A MAJOR PROJECT –II REPORT

ON

AI ENHANCED APTITUDE ANALYSIS AND CAREER PREDICTION SYSTEM

Submitted in Partial Fulfilment of the Requirements

For The Award of the Degree of

MASTER OF TECHNOLOGY

IN

COMPUTER SCIENCE & ENGINEERING

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I, Ishita Chandra, Roll No. 2K22/CSE/09 student of M. Tech (Computer Science and Engineering), hereby declare that the Project Dissertation titled "AI Enhanced Aptitude Analysis and Career Prediction System" which is being submitted by me to the Department of Computer Science & Engineering, Delhi Technological University, Delhi, in partial fulfilment of requirements for the award of the degree of Master of Technology, is original and not copied from any source without proper citation. This work has not previously formed the basis for the award of any Degree, Diploma Associateship, Fellowship or other similar title or recognition.

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I, hereby certify that the Project Dissertation titled "AI Enhanced Aptitude Analysis and Career Prediction System", which is submitted by Ishita Chandra, Roll No. 2K22/CSE/09, Department of Computer Science & Engineering, Delhi Technological University, Delhi in partial fulfilment of the requirement for the award of the degree of Master of Technology, is a record of the project work carried out by the student under my supervision. To the best of my knowledge this work has not been submitted in part or full for any Degree or Diploma to this University or elsewhere.

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ABSTRACT

The landscape of secondary education underwent a significant transformation with the introduction of the 2020 educational policy, which emphasized the dissolution of rigid disciplinary boundaries between Science, Commerce, and Arts streams in the (10+2) curriculum. This shift has created a need for innovative tools to assist students in navigating the expanded array of subject choices and potential career pathways. To address this challenge, this thesis presents the design and development of an educational app aimed at guiding students through this new educational paradigm. The primary focus of this project is twofold: first, the implementation of a fuzzy logic-based aptitude assessment tool and secondly, the project will incorporate a collaborative filtering-based career recommender system within the app. This project aims to contribute to enhancing students' educational experiences and career readiness in the context of the evolving educational landscape. By leveraging fuzzy logic for aptitude assessment and collaborative filtering for career guidance, the educational app seeks to empower students with the knowledge and insights necessary to make informed academic and career decisions amidst the new educational paradigm characterized by interdisciplinary learning and holistic skill development.

Keywords: recommender system, fuzzy logic, content based filtering, machine learning.

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ACKNOWLEDGEMENT

I wish to express my sincerest gratitude to Dr Rajesh Kumar Yadav for his continuous guidance and mentorship that he provided me during the project. He showed me the path to achieve our targets by explaining all the tasks to be done and explained to me the importance of this project as well as its industrial relevance. He was always ready to help me and clear our doubts regarding any hurdles in this project. Without his constant support and motivation, this project would not have been successful.

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CHAPTER 1: INTRODUCTION

1.1 OVERVIEW

Education is a vital as well as strong instrument to shape and mold the individual and society in a desirable manner. On July 29 2020, the Government of India approved a new education policy. Under the New Education Policy 2020, the three separate streams i.e. science commerce and humanities are now intended to be mixed into one curriculum. "There will be no rigid separation between the three streams" stated by the New Education Plan [1]. Meaning that there will be increased adaptability in choice of subjects and students could now choose between set of subjects within one curriculum. This policy can have a major intellectual force on student. It will allow the students to have a broader outlook and walk along the paths of knowledge which they prefer.

Figure 1.1 Education Policy 2020

Although, this policy can be misinterpreted or can lead to blunders. Having lack of proper knowledge about set of subjects and its scope student might make few mistakes [2]. Understanding which combinations of subjects will have what possible career outcomes can be a trick itself. Whether a subject has a future scope? Or will a particular combination will help them achieve good grades? These question will surely tickle every students mind. When it comes to scope and prediction, Artificial Intelligence is already advancing at a great pace in this field. Smartest technologies in

AI are more or less a prediction machine. For optimization of a goal, huge set of data are analyzed by using suitable algorithm. Moreover, during or after optimization, the machine understands how to improve their results. AI basically provides predictive analytics which not only tell you what's happening, but also what one should do about it. AI has also become a major part in education leaving traditional teaching methods behind. It enables students to know, which stream will be beneficial for them and how, ten years down the lane. AI has surely brought a revolution in the industry and so has IT. IT has brought revolution in a common man's life. Out of which students have dig out the most benefit. Gone are those days when textbooks and classroom teaching methods were the only ways of gaining knowledge. Now, technology brings and delivers education by just one click. Using mobile application (apps) has become inexorable in today's time. Technically, the major platform used in mobile application is Android Studio. It is basically the official IDE for an android application (app) development. It is a user friendly system which provides a rich layout editor which has numerous editing theme. Basic code templates are provided to build common features [3]. Considering the need of mobile applications (apps) in today's education system also the importance of Artificial Intelligence in mobile apps, mentioned above, in this paper, we study how an AI based career system which gives solution this education plan, can be developed for betterment of students.

1.2 PROBLEM STATEMENT

The implementation of the 2020 education policy, which aims to eliminate rigid boundaries between Science, Commerce, and Arts streams in the (10+2) curriculum, has resulted in confusion and uncertainty among students regarding optimal subject combinations and future career paths. This policy shift has created a need for effective guidance tools to assist students in making informed decisions aligned with their aptitudes and aspirations.

The problem lies in the absence of personalized and reliable resources to help students navigate the redefined educational landscape. Students face challenges in determining their strengths and identifying suitable career options based on their chosen subjects, leading to potential misalignments between academic choices and future aspirations. Therefore, the fundamental problem addressed by this project is the lack of clarity and

guidance for students in selecting subjects and exploring career paths within the context of the revised educational framework. The project seeks to develop a solution that addresses these challenges and supports students in making well-informed academic and career decisions amidst the evolving educational paradigm.

1.3 PROBLEM OBJECTIVE

The key idea of this project is to advance an educational app that can aid students to pass through the new model of learning imposed by the 2020 policy that underlines the combination of the academic streams and the concentration on general skills instead of the subjects. Specifically, the project aims to achieve the following objectives:

Firstly, create a comprehensive and effective measure of ability using fuzzy logic modeling to ascertain the areas in which students have the strongest aptitude and interests and those subject areas in which they are the least interested. With the use of fuzzy logic, the app will offer pin point generic and personified knowledge regarding subject choice of students above the box and fences of subject disciplines.

Secondly, adopt a collaborative filtering based career suggest system that recommends career options from a pool of possible careers based on the students' subjects of interest and the strengths that have been identified for the student. This system will utilize data on subject correlations and careers paths to recommend customized solutions to the students and in this way assist them to further streamline their studies with career progression.

Finally, test the educational app extensively and evaluate its quality in terms of usability, plausibility, and students' choice making. The users' responses, and performance, will be used to improve or adjust areas and features of the app to better support student engagement in the new education environment. These objectives will help to drive the effectiveness of this project towards the larger good by enhancing the quality of education for students and their career success as well as ensuring that they will be able to make their own choices in the modern changing educational environment in accordance with the principles of the revised education policy.

CHAPTER 2: RELATED WORK

Recommender systems are of great significance to modern search because it helps to find the information the user wants in the billions of pages on the Internet. One of the most important recommendation system techniques is collaborative filtering that draws on user behavior to find recommendations for a user.

D. Grewal showing how collaborative filtering is useful for recommendation purposes as it allows for extrapolation of user preferences based on previous choices and previous similar use of the system without an explicit 'attribute' to be used as a proxy. On the other hand, item based recommenders are based on the fact that item attributes are used to create user profiles with rich item descriptions. These systems are exceptionally well suited to recommending products that are similar to those that have been handled by the user in the past, in order to meet the needs of the individual user and his or her ideas for different items. The world of academia can also be seen the introduction of citation references systems which seek to aid the literature review process by mapping language reference. The relevance of citation retrieval becomes increasingly difficult in the rapidly increasing number of scholarly works and recommendation systems while at the same time presenting promising ways to improve the effectiveness One of the most useful recommendation systems faces challenges

Despite several benefits, recommendation systems face several challenges. The risks of violating user privacy are high and demand appropriate care when optimizing on personalized recommendations. Furthermore, the combination of different data and the use of various techniques used to analyze these data sources intensifies as a significant challenge to the development of a complex algorithm for automatically summarizing these types of data. Cold start problem thus continues to be a formidable challenge, especially for new user and new item with no history data [4]. Dealing with this problem calls for novel recommendation generation techniques like using contextual information or applying a hybrid approach oriented upon the aforementioned criterion. In addition, it is sometimes argued that user-generated content is not trustworthy due to the unexpected intermissions in users' activities that may result in ineffective feedback. Recall as well that recommendation systems are

designed to provide users with credible and or pertinent recommendations while overcoming the complexities of user engagement. Al-Badarenah and J. Alsakran started an elegant method that helped the students make proper choices regarding their careers.

They concentrated on using a recommender system to offer tailored suggestions points of grade according to students' grades and interests. One of the main functions the system can perform was to address the issue of learning and training students and identifying their learning potential and personal preference for particular spheres. The first of the two main concepts described in the article by Castagno and Lewis is a model called the Career Advisor Model (CAM) [5]. This model can be used as a reference by students to assist them in the difficult task of identifying a field that is better suited under the CSE/IT umbrella. The CAM aims to empower students to choose a career path that entails best-suited recommendations based on their demands and capacity. The article also underlines the use of machine learning techniques for dropout prediction and student achievement prediction. It is a system which employs various machine learning techniques to predict students' success, recommend courses for the skill building, and recommend career paths to students. Decision tree, artificial neural network, matrix factorization, collaborative filters, probabilistic graphical models, Bayesian classification, SVC, random forest, XG boost are some of the machine learning methods that are mentioned in the paper. The Career Master System (CMS) that formed the topic for the study was developed using Visual Basic software. This desktop system can be used by counselor to provide suggestions based on a variety of factors such as ability, talent, IQ, interest, parental influence, academic performance, etc. However, there are a number of concerns which may be addressed with regard to the current implementation of the Smart Career Guidance and Recommendation System described in the present paper, to improve the performance of such a system in providing students with career guidance and recommendations for the CSE/IT field.

It was observed that the system would end up providing limited information on a student's interest and ability because it is largely based on survey and class tests. An eligible extracurricular or employment history may be collected from students to address this restriction to provide more information about the students' profiles in the

system. The study performed by K. Taiwo and K. Joshua [6] on career guidance systems based on AI presented a number of findings, effects, benefits, and challenges of applying AI in career counselling, in particular on career counselling processes, counselling, careers, and choices: the development of career counselling and choices: the impact of the Industrial Revolution 4.0 on career counselling, choices, and developments. Traditional methods of manual career counselling are considered to be ineffective and inefficient, so the question of its automation arises The use of AI in career counselling helps people find the right path in their professional life. There are fewer errors, and serves are accessed fast, unlike human counsellors who display mood swings and reactions, which can delay services. AI ensures better career guidance, saving time and different tasks can all be done through automation. But the research also points to challenges that could hinder the use of AI within career counselling services. These challenges include an unclear picture of factors that are used in the process of career choice; inadequate design to identify personality traits that are essential for the development of automated guidance systems; and proper data management for the development of standardized data sets to use in their work for accurate guidance. These are factors that need to be addressed to make the career counsellor better adopt using the AI based systems. Predictive analysis tools are used to obtain information and insights regarding career decisions, attitudes, and indicators of success among significant patient populations. Genetic algorithms are a specialized class of optimization problems that follow a Darwinian approach toward making decisions.

