to-Text for voice recognition, sentiment analysis APIs are used as external APIs for getting the user's information. Also, relevant data such as scenarios, responses, and preferences should be stored in a database. Because prior information is important when the user is training on the same relation multiple times.

As a final step, information about the transactions made with the AR character is collated. Based on that information, the user is given a final level assessment of his training. At the end of one training, the relevant information is stored in a database and the user has the ability to access the information later. According to the final summary provided, the user is able to understand about his relationship.

Technologies	React Native, Python, TensorFlow, IntelliJ Idea, NLTK
Techniques	Develop decision trees
Algorithms	Dialog generation algorithms

3.1.1 Software solution

Agile Scrum Methodology is the software development life cycle suggested for this. This methodology offers a fast model for software development. In particular, Scrum is known as the most popular software development life cycle today. Also, parts of this method should not be followed by alternatives. Here the opportunity is provided to apply the measures according to the need. Compared to existing methodologies, this framework is very agile and stable, enabling complex problems to be solved comprehensively. [10,11,12,13]



- **Requirement Gathering and Analysis**
- **Interviews and Feedback**

A survey and interview sessions are conducted to find out user needs and their expectations. This enables correct inputs to function. Here, by using a questionnaire, a selected group of people will focus on the problems they face while building relationships.

- **Collecting information from Helping Hands in SLIIT**

The purpose of this is to discuss with the counselors who provide counseling services in the Helping Hands unit of our university. Currently, we have engaged a consultant who provides consulting services for this. There, she discussed the issues of grants for the weak for the relationships that she encountered daily. Based on that information, we use that information to shape our AR character and build the relevant environment.

- **Gathering data Using Google Form**

Through a Google form designed for different age groups, information about people's relationships is provided here. It contains questions that can be filled out by anyone, whether in a relationship or not.

- **Feasibility study (Planning)**

- **Technical Feasibility**

The technical status of our proposed solution is evaluated here. The technical profile required for the development of the mobile software application to be created, as well as the technical knowledge and requirements required to carry the system forward successfully, are considered here.

- **Economic feasibility**

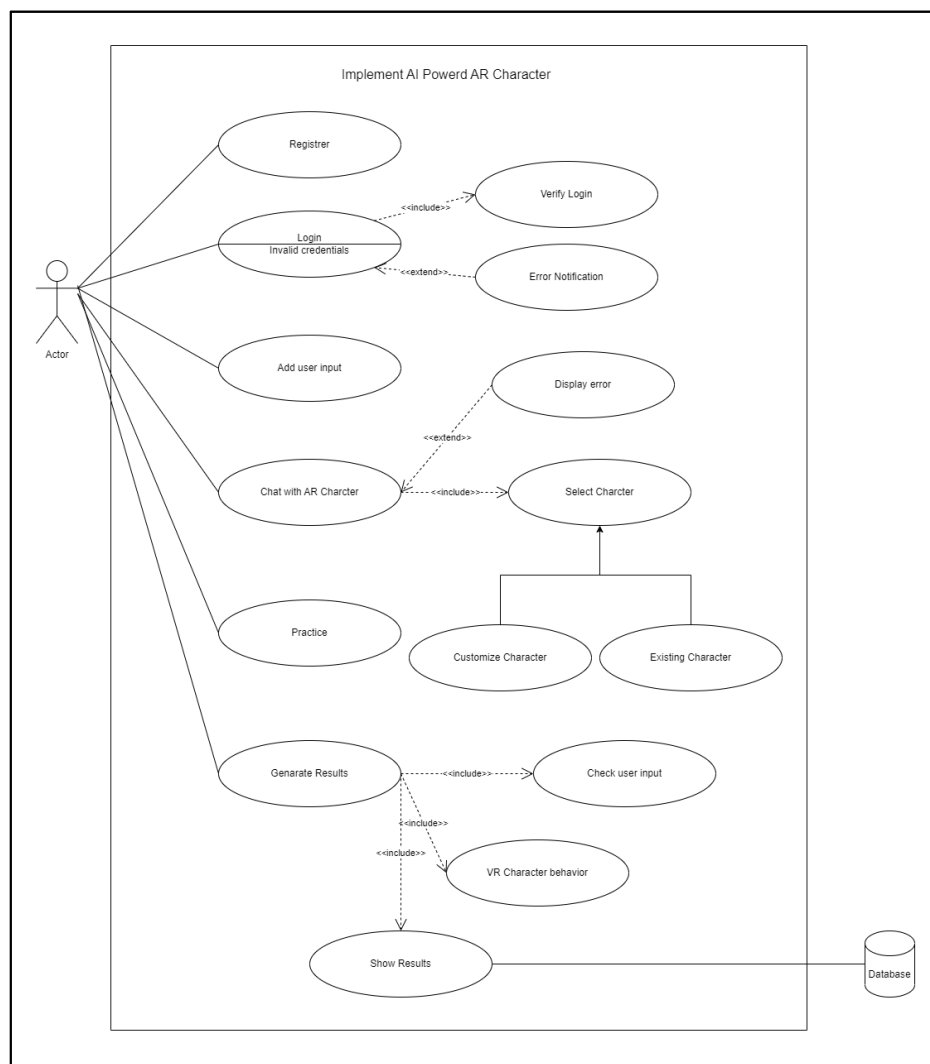
The economic feasibility assessment of our project is considered here. Here the initial investment required to develop and operate the mobile application is estimated. Here this is estimated using ROI. A thorough cost-benefit analysis looks at whether the benefits outweigh the costs of the work. The goal is to create an efficient system with value by using less.