Genetic algorithms can be used for career path optimization, career guidance, and artificial intelligence services in the field of career selection and trait-specific personalized career recommendations. Statistics employ advanced modeling techniques to explain data pertaining to career progression rates and success factors as well as patterns in career choices. These models assist in ascertaining patterns, relationships, and conditions that may affect career choice [7]. There are some interesting information concerning the use of AI technologies for career guidance but as compared to the search conducted under similar topics the research doesn’t contrast AI-based career guidance systems with other technologies that are currently employed or with the manual systems that existed for a long period of time. An evaluation of the

differences between the two methodologies might prove to be enlightening as to where AI systems perform, or are less likely to perform, as compared with conventional strategies. The sections of the paper that can be improved are the one that looks at a discussion in the performance and the efficiency and the user's experience in the alien-based career guidance systems that compare the alien-based career guidance systems and the traditional one. The subsequent analysis could focus on the potential benefits and risks of AI technologies that relate to the application of career counselling. The authors of the paper considered the case of Naïve Bayes and Decision Trees where some authors tried to compare two approaches on a certain algorithm or task. Using boosting techniques, they also tried AdaBoost and realized it led to a high accuracy rate of 82 percent. 7%. Also comparable to the present study is skin lesion classification through automated computer-aided diagnostic (CAD) method proposed by Salma et al. The accuracy rate achieved was 99%. Of these, 87 per cent and an area under the receiver operating characteristic (ROC) curve of 99 were correctly identified as having experienced abuse. 52% and this system was very effective in classification. These results are significant as they show promising ML application for addressing some of the challenges of computing systems and medical diagnosis complexity. Sharma et al. focused on developing a predictive model for student career prediction, employing four ML algorithms: Decision Tree,Randm Forest Support vector machine (SVM) and AdaBoost.

However, among the above three, Random Forest classifier worked with the highest accuracy of 93%. This research also justified the use of ML techniques in counselling career choices. As far as healthcare is concerned, there exists a model by Saxena et al. for classification and prediction of diabetes through the use of Decision Tree. This study was able to achieve a more accurate but comparatively lower 71% accuracy. Nevertheless, this work falls within an emerging body of research that applies machine learning for disease diagnosis and prognosis. Another example by O. A. Abisoye [8] proposed a job recommendation system using Decision Trees and Support Vector Machine (SVM). It is also important to note that their research also points to the fact that the Random Forest algorithm performed at a 96% level on the precision rate and that this is impressive as it shows that there is a corresponding matching between the job seekers and the best environments that can be availed to them. Usman. studied text

classification in Urdu news documents using a Voting classifier. Their choice was successful – their model worked well, giving precision and recall rates of 94% by majority voting – which makes categorization of textual data easier and more effective. Within the context of sentiment analysis, Yousaf used ML models for emotion classification in text corpora, mainly Twitter. They concluded that the emotional classification voting method LR-SGD classified the best emotional type-oriented content from the above-discussed online discourse with accuracy of 70% and an F1 score of this classifier is 81% which digitally helps in the correct identification of emotional content. In Mahabub proved useful to the domain of fake news detection by adopting the ensemble of ML-models. After several trials of cross-validation, the proposed system displayed a highly acceptable accuracy rate of almost 94%. 5 percent indicating that it could be usefully employed to counter misinformation spread. Lastly, V. Balogun, A. Thompson explained the problem using Decision Tree Classifier for the task of handwritten digit recognition. The model had an ability to generalize the task despite showing the difficulties which often occur when performing digit recognition tasks; the precision was 83%. 4% of which demonstrates how effective the system was at predicting handwritten digits [9].

Certainly, these works demonstrate how ML methods can be used in a wide range of problems from healthcare and education to text classification and sentiment analysis. Although each study has its specific research problems and issues with the way they are conducted, the purpose of these studies is to expand the boundaries of the ML field and its use. Ezenkwu and partners have very recently given a comprehensive account on their efforts on the development and implementation of an online career advice website. What set the system apart was that it was designed to address the limitations of traditional manual career guidance methods by providing personalized guidance based on individual interests, skills, and aptitudes. It conducted psychometric tests to identify the user's interests and preferences. The system operates automatically once set up, eliminating the need for manual intervention. The system utilizes software tools such as Python, Django, VS Code, HTML, and CSS to create an interactive and user-friendly interface for students. The paper stated many useful and new algorithms adopted. ACO is utilized for test composition, aiming to search for high-quality results and generate tests with high assessment qualities [10]. Text mining techniques are used to extract and analyze user profiles and resumes, identifying key skills and

providing personalized job recommendations. Collaborative filtering algorithms are applied to recommend additional skills and job openings based on the user's profile and preferences. Statistical correlation techniques are used to analyze the results and generate rules for career path recommendations. The paper suggests that an online career guidance system can effectively address the shortcomings of the manual system. To overcome the limitations, the implementation of the web-based system should focus on providing easy access, user-friendly interfaces, and interactive features to engage students effectively.

One more thing I noticed in this paper is that there is no description or any evidence that usability testing of the system had been performed on the user interface. It is important to perform usability testing to make the system convenient for the users in terms of accessibility and interfaces. To create a richer application that is more optimally designed, they would need to consider usability testing to enhance the application and eliminate any possible complications upon the users. This is possible by important tools such as the System of Interactive Guidance Information (SIGI) and DISCOVER launched at the turn of the 1970s, which fashioned the era of career guidance well beyond its initial iterations as vocational guidance. It has been advantageous for the student controlled self-assessment and career opportunity access system. They also make it relatively easy to access educational and occupational information and also to promote interest and ability and to ensure better decision making is done. Recent studies in helping students to identify suitable jobs for them have through decision support systems and models facilitated matching a specific set of academic profiles with job posting [11]. However, career assessment for candidates has to be comprehensive and should include consideration of things like the ability to work well in a group, communication skills, and non-technical skills, in addition to candidates' basic technical skills and capability. Various career portals of online career platforms give students the opportunity to investigate their abilities and acquire work knowledge.

In order to close this gap the C3-IoC system creates an exhaustive knowledge base that includes skill needs for technical and non-technical skills for different jobs by utilizing complementary data sets: for instance the corpus of IT relevant job advertisements corpora and another corpus of general jobs. The paper: "Career

guidance Website: Accompanying aptitude test" provides for the solution to the problems faced by the students while choosing a realistic career option. It highlights the importance of vetting correct career guidance for helping people make informed and wise decisions based on their talents, interests, and skills. Given the fact that students struggle with understanding their personality types, skills, and strengths, the current paper introduces a web-based application developed following the principles of web development techniques and data mining algorithms. Students may use the application to understand career guidance based on personal preferences and qualifications. The study also proposes a professionalized Career Guidance and Recommendation System intended for the prediction of appropriate career path based on the student interest and performance in schools using the pre-engineered recommendation system. The technologies used in order to factor out a useful web application for the paper include HTML, CSS, JavaScript, PHP, and Apache Server. It discusses the ability of the data mining algorithms and the use of algorithms to exemplify the data mining algorithms in the context of job recommendations which are individualized based on unique aptitude and or interest of users to help students to understand their aptitude, strengths, capabilities, and personality. Smart Career Guidance and Recommendation System is possibly using recommender systems to suggest suitable career options based on the person's skills and interests as well as course attendance and performance. The end result of the paper is a powerful web application with which students can effectively navigate their job searching needs. There are some limitations in the study, for instance, clearly inadequate discussion of data security yet contributing in a notable way to career counselling. Also, it should be noted that the study fails to address the question of reliability and the methods of reliability in aptitude test questions. Potential areas of improvement to expand the overall usefulness of the web application for users may include adding more career resources such as information about wages, job market changes, and linking users to the job market. It considered the research paper titled "Career Guidance System Using Machine Learning for Engineering Students (CS/IT)" [12] which is an article published in the International Research Journal of Engineering and Technology (IRJET), exploring the application of machine learning technique to help engineering students to ascertain their skill sets and choose the best career avenue. The objective of the project is to deliver a useful solution to final year students or recent graduates

of computer science or information technologies discipline. One of the main issues discussed in the paper is the use of the Naïve Bayes algorithm to classify and construct models using feature vectors of data and assign class labels to them. This algorithm is significant in the prediction of the course of career success among students because it considers not only academic achievements but also students' temperaments and interests, as well as participation in the workshops. Based on the reports from the Naïve Bayes Algorithm-developed model, the precision of career prediction is 93% and this can largely be considered as accurate. This included data gathered from 21 categories having 20,000 records that the researchers used to identify the factors that would forecast pupils' career trajectories. The system [13] also has an implementation of a feedback loop to ensure the enhancement of accuracy and reduce user dissatisfaction; the system also provides career recommendations associated with information on the top three probable careers. To increase the accuracy of the model, the researchers also use 'Siectkbest' and 'chi2(chisquare)' methods to decrease the number of features in the dataset from 38 to 20 for feature scaling.

ASPECT	**EXISTING SYSTEM**	**PROPOSED SYSTEM**
Main Function	Job Recommendation	Career Path Recommendation
Approach	Based on standardized tests and academic performance.	Integrates fuzzy logic-based aptitude testing to identify nuanced strengths and areas of interest.
Handling Ambiguity	May struggle to account for nuanced preferences or uncertain strengths.	Utilizes fuzzy logic to manage uncertainty and ambiguity in assessing aptitude and strengths.
Career Recommendations	Often provides generic career suggestions based on academic streams or test scores.	Uses collaborative filtering to recommend careers tailored to individual subject preferences.

Table 2.1 Comparison Table

CHAPTER 3: PROPOSED ARCHITECTURE

3.1 COMPONENTS USED

3.1.1 FUZZY LOGIC

Fuzzy logic is a logical system based on fuzzy set theory and the general concepts of intuitionism that deals with ambiguity and uncertainty by using partial truth that ranges from zero to one rather than the usual concept of true or false. Unlike the precise logic values of Boolean logic fuzzy logic incorporates some concepts and measurements as partially true either only partially true or true with respect to a certain degree. Fuzzy logic is described as a computational paradigm characterized by the existence of fuzzy sets. Classical set theory: An element is either in a given set or does not [14]. For example, in a given set of people tall two people are either tall or not tall according to some specific height. As opposed to a crisp set, a fuzzy set rules permit partial membership. For example, instead of identifying people as just tall or not tall, a fuzzy set that defined tallness as a matter of degree may include the following: the scale of tallness describes how tall an individual is expressed as a percentage of the total height range in units. EES brought the idea of linguistic variables and it does not rely on quantifiable numbers or terms like “tall,” “short,” “hot,” “cold”, etc.