- **Scheduled feasibility**

Here the focus is on whether the feasibility assessment created here can be completed within the expected time frame. This involves considering various emergency risks and opportunities and providing a solution within a specific time frame by flexibly adapting to the circumstances. Therefore, the proposed section should be completed within the relevant period.

- **Design**

After the planning is completed under various criteria, user experience and visual design are done at this stage.



- **Implementation**

The steps are to implement the proposed improved AR application methodology and make the application a reality. The following steps are to be followed to create the application so that users can meet their usability needs. In this phase, the AI-powered AR character is made a reality to help users build relationships by communicating the pre-made plan.

- Creating an application using Android Studio with ARCore plugin and React native to be able to use the AR environment and character.
- Creating AI algorithms that can understand users' emotions, thoughts, and inputs.
- Here, using NLP frameworks and using Python programming language, API/library is used to perform Behavior Modeling, Voice Recognition model, and emotion analysis required for AR characters and understanding user inputs and generating responses.
- Visual appearance, animations, and movements of the AR character are created using Blender or Maya
- Enable the character's realistic interactions in the AR character using TensorFlow machine learning frameworks, which is an application of Artificial Intelligence for character behavior and responses.
- Integrated graphics engines into development environments (Unity3D, Unreal Engine) for visually appealing real-world AR experiences.

- **Testing**

Ensure that the application works seamlessly provides a valuable training environment to users and identifies potential issues before the application reaches its intended audience. This test is done in several stages. This app is free of bugs and focuses on the quality of the app.

Unit testing

The components of the system are taken separately and tested by the developers to evaluate them. Here the parts like algorithm testing, user input testing etc. are done. The primary objective of unit testing is to ensure that the relevant components behave as expected and produce correct outputs

Integration testing

Focus on cooperation between all systems and interactions between subsystems. Here we look at the problems that may arise in making all the components work as an integrated system. The primary objective of integrity testing is to ensure that the system is functioning correctly and meeting its intended requirements.

Scenario Testing

The focus here is on how well the designed application performs in real-world scenarios. Ensures that the application functions correctly and meets user expectations, and determines the behavior of the application in various contexts and situations. This can detect problems that cannot be seen through traditional functional testing.

3.1.2 Commercialization

This program is introduced as a mobile application that can be used to create better human relations even for those who are afraid of building relationships. This is also available in two versions, the first version is free and the second version has to be paid by the user. The free version has the ability to get simple level characters and the character-building option is not provided. The number of times you can practice is limited to 5 per day. The paid version allows the user to build characters as he likes and the number of times he can train per day is not limited.

Target Audience

- Teenagers
- Workers
- Parents

Versions

- **Free Version** - Identification of emotion.
 - Relation build-up tracking system.
 - Provide advice on how to manage the situation.
 - Realtime notifications.
- **Paid version** - Can Enable AR Character
 - Can Enable AR AR environment and customization
 - Severity level of the tracking system
 - Severity level of counselor and other tips

Marketing Plan

- No age limitation for users.
- No need to advanced knowledge of technology

4 PROJECT REQUIREMENTS

4.1 Functional requirements

- The application should be able to properly analyze the user's input through AI technology.
- The application should be able to adjust the AR character and environment by properly analyzing the user's input.
- The application should be able to provide accurate feedback and feedback to the user through the AR character.
- The application should be able to keep a retrospective memory of the feedback given to the user through the AR character when the same user uses the application for the same task.
- The behavior of the AR character and the spoken dialogues should resemble the behavior of a normal human.