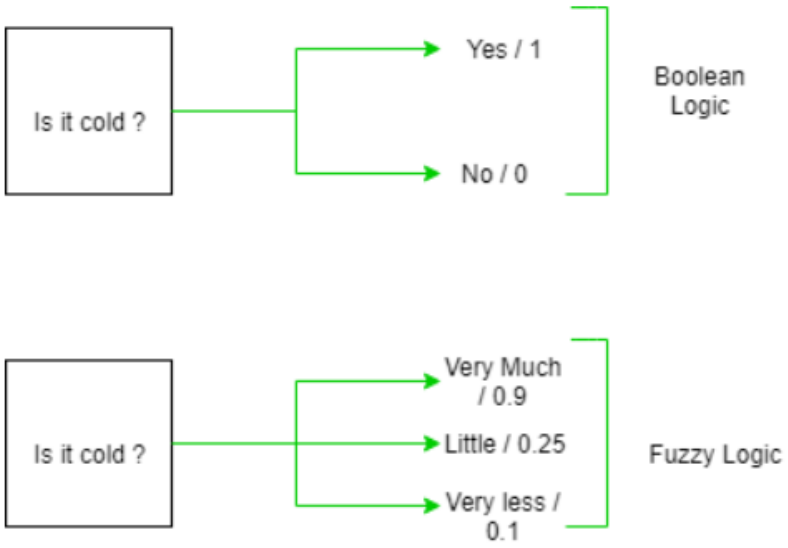

Figure 3.1 Fuzzy Logic and Boolean Logic

The propositional connectives used in fuzzy logic are called Boolean relations and they can be operated on both fuzzy sets and linguistic variables but with truth degrees. Such flexibility is especially helpful in scenarios or problems where uncertainties or vagueness are unavoidable, thus promoting human-like problem-solving. Fuzzy logic operators are used to represent vagueness of the information as well as handling its partiality and lead to successful implication of fuzzy systems in a wide range of application areas like control systems, pattern recognition, decision support systems etc. Fuzzy logic operations extend traditional Boolean operations to accommodate fuzzy values:

- Fuzzy AND (Intersection): A operator is used to find the degrees of the intersection of two fuzzy sets based on the membership values of the sets. The result indicates the union of the sets of the combined membership values.

Fuzzy OR (Union): Fuzzification with the AND operator: this operation combines the membership values of two fuzzy sets to determine the membership of their union. The invariant shows the total membership of sets when combined together.

- Fuzzy NOT (Complement): Deduplicates a fuzzy set of the degree of not belonging to the set.

ARCHIETECTURE

The architecture of fuzzy logic consists of the following principal blocks: fuzzy data and rule processing blocks that produce fuzzy implications, truth evaluation blocks used to derive leaves of the semantic tree and infer the conclusion.

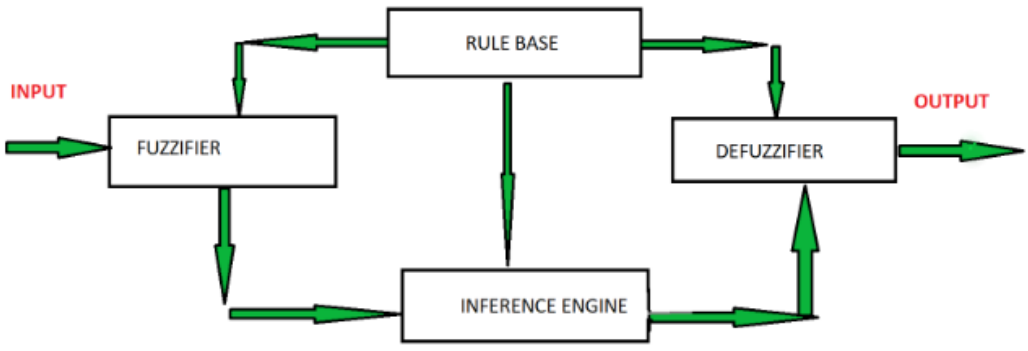

Figure 3.2 Fuzzy Logic Architecture

1. Input Interface: The architecture starts with the input interface to define variables, receive linguist input values. Linguistic variables refer to the symbolic meanings or qualitative attributes. g. the different characteristics (e. g. temperature, speed), valued by fuzzy sets, which describe the possible combinations of values for these variables.

2. Fuzzification: The input parameters from the fuzzy variables need to be substituted through a process called defuzzification. Fuzzification processes the crisp input values to describe the degrees of membership in different fuzzy sets that are contextually representative of their uncertainty.

3. Fuzzy Rule Base: The fuzzy rule base is a collection of fuzzy IF-THEN rules that are expressed as human set of knowledge or heuristic arguments in linguistic forms. Each rule consists of fuzzy conditional statements that define an output contingent upon input.

4. Inference Engine: Fuzzy reasoning further involves the use of the inference engine that is used to apply the rules of fuzzy logic to the obtained fuzzy input values in order to produce fuzzy output. It has fuzzy-logic operations to work on a combination of multiple rules. g. An IF-THEN rule is then applied to each intermediate fuzzy output in order to compute a final output for each of these.

5. Fuzzy Logic Operations:

- Fuzzy AND (Intersection): Combines the transitional fuzzy sets to determine the intersection of the members of both sets.

- Fuzzy OR (Union): Fuzzifies individual sets to decide the membership values of fuzzy sets.

- Fuzzy NOT (Complement): Is used to calculate the inverse values of membership degree of fuzzy sets.

6. Aggregation: The final result from the inference engine is achieved by combining the results from the input passed to the inference engine to arrive at a single defuzzed result which is also the overall conclusion or decision. A popular approach in data aggregation may include max-min or max-average.

7. Defuzzification: In the exit of this architecture is shown defuzzification stage – the process of transforming the fuzzy output to the crisp value or decision. This involves the conversion of the fuzzy output into a crisp value and this is done by associating a mapping function to the fuzzy output's membership function; which may be by centroid or weighted average.

In short, the architecture of fuzzy logic system enables structured knowledge representation and manipulation of vague and imprecise quantity or data. Through their use of linguistic variables, membership functions, and fuzzy rules, fuzzy logic facilitates the design of intelligent systems to address distinct and typically non-linear real-world applications.

APPLICATIONS

A number of fuzzy logic is used in a range of fields because it can be effectively applied to deal with the uncertainty, imprecision, and complexity which exist in real-world systems. Some key applications of fuzzy logic include:

1. Control Systems: Fuzzy logic is a highly applied control approach in the non-linear systems where formulation of precise mathematical models is difficult for the system. Fuzzy control systems can respond efficiently to dynamic change in the underlying processes and environment in which the system operates. This can be demonstrated by examples of fuzzy logic-based temperature controllers, washing machine controllers, and the navigation system in vehicles.

2. Pattern Recognition and Image Processing: Computational intelligence uses the principle of fuzzy logic in classifying and identifying certain patterns of images and other data where there are insecurities or vagueness involving the features. Algorithms or categories of Fuzzy clustering like Fuzzy c-means method are used in determining of the groups to which the data items belong in terms of degrees of membership of the data items in the respective groups instead of defining strict boundaries. It is known that fuzzy image processing techniques are useful in achieving better image segmentation of features in such fields as medical image processing and robotics.

3. Automated Reasoning and Expert Systems: The fuzzy logic is one of these areas that are used in the design of intelligent systems and expert systems that perform reasoning and decisions similar to the human mind. Fuzzy rule-based systems acquire expert knowledge which is expressed in imprecise terms of natural languages for its application to the areas such as diagnostics, fault detection, and customer services.

4. Natural Language Processing (NLP): In NLP systems fuzzy logic is used to deal with ambiguities in the input human language and also to process the imprecision in them. It is necessary to note that fuzzy matching algorithms play an important role in the context of text retrieval and information retrieval as they can tackle some inconsistencies in the language and semantics. There are specific software programs that apply fuzzy logic in processing the contents to extract subjective opinions and emotions in such data.

ADVANTAGES:

1. Handling of Uncertainty: It is a type of reasoning that is most suitable in cases where the information provided or the inputs are not definite and may be ambiguous or insufficient. It is able to depict concepts that are mostly imprecise and also incorporate true values that do not only take Boolean values but rather degrees of truth.

2. Flexibility: This concept works around the idea of imprecision and can deal with complexity and nonlinearity of relationships in a much better way than the more formal, mechanistic truth. It allows for the manipulation of values and concepts that are inherently 'fuzzy' – which means that it works well with human characteristics.

3. Intuitive Representation: Fuzzy logic is a method which can be used to represent knowledge and make decisions in an easier and more human like manner by using natural language terminology. g. Abstract – Fuzzy logic is a mathematical soft computing modelling that has an ability to express itself in qualitative assessments such as "high," "low," "very hot," "not very cold"; it's a language familiar to the non-expert and hence allows for intuitive manipulation and interaction with a system based on fuzzy logic.

4. Robustness to Noise: The fuzzy logic systems are typically more noise tolerant and more resistant to the perturbations of the input data than classical methods working

with quantitative information. They can accept minor changes in inputs and some imprecision without a major impact on performance.

5. Adaptability: Fuzzy logic can be described as a self-learning system that can learn from feedback and other new data. They are useful in cases where the conditions cannot be easily predicted or are liable to change dramatically.

DISADVANTAGES

1. Complexity: This can make designing and tuning fuzzy logic systems very complex and time consuming when there are many and/or complex variables and huge numbers of rules. Designing neurofuzzy systems may demand significant domain knowledge and testing.

2. Interpretability: The main problem with fuzzy systems is that though it deals with a natural way of human knowledge expression with the use of linguistic terms, it is difficult to explain the behaviour of complex fuzzy systems. It is important to understand that deductive thinking might not be explicit in the decisions that are made.

3. Computational Overhead: Or in other words there are more hardware computations required to implement a fuzzy logic system as compared to traditional binary logic system. The computation time involved in the manipulation of fuzzy sets and the process of fuzzy inference can be substantial in the case of real-time applications.

4. Limited Formalism: Unlike conventional probabilistic methods or Boolean logic, fuzzy logic has a loose mathematical base. It can make formal analysis and verification of fuzzy systems tedious.

5. Overfitting and Generalization: Another issue that relates to overfitting and which affects fuzzy logic systems similar to other machine learning approaches, is the over-complication of the rule base and data training. There might be a performance of good or even medium generalization of the model on data that it has seen a problem.

3.1.2 RECOMMENDER SYSTEM

A recommender system is a particular type of technology tool or algorithm that is used to predict user preferences and generate and present them with relevant suggestions. It works through determining the preferences and behaviors of a large population and past or potential interactions with items, in order to determine which items are likely to interest a particular user. As such a recommender system works by finding correlations between users and items using data. It leverages this understanding in order to produce recommendations for items that will have an appeal to users. Such predictive capability is achieved through several methods, including collaborative and content-based filtering or its combinations using hybrid strategies. In practice, a recommender system typically involves several key components:

1. Data Collection: Collecting information on so-called behavior: purchases, clicks, preferences, ratings, etc.

2. Data Processing: This include parsing and processing of such data to obtain features that best describe various properties of user and items.