4.2 Non-Functional requirements

- Performance - It should be able to respond quickly without getting stuck to give the user a better experience.
- Security and Privacy - Better security measures should be maintained to protect users' information.
- Ethical Considerations - The advice given through the app's AI technology should be culturally sensitive and ethical for all. Those conditions should be respected.
- Availability - Anyone looking to build a relationship should be able to use this app.
- Compatibility - The phone app should run on any existing phone and OS regardless.

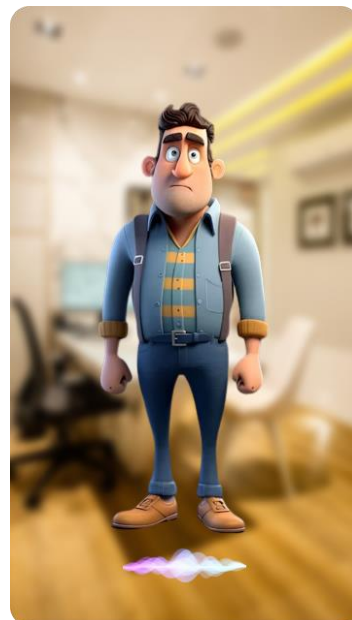
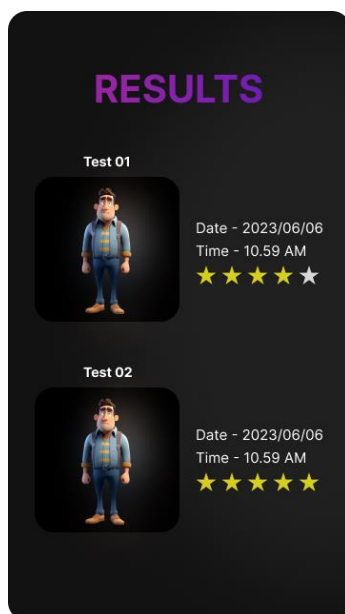
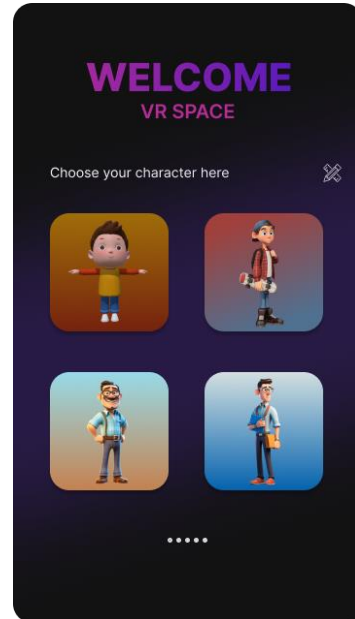
4.3 System requirements

- React native is used to build the mobile application.
- Blender, Maya, or 3ds Max is used to create the 3D model
- Uses Unity3D as one of the AR Development Platforms.
- Tensor Flow is used as a machine learning framework for behavior generation.
- Node.js is used for Server-side Programming and RESTful API is used as Web APIs.
- Encryption techniques like AES, and SSL/TLS are used.
- Amazon uses Cloud Front as a Content Delivery Network (CDN).
- Visual Studio IntelliJ is used for coding.