3. Algorithm Selection: Selecting the proper algorithms based on the type of data and the method of recommendation (for example either top-n, collaborative filtering, or both). g. Let it be the user based filtering (collaborative filtering), content based filtering or matrix factorization).

4. Model Training: Training the selected algorithms using historical data to acquire the models and discover the user-item relations.

5. Recommendation Generation: Training a model which will generate recommendations related to users based on their descriptions and current conditions.

TYPES OF RECOMMENDER SYSTEMS

Recommender systems are algorithms aimed at recommending products to users based on their interests and behaviours. Recommender systems based on different techniques have been proposed targeting to predict items which will be suitable to a specific user. Here are the main types along with examples:

1. Collaborative Filtering:

This approach is known as collaborative filtering and would arrive at items recommended based on other users who have similar preferences. It learns about the behavior of users based on their interactions with the items on the platform and predicts the preferences of other users who share similar behaviors. There are two types of collaborative filtering:

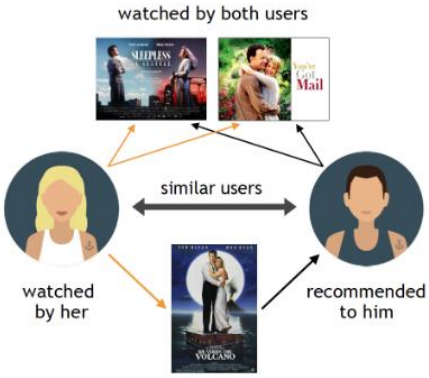

Figure 3.3 Collaborative Filtering

- **User-Based Collaborative Filtering:** Based on information from other consumers shows the user multiple items other individuals with who have a similar profile viewed or bookmarked. For instance, if the User A shows interest in the X, Y, and Z the movies then the User B and C who are interested in the same movies also might be interest in such movies and this might lead to the recommendation of such movies to the User A.
- **Item-Based Collaborative Filtering:** Supplies related products from the product variety of a user who likes the products listed by the dynamic collator. For example, if a shopper has purchased a particular book the system will recommend related books that are often purchased by purchasers of the initial book.

  Example: Two other well-known examples of community-based technologies are Netflix's movie recommendation algorithms and Amazon's product recommendations based on customer purchase histories.

2. Content-Based Filtering:

Content- based filtering algorithms predict individual items which are relevant by analyzing the preferences of a given set of users. This approach focuses on the description of the items rather than on the interaction of the user based on his or her preferences.

Figure 3.4 Content Based Filtering

Example: I chose Netflix and Spotify because, a movie recommendation platform or a music streaming site can recommend movies or songs depending on the genre, artist, or track characteristics (e.g., tempo, and mood) of songs that the user liked in the past. The model essentially captures associations between the moods that the user has previously liked.

3. Hybrid Recommender Systems:

Hybrid systems are designed on the principle that the best combination of collaborative filtering and content-based filtering techniques can be used to maximize the advantages of both approaches while eliminating the disadvantages [16]. Combining different principles can result in richer and better recommendations delivered by hybrid systems. For example: YouTube deploys a unique Hybrid recommendation system that first uses content-based filtering to recommend videos

based on their content and then uses collaborative filtering to recommend videos depending on individual users' viewing history.

4. Knowledge-Based Recommender Systems:

Collaborative filtering approaches suggest products to customers based on their inputs and absolute knowledge of the items. They may employ information from the user or the user established knowledge in a specific domain to recommend. For example: A travel planning site that is able to suggest travel destinations to the potential users based on their specific preferences regarding the travel destinations in terms of the budget, activities that they want to engage in during the travel period as well as the dates of travel.

5. Context-Aware Recommender Systems: Situational recommendation uses situational contextual information like location, time of day, user device and social situational personality context to recommend more relevant content to users.

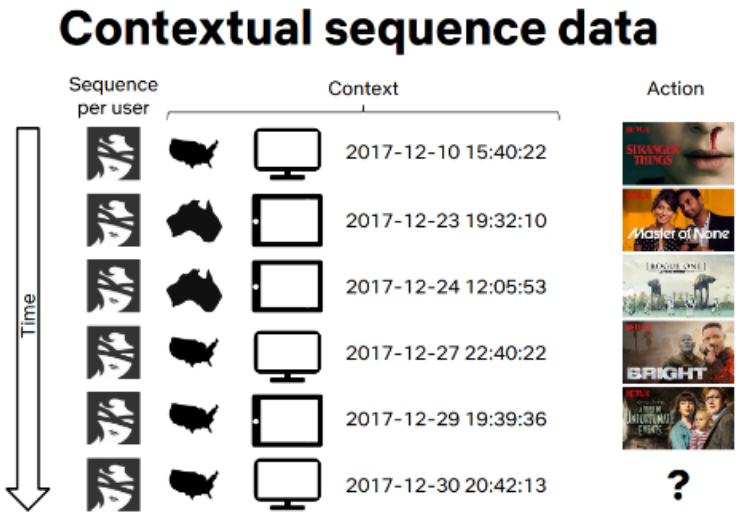

Figure 3.5 Context-Aware Recommender Systems

Example: Application providing information about restaurants nearby and at the same time considering time of day and location.

WORKING

Collaborative filtering is the process of employing user data and item content to provide individualized recommendations by the recommender system. It involves a number of steps and techniques that allow the understanding of user preferences and the prediction of the items that may be relevant to a particular user. Here's how recommender systems generally work, along with an example:

1. Data Collection: The first stage implies obtaining data concerning the user's behavior regarding the items. This data may include any aspect that portrays user's preferences such as ratings, reviews, purchases, clicks or any other activity that is relevant to the user.

2. Data Pre-processing: After data collection, it has to go through the pre-processing step for data transformation. This may involve filtering dirty data, imputing missing information, and converting the data into the appropriate analytical format.

3. Feature Extraction: In the case of content-based filtering, information describing items is derived. Such features can be either textual (the keywords or descriptions) or categorical (for example describing the genre or category of the resource), or continuous (such as documentary ratings or prices).

4. User Profiling: Profile modelling is a type of recommender which develops a profile of a user based on his previous behavior. This maybe something like creating vectors which define users liking and disliking or clusters of users who purchase similar products.

5. Algorithm Selection: There are various ways of curating these suggestions. Common algorithms include:

-Collaborative filtering: Such analysis helps classify possible users who may have similar tastes or activities and determine which activity they have engaged.

- Content-Based Filtering: Similar that suggest products based on the products that a user likes.

- Matrix Factorization: Result of bipartite matrix factorization to extract the latent factors from the user-item interaction matrix.

- Neural Networks: Recommender systems based on deep learning where machine learning models extract intricate image correlations from user item data.

6. Model Training: The algorithm used is trained on the input data after some pre-processing to be able to acquire the relationship between users and items. This is done through minimizing the errors of prediction while carrying on the model parameters.

7. Recommendation Generation: After the model has been trained the product recommendation can be provided to members in the group. For a single user the system assigns ranks indicating the items that the given user is likely to prefer based on the learned patterns and user similarities.

For example, let's think about a site like Netflix that streams movies over the Internet. Recommender system studies user activities like the rating and watch history of movie and inferred it from genre preference. It performs initial preprocessing on this data by cleaning and preparing the data in a given format required for the model. For the purpose of feature extraction textual descriptions become important features as does genres and user ratings. In collaborative filtering Netflix understands the users of similar movie tastes to recommend. For example, if User A has stated that he/she views and rates a particular set of movies positively, the system will try to find other users who have rated the same set of movies. It then suggests other films that rated highly by the previous similar users to User A. Content-based filtering system may also be employed where it suggests movies based on the genre or actors which the user has expressed an interest in. Netflix can thus identify the weakest link between the commercial, transactional, and relational in order to embrace a more effective means of generating recommendations that are tailored to individual preferences to enrich user experience.

ADVANTAGES OF RECOMMENDER SYSTEMS

1. Personalization: Recommendation engines offer customised suggestions to interest individual users. This personalization also increases user satisfaction, as it provides the content or products in a relevant context.

Example: Green also outlined a product recommendation service through which Amazon recommend items based on customers' web browsing history and purchasing history.

2. Increased User Engagement: Recommender systems are beneficial for users because they provide hints that extend users' attention on a product or digital items. This results in higher duration of sessions and more activities.

Example: User personalization of Spotify notifies users about the presence of new songs and playlists identical with the user's preferences and interest and allows them to find new songs without leaving the platform.

3. Discovery of New Items: Recommendation systems are such tools that assist users in finding new pieces of content or items that they would not have found otherwise. This can lead to greater discovery to the user and expansion of their interests.

Example: The algorithm of YouTube is responsible for suggesting people videos from different channels and topics they have never seen before.

DISADVANTAGES OF RECOMMENDER SYSTEMS

1. Filter Bubble: One of the criticisms A targeting recommender system faces is creating a filter bubble where the user will only see the content that they are interested or want to see. This can be restrictive and lacks the chance for a variety of occurrences.

Example: Social network site like Facebook may also present users' perspective by predicting which content it will recommend to them based on the content they liked or shared before; this may significantly lead to the user's entrapment in the echo chambers.

2. Over-Specialization: Recommender systems might encourage users to ignore broader genres of items in favor of specific groups of objects or services.

For example: A news recommendation system that will recommends only the news pertaining to that particular topic they are interested in and ignore other equally important news in the market.

3. Cold-Start Problem: Recommender systems can't base their suggestion on the data for new users or new items and imply arbitrary predictions for them. It can lead to users' frustration at the onset.

Example: A new user that just registered for a movie streaming service may not receive the best recommendations at start because of the learning-based disregarding system.

4. Privacy Concerns: It evokes concerns in privacy since personal data relating to users is collected in order to make recommendations automatically and without users being informed on what is done with their data.

3.1.3 ANDROID STUDIO

It is a prime integrated development environment use for development of android application. It is based on IntelliJIDEA. Android Studio offers best tools for editing and developing code. It also provides more features which will enhance the working and productivity while creating android apps. Few features include:

- An adaptable Gradle-based form framework
- A quick working emulator
- A bounded environment where development becomes easy
- Editing codes is easy and restarting of app isn't required.
- Importing codes is quick and easy.
- Associated with GitHub.
- Supported with NDK and C++
- Supported for platforms like Google cloud and engine, which makes integration easy.

Setting up Android Studio: Out of the few things, one easiest and comfortable aspect of android studio is, it can be developed on any operating systems whether Windows, Linux, Microsoft or Mac. Prior to implementation, these software's needs to be installed:

1. JDK Installation

JDK is basically an environment for software development which is used for creating Java Applications and applets. It also consists of JRE, loader, compiler documentation

generator, archive method and many other tools which would be needed for development of Java. So it's imperative to install JDK on the system. After this android installation can be done:

2. Android Studio

On webpage a link is easily available to download latest version of the Android studio. There are many tutorials on YouTube itself for the same. Once configuration is done, app development can be started.