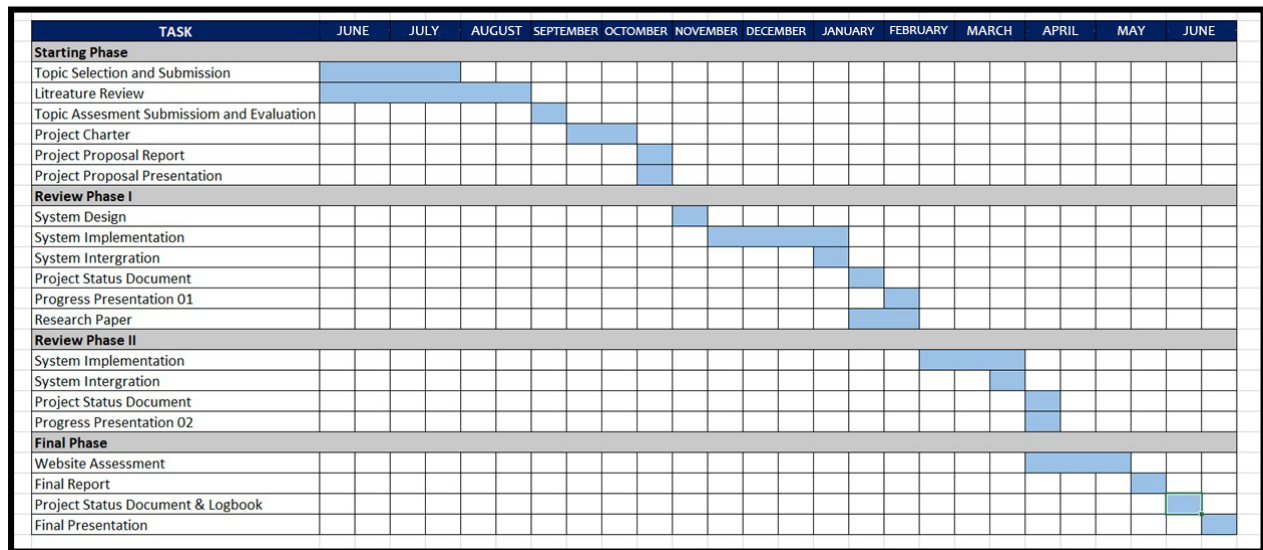
4.4 User requirements

- The user should be able to customize the appearance, traits, and personality of the AR character
- The user should be able to select from a variety of relationship scenarios to practice
- The user should be able to share their emotions and thoughts with the AR character by voice command
- The user should be able to track their progress and improvement in relationship-building skills