Android Layout Design

For user interface designing of an app, layout is needed. It consists of several components such as:

- Main Action Bar
- View Control
- Content Area
- Split Action Bar

Their function is vital for the creation of tough applications. One more aspect that enhances user interface designing is view component.

Android and Java

Without a good knowledge of Java, developing android applications would become complex. Java is one of the most useful as well as in demand language. One of the prime reason is its management of memory which means that there is no need for the programmer to de-allocate the memory heap or get anxious about memory leaks. This makes the process productive and the programs to have less errors at runtime. Similarly, android is also memory managed environment.

The Main Menu Bar

This is the uppermost bar which can be virtually executed through actions and navigating its menus and sub parts. This bar cannot be hidden. But not many actions of menu bar doesn't get even used on the daily bases. They also have key shortcuts respectively.

The Toolbar

The toolbar consists of buttons for actions which are used quite often like Cut, Copy, Paste,

Undo and Redo. Additionally, it consists of buttons to different administrators inside Android Studio, including the SDK Manager and the Android Virtual Device Manager. There are buttons for Settings Run, Help, and Debug your application. Each button has its respective menu items as well as keyboard shortcuts.

Figure 3.6 Toolbar

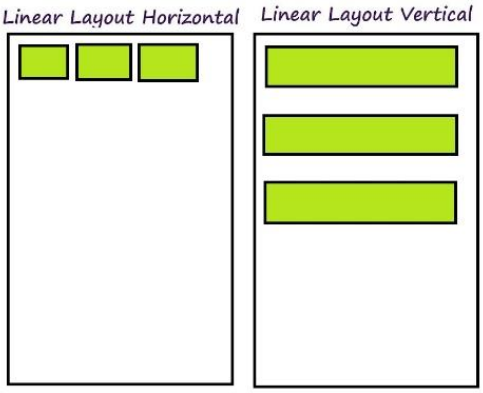

Figure 2.7 Types of Linear Layout

Linear Layouts

It basically displays the sub layouts side by side either in portrait mode or landscape. By this the list will have only a child per row irrespective of their width. Linear layout maintains margins amongst alignment and children per child.

android:layout_weight is an attribute which denotes a value which tells how much space it should cover on the screen. Larger the coverage area better it is to fill rest of the area in parent view. In this, default value of the weight is zero.

Relative Layouts:

This layout manages its children side by side by using relative properties. A much complexed designs can be created while using such layouts as there is a better control on the sub views and its placement.

Nested Layouts

Not only single but multiple layouts can also be used to create compound designs. For enhancing prior profile, nested view can be of great help by placing linear layout under relative layout. Online status label as well as a description field is also available.

Fragments

It is basically a part between the includable files as well as activities. There recyclable short codes of XML which are nearly same as include layouts. They have an additional advantage of business logic. They are considered to make the UI adjust to multiple forms. Both the files can be combined together using fragments which results in series of screens. When it comes to ListView and PersonAdaptor inside the MainActivity, the nested class needs to be extracted from top level classes.

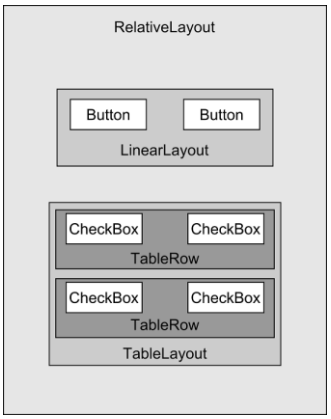

Figure 3.8 Relative Layout

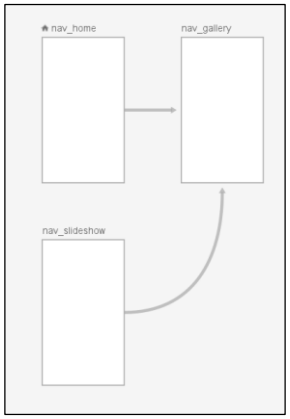

Figure 3.9 Nested Layout

Pull vs. Push Model

There are many old yet still working VCS models which depend on push model. This model has been working in industry for a decade, yet it has few limitations which is corruption of the single copy of the master branch while trying to use diffs as well as patch files. The actions which are taken to convert file source is represented textually and is known as patch files. When it comes to Git, it specifically follows pull model in which the project is considered as shared unit. Since distributed copies is allowed in Git, which comes under the master branch, any one is permitted to make changes in local copy during any time. This helps in reducing the complexity associated with mixing work amongst contributors.

3.1.4 ADOBE ILLUSTRATOR

It is basically a software app which is used to create artwork such as drawings as well as illustrations. It can be done on either of the operation system i.e. Windows or Mac. It has recently become a part of Adobe Creative Cloud. It is highly preferred by Graphic, Web professional designers as well as visual artist because of it premium quality product. It reduces a lot of time by having easy drawing tools for creation.

Illustrator CC

One feature that makes illustrator CC best from the lot is its capability to synch as well as save the work to the cloud. Behance is also integrated with it, in order to help creators to display their artwork and files. With time there has been a lot of changes when it comes to functionality like fonts and sync and color saving settings too. Illustrator CC has many capabilities which also include touchscreen tools for the modern versions.

USAGE:

Tons of digital as well as printed images which may include, illustrations, cartoons, diagrams etc. In this, creator may import the picture and then work on it. Recoloring of sketches or imitating another picture is also done. Text tool can be manipulated in many ways. Postcards or posters can be created using mixture of text as well as images. One of the most eye catch tool is to put the text around a bulge or curve. This enhances creator's work to a lot of extend. There are tons of tutorials to understand each and every tool in detail.

TOOLS:

There are tons of tools which make illustrator a hit. The side bar which is placed at the left part of the screen has numerous tools which can select item, create or draw as well as manipulate artworks. To name few: drawing, slicing, painting, symbolism, typing and zoom in zoom out. Maximum work in illustrator is done through basic tools such as selection, pencil/pen or paintbrush tools.

Selection tool: it is used to draw a layout organize or even adjust the artwork. It also helps to position and stack the objects perfectly. Additionally, selecting the tools and locking/hiding or even measuring is also done by selection tool.

Paint Brush Tool: it helps in modification of the look of the work. There are numerous types like: bristle, calligraphic, art, etc.

Pen Tools: for drawing straight or even curve lines and anchoring of points as well as delete those from root are functions of pen tool.

Pencil tool: in this you can use free hand for creating lines

Function of Illustrator in Creative Cloud

To access illustrator, some part is available for free and some tools need subscription. The artwork in this can be exported to other adobe applications for numerous functions like Photoshop or After Effects and Premium Pro. Sometimes creators draw an initial piece and send it to other applications for enhancement like animation, illustrations and mixing text.

Function of Vector Graphics in Adobe Illustrator

The quality of the product is unmatched when it comes to Illustrator. The creation of artwork has no relation with resolution of the display. Which means, the size of the image can be changed without affecting the image quality. Mathematical equations are used to show lines as well as arc or maybe more in the Adobe Illustrator. A vector reasonable is a lot of polygons that makes the image, which consist of set of vectors. Each vector goes through a space known as a center or control point, which has a described territory on the x and y hatchets on a plane. This center chooses the vector's way, which has various characteristics like tone, twist, fill, shape and thickness. The circumstance of vectors can be related to each other by mathematical conditions, which totally recalculate its position after image resizing. There is a difference in vector graphics when it comes to comparison of other imagine applications for instance, Photoshop in which pixel grids may be used to give image. This concept brings about a deficiency of picture quality i.e. pixilation, which helps Illustrator make much better for making huge pictures, for example, a board sign.

3.2 DESCRIPTION OF MODEL

The proposed system aims to develop an app-based solution that integrates fuzzy logic-based aptitude testing and collaborative filtering techniques to enhance educational and career guidance for students. The system will consist of two main components: Aptitude Assessment Module and Career Recommender System.

The Aptitude Assessment Module will be the cornerstone of the app-based solution, utilizing fuzzy logic algorithms to conduct comprehensive assessments of students' aptitudes. Cognitive abilities that will be covered under the module are critical thinking, problem-solving, analytical reasoning, creativity, as well as the corresponding facet of emotional intelligence. Students will be required to take a set of tests and answer quizzes that are battery of questions and tasks that are used to determine the competency of the students in the different spheres. The fuzzy logic algorithms will then process these responses as it incorporates the fact that human decision making process is often non-deterministic to give more accurate or more specific in describing the students' strengths and weaknesses. To answer the need for an aptitude assessment among students who view career planning as a puzzle that must be solved, the Career Recommender System will provide a function that will have an aptitude recommendation based on the collaborative filtering algorithm.

This system will connect to a database containing the information on a wide range of careers including various fields, career types, and job positions. Based on the common trends among students with the same levels of intelligence and formative educational experience, the system will show which career trajectories are more relevant for students [15] to pursue. The recommendations will be generated based on student performance in the entire school based on their preferences and interests. Design of the app would be simple and provide easy user interface for students to follow so they can access the aptitude tests, their results and view career recommendations. Also, there will be some methods of feedback so that students will be able to share their thoughts regarding the effectiveness of the assessments and the recommendations made by the app. This feedback loop will provide for better amendments and quality of information in the system for perfection. It will be available through web, cell phones and tablets to ensure that the site is easily reachable for the users. The proposed system along with the elements of the proposed system can be considered as a

combination of the elements of educational and career guidance including TGAT and applying the more active innovations of the technological and recommendation background.

In this work android mobile application that would help the user or the students of this age in the process of career path recommendation based on NEP 2020 announced by the Government of India. Agile Methodology will be adapted for continuous development as well as maintenance of the system.

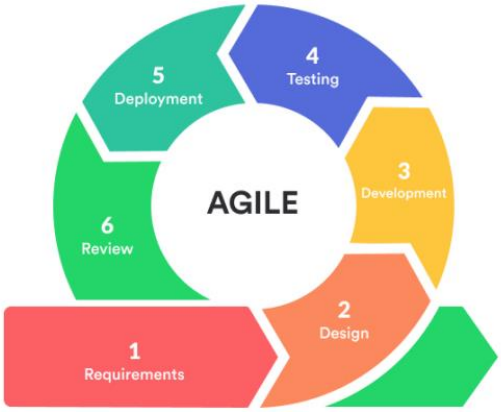

Figure 3.10 Agile Methodology

According to this methodology a project can be managed by breaking it up into several stages and continuous improvement and iteration at every stage. After subsequently gathering the project necessities, it is inspected regularly in the form of small iterations and made into action by executing it. The primary preferred advantage of this approach is that we can change the necessities or plan even in the middle of the project when the circumstances arises. Additionally, code maintenance is easier in contrast to Waterfall Approach. In Waterfall technique, there is no flexibility in changing the necessities when we build up the project since we must comprehend the working flow of the project at least 80% even before the beginning of the project and work accordingly in that direction. Only if the design process is done, we can move to development, testing, support and maintenance. Whereas, in Agile Methodology we can start the development part with around 50% knowledge of the work flow of the project and if any discrepancy occur in between we can handle that according to that particular iteration.