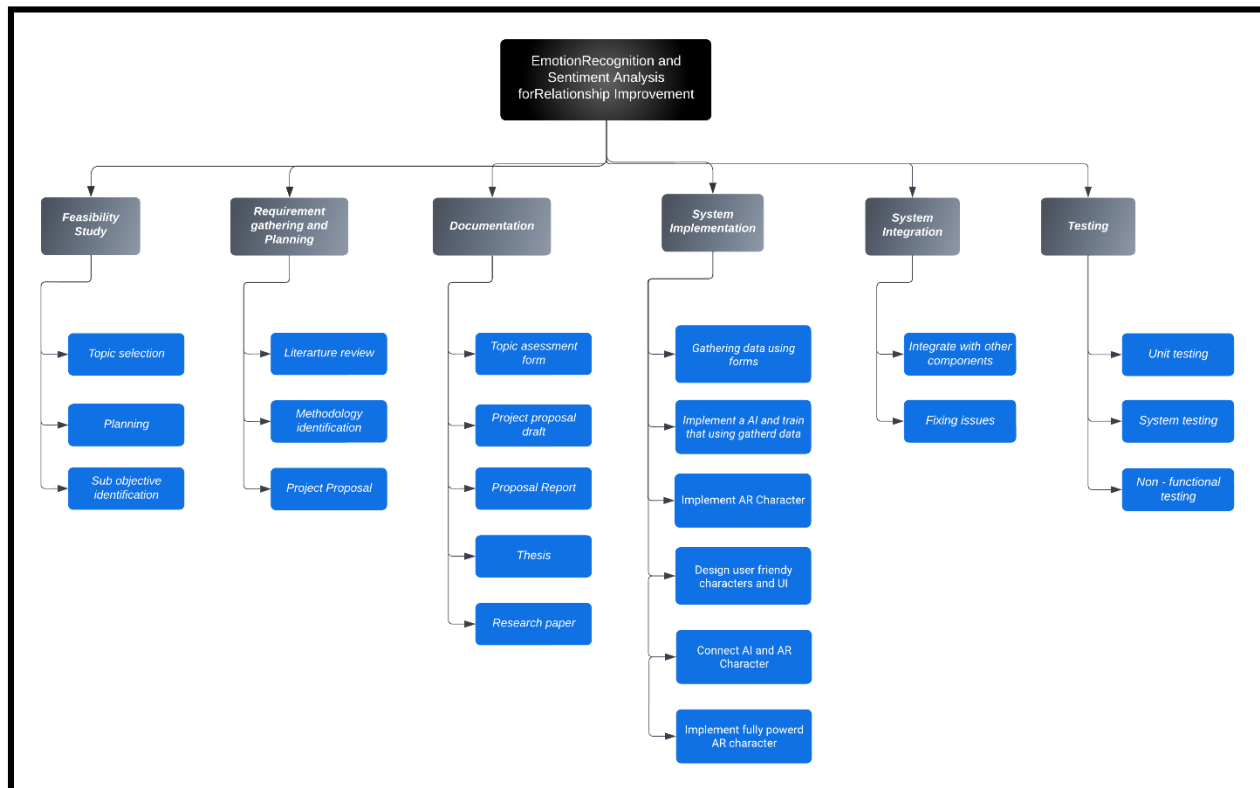
4.5 Wireframe



5 GANTT CHART



5.1 Work Breakdown Structure (WBS)



6 BUDGET AND BUDGET JUSTIFICATION

Requirement	Cost(Rs.)
Mobile app hosting charge – Play store	5 000.00
Cloud service	6 000.00/month
Internet Charges	5 000.00
Total Cost	16 000.00

REFERENCES

[1]

S. Holt, "Virtual reality, augmented reality and mixed reality: For astronaut mental health; and space tourism, education and outreach," *Acta Astronautica*, Dec. 2022, doi:

[2]

K.-Y. Wang, A. R. Ashraf, Narongsak Tek Thongpapanl, and O. Nguyen, "Influence of social augmented reality app usage on customer relationships and continuance intention: The role of shared social experience," vol. 166, pp. 114092–114092, Nov. 2023, doi:

[3]

H. Kumar and A. Martin, "Artificial Emotional Intelligence: Conventional and Deep learning Approach," *Expert Systems with Applications*, p. 118651, Aug. 2022, doi:

[4]

A. J. Horn and C. S. Carter, "Love and longevity: A Social Dependency Hypothesis," *Comprehensive Psychoneuroendocrinology*, vol. 8, p. 100088, Nov. 2021, doi:

[5]

T. A. Karslı and İ. Anlı, "Relationship among introvertism - extrovertism, narcissistic developmental line, locus of control and level of trait and state anxiety in a Turkish adolescent population preparing for university entrance exam," *Procedia - Social and Behavioral Sciences*, vol. 2, no. 2, pp. 787–791, 2010, doi:

[6]

J. S. Devagiri, S. Paheding, Q. Niyaz, X. Yang, and S. Smith, "Augmented Reality and Artificial Intelligence in industry: Trends, tools, and future challenges," *Expert Systems with Applications*, vol. 207, no. 118002, p. 118002, Nov. 2022, doi:

[7]

S. Sabeti, O. Shoghli, M. Baharani, and H. Tabkhi, "Toward AI-enabled augmented reality to enhance the safety of highway work zones: Feasibility, requirements, and challenges," *Advanced Engineering Informatics*, vol. 50, p. 101429, Oct. 2021, doi:

[8]

J. Grodotzki, B. T. Müller, and A. E. Tekkaya, "Introducing a general-purpose augmented reality platform for the use in engineering education," *Advances in Industrial and Manufacturing Engineering*, vol. 6, p. 100116, May 2023, doi:

[9]

G. Dominique *et al.*, "Evaluation of augmented reality technology in global urologic surgery," *The American Journal of Surgery*, May 2023, doi:

[10]

F. K. Y. Chan and J. Y. L. Thong, "Acceptance of agile methodologies: A critical review and conceptual framework," *Decision Support Systems*, vol. 46, no. 4, pp. 803–814, Mar. 2009, doi:

[11]

M. Hron and N. Obwegeser, "Why and how is Scrum being adapted in practice: A systematic review," *Journal of Systems and Software*, vol. 183, p. 111110, Oct. 2021, doi:

[12]

K. Vlaanderen, S. Jansen, S. Brinkkemper, and E. Jaspers, "The agile requirements refinery: Applying SCRUM principles to software product management," *Information and Software Technology*, vol. 53, no. 1, pp. 58–70, Jan. 2011, doi:

[13]

J. Heimicke, K. Dühr, M. Krüger, G.-L. Ng, and A. Albers, "A framework for generating agile methods for product development," *Procedia CIRP*, vol. 100, pp. 786–791, 2021, doi: <https://doi.org/10.1016/j.procir.2021.05.043>.