3.3 STATE DIAGRAM

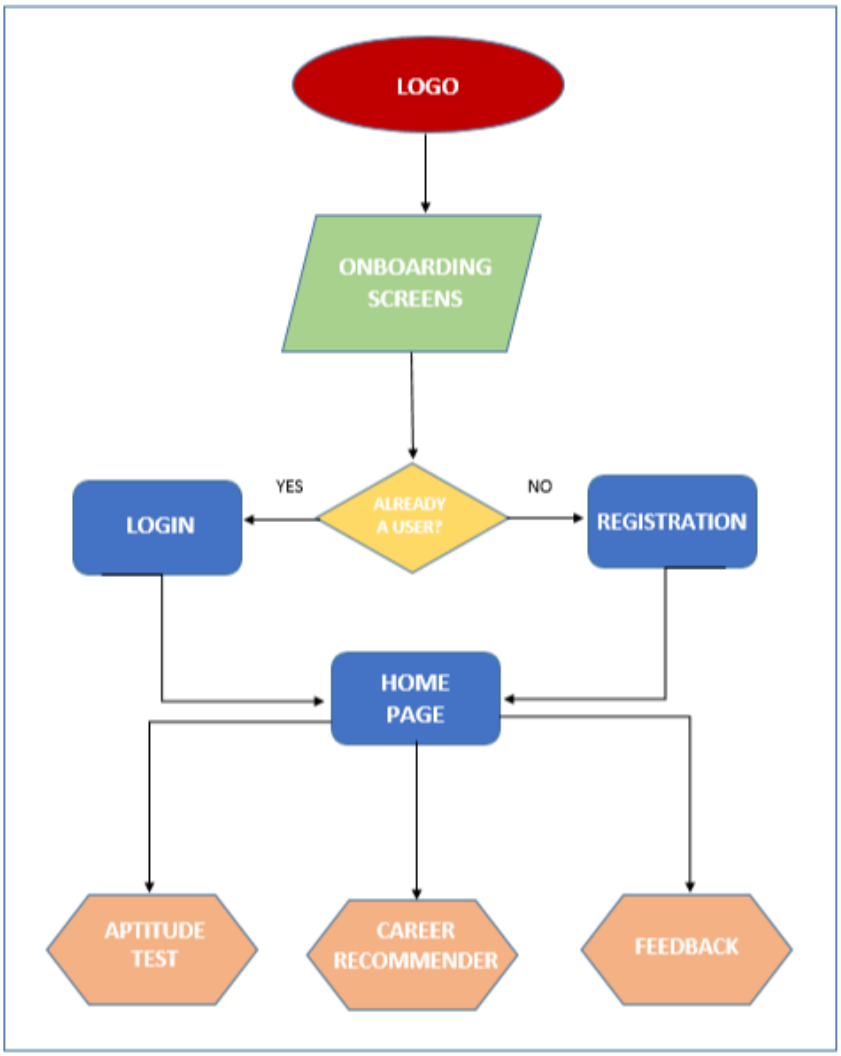

Figure 3.11 State Diagram

State diagram, is a UML behavioural diagram that shows the many states and state transitions of objects in a system. It depicts the life cycle of an object by representing the various states it can be in and the events that trigger transitions between these states. Each state represents a specific behaviour or condition of the object, and the transitions illustrate how the object moves from one state to another based on the occurrence of events. State diagrams help to visualize and understand the dynamic behavior of objects and the sequences of state changes that occur within a system.

CHAPTER 4 RESULTS

4.1 Designing and Development of Logo

Logo a huge part of the application's brand identity. This is the first thing that the people will look and snap judgements before even downloading the application. KnowToGrow has an aesthetically pleasing and explanatory graphical logo. An animated logo is opted rather than static logo as it seeks more attention of users and it also enhances entire presentation. It was created using Android Studio in which splash screen was implemented. Splash screen is basically a constant screen which has fixed limit of time which is used by the developer to display logo, advertising, etc. It generally displays when the application is launched first time or before the application loads entirely.

Figure 4.1: Design of Logo

4.2 Designing and Development of Screens

Screen designing was an important and initial part of the project development. It basically displays the designing area of the GUI. The basic concept of all the designing part is to show the layout. Each aspect should be seen in detail. The technical implementation is not the part of the screen designing. Different software was used to design these screens. **Development of screens** was done using software – Android Studio. It is specifically designed for Android app development. Considering the designs which were created for each screen, the development part was initiated. The entire coding part was done using Java language. There were many tools, tags and attributes which were used to create certain aspects of each screen.

4.3 Development of Onboarding Screens

Onboarding screen process is basically a series of pages which gives direction to user through interface of the application. Displaying onboarding/ walk through screens is very common in apps. For a continuous user engagement as well as success of application, developing an engaging first time positive experience is very crucial. Generally, it seen that user loses interest when the application is difficult to navigate of confusing. These screens provide an introduction to the application. Provided, these are initial set of screens which user interacts with and also tries to understand the application. There are basically three screens which describes the three prime parts of KnowToGrow i.e. Aptitude Test, Predictor and Chat panel. The purpose for creating these three screens are:

1. Inform the student about the functions as well as benefits of the application
2. Allow the user to register only after understanding the prime features.
3. Get a good user interface.

The UI is designed is aesthetic and catchy which would eventually attract users to use the application further.

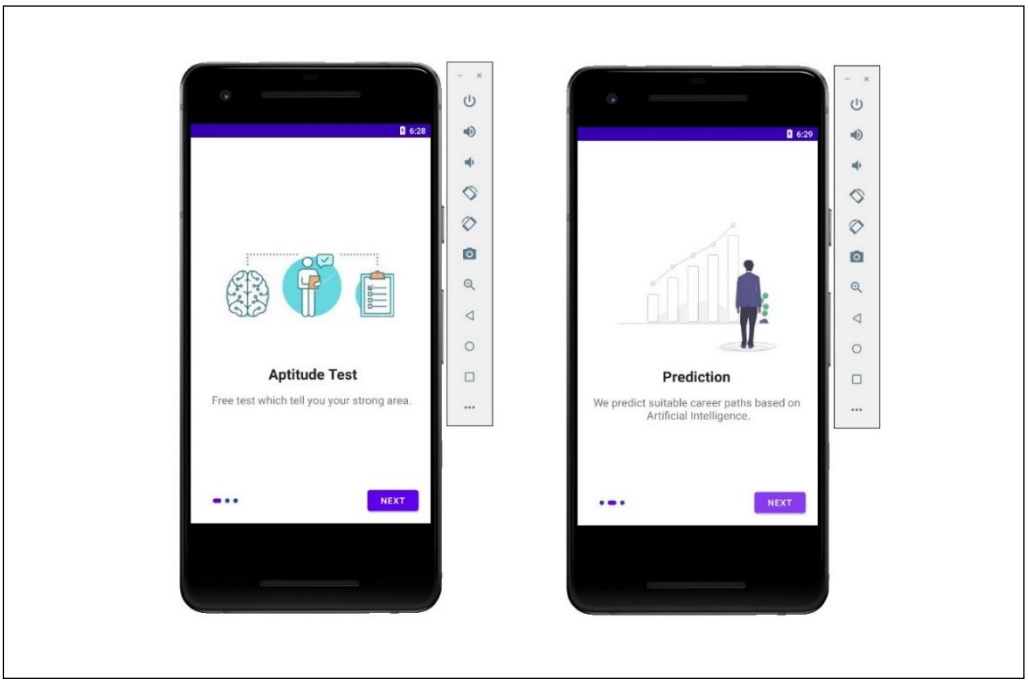

Figure 4.2 Onboarding Screens

4.4 UI and Development of Home Screen

The homepage is the area that people notice at the first look and decide their basic idea about a mobile app. This aspect is very important, as users should get to see a readable text and a positive user experience. So creating a nice user experience design and draw the users' attention was the prime concern. The home page begins with the tag line i.e. 'We think one step forward for you' and gives a short and crisp introduction to the app. This line perfectly describes the motto and functionality of KnowToGrow.

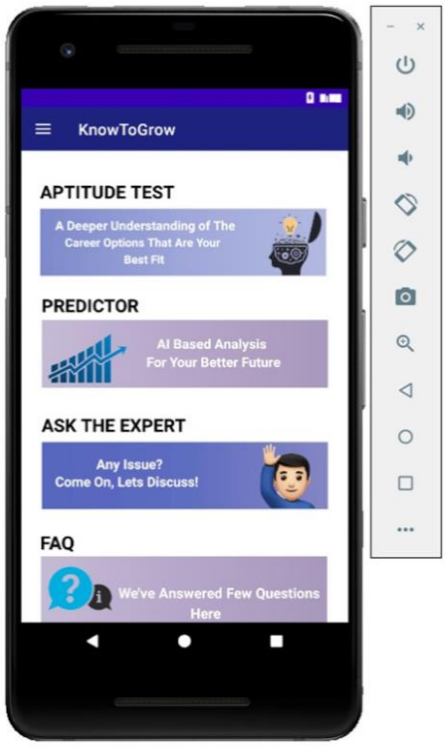

Figure 4.3: Home Screen UI (Scroll View)

Then in order to make it an easy user experience, we came directly to how the app can solve problems which is closely related to the functions/services the app provides. A layout is designed in such a manner that it precisely demonstrates the core classification of the features of the app in properly titled tabs and buttons which increases the user's urge to use further. RecyclerView is used to design the tabs. It provides a similar view as adapter based. ListView and GridView are two of its predecessors. RecyclerView has a lot better extensible framework and it also provides both horizontal as well as vertical layouts. The order of components on the home page is that it starts with the aptitude test option followed by predictor, then a chat panel named Ask the Expert and lastly Frequently Asked Question (FAQ). The home page consist of the four utmost important components of the application. But there are other small yet imperative features of the application. Those are available at the side bar. A side bar / navigation bar is provided for the user to explore features of the app.

4.5 Aptitude Test

The data used in the present study were derived from several research and studies. Initially, an appropriate optimal 60 questions quiz is constructed on the basis of the different genres and fields. The final database of result contains broad categorizations of fields, details, and requirements in getting into those fields, among other features. It will be created with the idea that the user will gain a percentage of whatever they do and brief descriptions of each category.

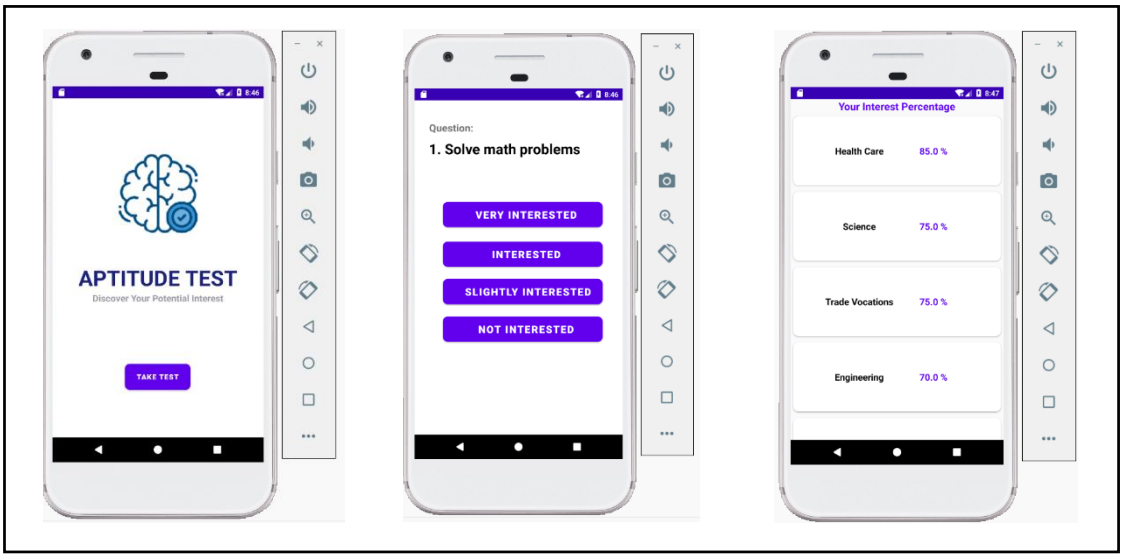

Figure 4.4: Aptitude Test Screens

In order to check the efficiency of the predictions made and to make sure that we are providing relevant information, we have created a survey using Google Form. To perform this test let me first ask you whether you agree with the top three streams as thou art diagnosed by the app. The options for feedback are: It was responded in a way like Yes/No/Partially. Moving forward, we dissect the feedback to arguably demonstrate the percentage of users that agreed, disagreed, or partially agreed with the forecasts presented in the feedback section as a pie chart. This enables us gain insight into how our app is performing; the need for any changes etc. Summing up, several remarks seem to be critically important after reading the feedback. First, many participants demonstrated that they found the top predicted stream appealing, meaning that users' preferences of content consistently matched the proposed app. This indicates that the utilized MCQ questions were posited appropriately to elicit the

respondents' preferences, which the app's algorithm sought to identify and interpret accordingly. Nonetheless, a significant number of respondents also supported the notion of predicted streams partly, which implies that they acknowledged the authenticity of those predictions, but also found some concerns where the predictions did not meet their expectations or failed to fully capture all aspects of their interests.

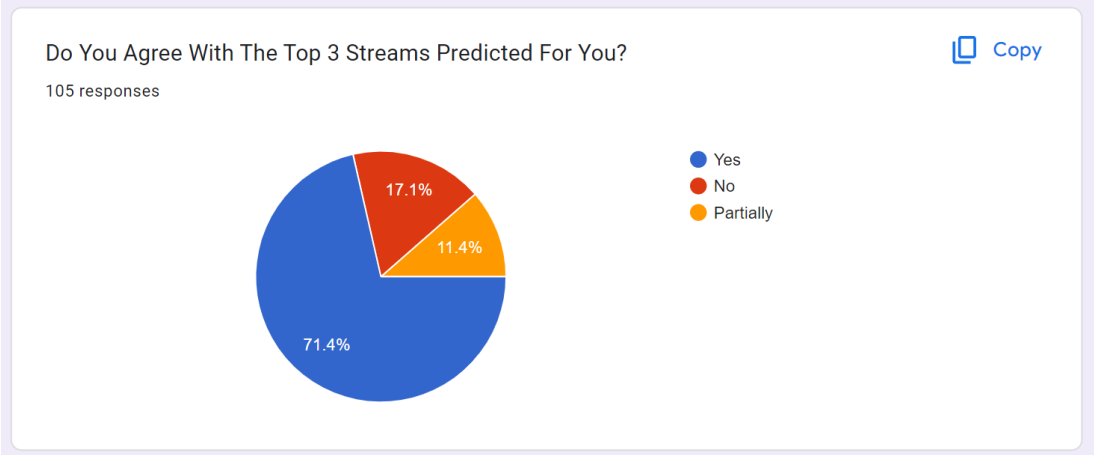

Figure 4.5: Pie Chart for Feedback Analysis

Additionally, some of the respondents opted to give narrative responses where they proposed recommendations for aspects pertaining to the calculative prediction exactitude and usability of the application. Improvement suggestions to the current process included adding additional filtering options, such as open-ended questions to capture more personal details about interests or streamlining the presentation of the streams so that the visualizations can be easier to interpret.

4.6 Career Predictor

Career prediction is a screen which uses analytical methods to display possible career paths to the students which depends on the subjects they have chosen. Collection of data was one of the prime task for this screen. An accurate set of data is prepared by considering different websites and books to collect the data. Teachers and experienced students were also consulted in order to get a detailed and legit information. The data consist of total seventeen subject choice given to students and further several career paths regarding each subject. The UI starts with a screen which gives students four drop down options to choose from 17 different subjects which are considered from all the three streams. Then to move further a submit button is there. Next is the loading screen. To add interesting user interface, a loading screen is designed in such a way that a thinking man is displayed which signifies that the app is thinking about the opportunities related to the subjects chosen by the user. After the screen gets load a result screen gets displayed showing different career options according to choices user has made.

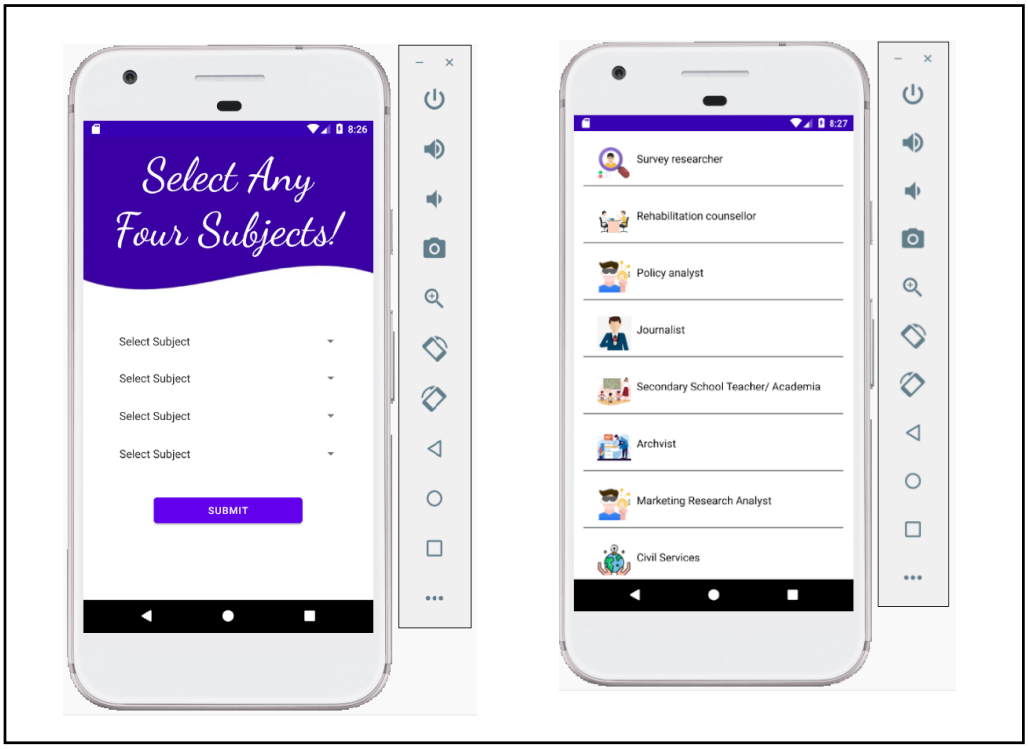

Figure 4.6 Career Prediction

4.7 Frequently Asked Questions (FAQ)

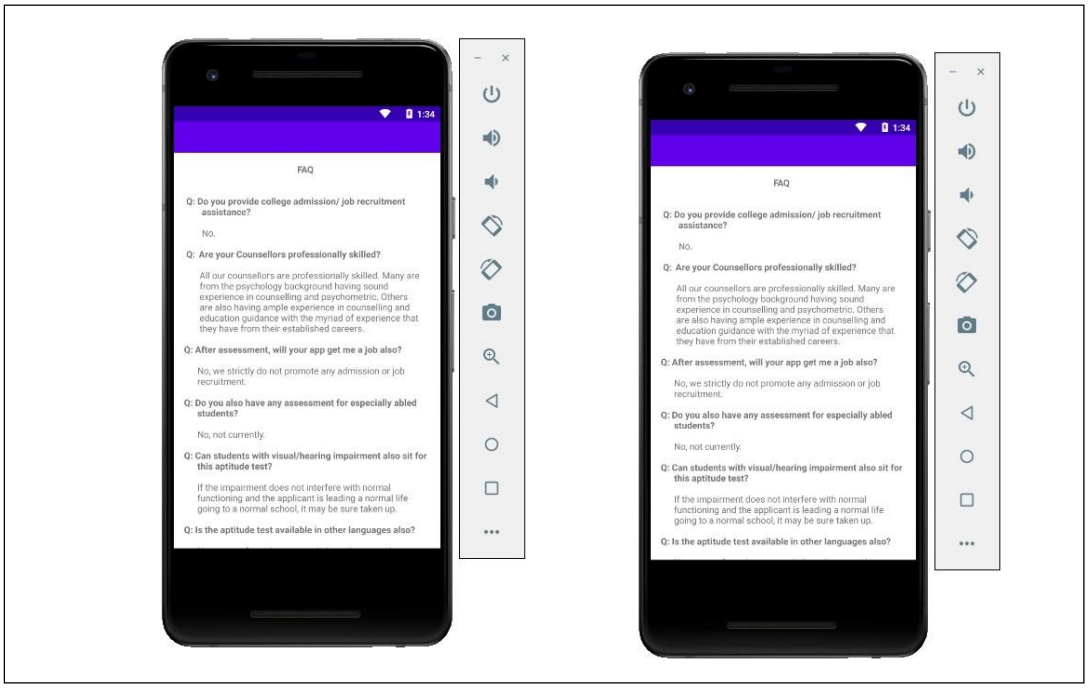

Figure 4.7 FAQ Section

Frequently Asked Questions (FAQ) section is a part of the application where common concerns, questions, and objections that customers might have about the application, are addressed. It helps us to connect with the users and bridge the gap. It acts as the first point of contact for customers looking for answers before they reach out to us directly with their questions. Therefore, FAQ is an imperative element of an application the content in the FAQ screen is high quality as well as relevant. For this, we first tried to contemplate the target user. Majority of the users will be young aging 14-17 years old. So using high level keywords or tough language will make them disinterested which will lead to their query getting unsolved. Due to this they won't be able to take the entire advantage of the application. Writing answers to the FAQs, we ensured to be concise and insightful. No fake information or promise is available. This will give users an interactive and satisfactorily experience.

4.8 Navigation Drawer

A sidebar or navigation bar is basically a widget-ready part which is used to display information which isn't the part of main home screen. In this application, the side bar/navigation bar starts with a header start. It displays the basic details- name and email address as entered by the user who has logged in. There are many application screens that lie in there, i.e. About Us: explaining the aim of the app, Contact Us: Displays the contactable details of the developers, Feedback: where user can share their experience as well as complaints and last is the Terms and Condition: where the company policies are described.

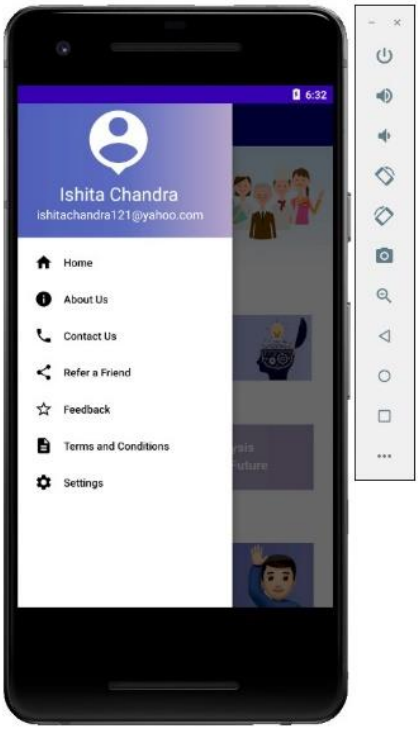

Figure 4.8 Navigation Drawer consisting other features

4.8.1 About Us

The about us screen consist of few lines are written which expresses applications KnowToGrow would provide in brief. It is developed in android studio using style technique. The designing is aesthetic and different from the theme of the application.

4.8.2 Contact Us

A contact page is a common screen on an application for users to contact the company or the individual in charge. If in case of large companies, the contact screen provides details of several other offices and departments linked. Although frequently asked question (FAQ) section is provided for details, yet there are few issues which the user might face and would want to get it discussed verbally. In this application, the screen contains more than one details: a mobile number, an email address and link to connect through Facebook (social media).

4.8.3 Terms and Conditions

Terms and conditions is an agreement with set of rules which user needs to follow or consider in order to avail the service. This screen serves the policies of the app. It basically provides a binding contract between the company and the user. These policies are specifically written according to the application. It states that we are the owner of the content present in application such as logo, database and images for user interface. Few points that lies in the agreement are: Limitation of liability, Copyright and Change clause.

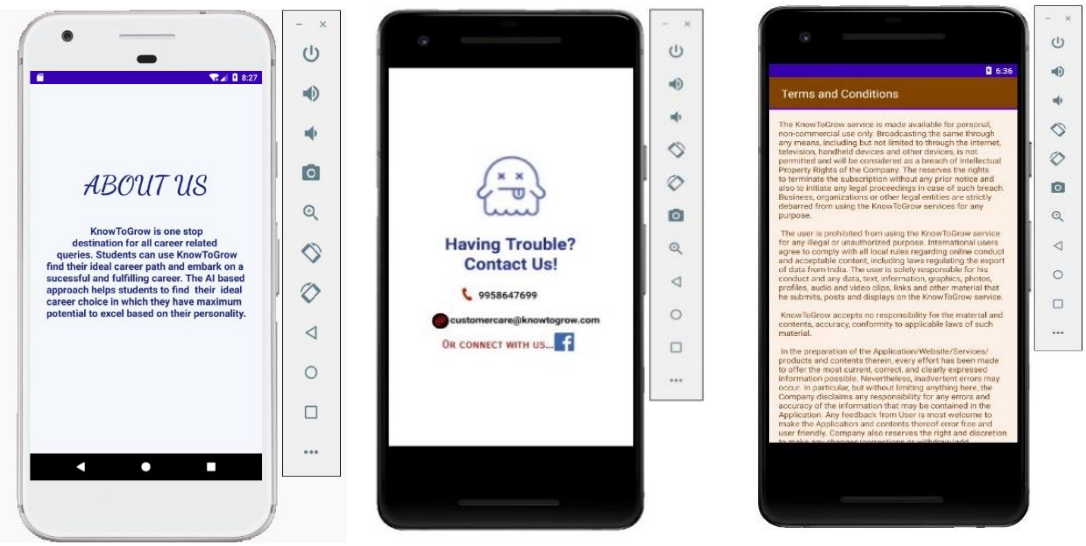

Figure 4.9 About Us, Contact Us and T&C Screens

4.8.4 Feedback

Feedback screen is where customer feedback is obtained. This is used to understand or determine which services that the company offers are users satisfied with and from which they aren't. The screen can also be used by the customer to express their happiness for the service. These comments encourage the developers to work harder. In the app we have used ask for review with rating bar. We tried to make everything very user friendly but still we always have a room for improvement, which is the reason a feedback form was created for the users to fill, in which they can tell us what they don't like about the application also what they want us to change.

By this we will be able to understand the user's perspective and then we will be able to improve the application. The result which to us through Firebase as the screen is connected to the Real-time database through firebase console. The real time database is a NoSQL database which is hosted by cloud which lets the developer to sync as well store information or data between the users in real time at a global scale. Also, to add touch of interesting user interface (UI), there's a rating bar in the feedback form through which the user can rate us by giving stars according to their satisfaction level.

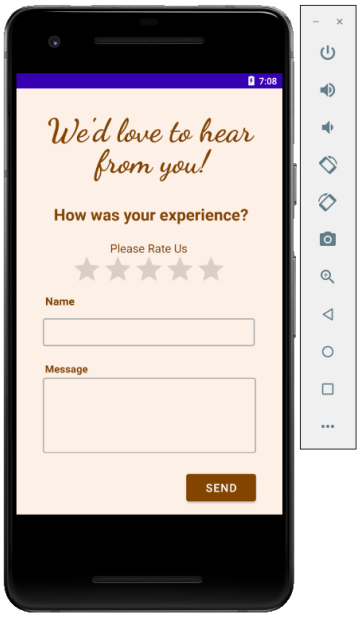

Figure 4.10 Feedback Screen

Figure 4.11 Backend Database

CONCLUSION

This flexibility is intended to encourage students to obtain a wide-ranging and inter-disciplinary learning while simultaneously raising concerns among students over questions as to what kind of combination of subjects will comply well with their strengths and the possible occupation they wish to pursue. This app is therefore a vital component that would help to guide and inform students on the choices to make. Imposing an aptitude test based on fuzzy logic the application helps to distinguish students' skills and interests with high accuracy. It gives the student an insight and also helps to know one's strength which may be of great importance in making the right judgment. Moreover, the career recommender system of the app is also based on the collaborative filtering concept and offers students a list of subject-related careers to consider. This personalization also boosts students' confidence in the decisions they make with regard to what subjects to study but also improves the educational system since students are guided to choose the best subjects to major in in light of viable careers that they may pursue.

FUTURE SCOPE

The overall utility potential of this project has a very promising future application. Firstly, being open source, the app can be constantly improved with the use of more and more information on the user, system's capabilities of predictions will be further increasing and providing even more customized and impactful advice. In other words, the app can add more functions to real-time news on new career opportunities and education resources and practice or internship applications for students as a more whole-student development tool. Other forms of industry collaboration include building partnerships with universities and other institutions that offer career guidance and counselling. In addition, the introduction of feedback functions will give users the opportunity to show their experiences and results, creating an opportunity for constantly improving the app's usability. Long term vision involves the transformation of the app into a comprehensive educational platform contributing to innovation and student support: providing mentorships, studying skills, and global market skills, in which students could feel comfortable and become active participants in their educational process.

REFRENCES

[1] P. Arsad, N. Buniyamin, and J. Manan, “Profiling the performance of electrical engineering bachelor degree students based on different entry levels,” International Journal of Education and Information Technologies, vol. 5, 2019.

[2] Al-Badarenah and J. Alsakran, “An automated recommender system for course selection,” International Journal of Advanced Computer Science and Applications, vol. 7, 2016.

[3] M. L. Waghmode and P. PJamsandekar, “Expert system for Career Selection: Theoretical Framework,” International Journal of Computer Science, vol. 4, 2016.

[4] D. Grewal and K. Kaur, “Developing an intelligent recommendation system for course selection by students for graduate courses,” Business and Economics Journal, vol. 7, 2020.

[5] N. Yorek and I. Ugulu, “A CFBPN Artificial Neural Network Model for Educational Qualitative Data Analyses: Example of Students’ Attitudes Based on Kellerts’ Typologies,” Educational Research and Reviews, vol. 10, 2015.

[6] K. Taiwo and K. Joshua, “Career Guidance Through Admission Procedures in Nigerian Universities Using Artificial Neural Networks,” International Journal of Advanced Research in Computer Science and Software Engineering, vol. 5, 2019.

[7] S. Ankit, K. Ashutosh, K. Sunil, K. Pardeep, and S. C. Durg, “Decision Support System for Determining Career”, vol. 4, 2022.

[8] O. A. Abisoye, I. Alabi, S. O. Ganiyu, B. O. Abisoye, and J. Omokore, “A web based career guidance information system for pre-tertiary institution students in Nigeria,” vol. 1, 2019.

[9] V. Balogun, A. Thompson, and M. Tech, “Career Master: A Decision Support System (DSS) for Guidance and Counseling in Nigeria,” Pacific Journal of Science and Technology, vol. 10, 2019.

[10] Ezenkwu, E. Johnson, and O. Jerome, “Automated Career Guidance Expert System Using Case-Based Reasoning,” Computing, Information Systems, Development Informatics & Allied Research Journal, vol. 8, 2017.

[11] R. Awasthi, “Typologies toward living things”, Journal of Science Education and Technology, vol. 9, 2015.

[12] S. Saraswathi, M. H. K. Reddy, S. U. Kumar, M. Suraj, and S. K. Shafi, “Design of an online expert system for career guidance,” The International Journal of Research in Engineering and Technology, vol. 3, 2023.

[13] M. Nawaz, A. Adnan, U. Tariq, F. Salman, R. Asjad, and M. Tamoor, “Automated career counseling system for students using cbr and j48,” Journal of Applied Environmental and Biological Sciences, vol. 4, 2022.

[14] T. Mehraj and A. M. Baba, “Scrutinizing artificial intelligence based career guidance and counselling systems: an appraisal,” International journal of interdisciplinary research and innovations, vol. 7, 2019.

[15] S. Sharma, S. Kumawat, and K. Garg, “Predicting Student Potential Using Machine Learning Techniques,” in International Conference on Innovative Computing and Communications: Proceedings of ICICC 2021, vol.1, 2021.

[16] Kamal, B. Naushad, H. Rafiq, and S. Tahzeeb, “Smart career guidance system,” in 2021 4th International Conference on Computing & Information Sciences (ICCIS), vol. 7, 2021.