Personalized Mobile Patient Guidance System for Early Detection and Management of Metabolic Syndrome

TMP-23-226

Final Project Thesis – Group

BSc (Hons) In Information Technology Specializing In Information Technology

Department of Information Technology

Sri Lanka Institute of Information Technology

Sri Lanka – **September 2023**

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Name	Student ID	Signature
Udayantha Yapa Y.M. S	IT20045708	
Dissanayaka D.M.R. A	IT20264048	
Peiris B.M. G	IT20147396	
Herath H.M.T. P	IT20147396	

The supervisor/s should certify the proposal report with the following declaration. The above candidates are carrying out research for the undergraduate Dissertation under my supervision.

Sanjeevi

………………………… …10/09/2023…

Signature of the supervisor Date

For:
Suriyaa (signed)

………………………………

Signature of the Co-supervisor

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Abstract

The development of a Mobile Personalized Patient Guidance System for Early Detection and Management of Metabolic Syndromes represents a pivotal advancement in healthcare technology. This mobile application offers a comprehensive and user-centric approach to health management. The methodology unfolds in a structured flow, commencing with users entering their personal and medical information into the system, which is securely stored to ensure data privacy. Users have the capability to regularly input health reports, enabling the system to continuously track and monitor their data. A distinctive feature of this application is its ability to assess the user's risk for the most critical diseases and determine their metabolic syndrome status through sophisticated backend logic and equations. Subsequently, the system calculates the weight of the highest risky disease, providing a quantitative representation of its severity in the user's health profile. This weight is then translated into a percentage status, aiding in the assessment of whether it falls within the low, medium, or high-risk category. Furthermore, the application computes tailored health diet plans and exercise regimens based on the user's unique health parameters. It goes a step further by calculating the approximate calorie intake for breakfast, lunch, and dinner, categorized by different age groups. These calculations adhere to a specific, scientifically validated method, ensuring precision in nutritional recommendations. The pinnacle of this methodology is the customization of health recommendations and suggestions according to the patient's individual details, such as age, gender, existing health conditions, and calculated disease risks. This personalization fosters effective disease prevention and management, empowering users to take control of their health proactively. In summary, this Mobile Personalized Patient Guidance System offers a groundbreaking approach to healthcare, integrating advanced technology, data analytics, and personalized guidance to enable early detection and effective management of metabolic syndromes. This holistic approach not only enhances healthcare outcomes but also promotes individual empowerment and engagement in health management.

Key words – management, health, metabolic syndrome, system

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List of Abbreviations

AI	American Indian
CF	Content based filtering
ACLS	Aerobics Center Longitudinal Study
CRF	Cardiorespiratory Fitness
METS	Metabolic Syndromes
IDF	International Diabetics Federation
SDG	Sustainable Development Goal
CVD	Cardiovascular disease
NCD	Noncommunicable disease
FAO	Food & agricultural organization
MAI	Mediterranean Adequacy Index
EHR	Electronic Health Record
DL	Deep Learning
HDL	High-Density Lipoprotein
LDL	Low-Density Lipoprotein
MetS	Metabolic Syndromes
HRQoL	health-related quality of life

1. Introduction

1.1 Background Context

Metabolic syndrome is a perilous affliction that impacts the human body through five primary factors:

1. Measurement of waist circumference for assessing abdominal obesity.

2. Elevated levels of fasting serum triglycerides.

3. Low levels of high-density lipoprotein (HDL) and elevated levels of low-density lipoprotein (LDL)or Cholesterol level.

4. Elevated blood pressure.

5. Increased levels of fasting plasma glucose.

Metabolic syndrome presents a heightened risk for major clinical maladies, such as cardiovascular disease, cancer, and certain types of diabetes. To effectively manage metabolic syndrome and reduce the potential for severe consequences, various recommendations and strategies have been advocated. One fundamental suggestion is the adoption of a healthy, well-balanced dietary regimen, replete with fruits and vegetables, complex carbohydrates, and prudent protein intake while minimizing saturated and trans fats. Consistent physical activity also plays a pivotal role, as it not only lowers cholesterol and blood pressure but also enhances glucose tolerance. Weight loss, achieved through a combination of proper nutrition and increased physical activity, can significantly improve metabolic function, especially in individuals grappling with obesity. Furthermore, smoking cessation and stress management techniques, such as relaxation exercises or meditation, hold substantial importance. Medical intervention may involve the prescription of medications to address elevated cholesterol, high blood pressure, and diabetes. Those afflicted with diabetes or prediabetes should maintain regular monitoring of their blood glucose levels. In essence, medical therapies aimed at ameliorating health conditions and bolstering overall well-being are seamlessly integrated with dietary modifications in the management of metabolic syndrome. A tailored plan can be collaboratively devised with the guidance of healthcare professionals to effectively address metabolic syndrome and reduce the risk of major complications.

Metabolic syndrome, characterized by a complex interplay of interconnected conditions, constitutes a formidable global health challenge with millions of individuals affected across the globe. It is intricately linked to severe ailments like type 2 diabetes, coronary heart disease, stroke, and more. Its hallmark features include elevated blood pressure, hyperglycemia, excess visceral fat accumulation, and aberrant lipid profiles. While conventional treatment modalities encompass pharmaceutical interventions and lifestyle adjustments, adherence to these regimens often proves challenging for many individuals. As technological advancements continue to reshape the landscape of healthcare, the concept of personalized health guidance systems driven by artificial intelligence (AI) and machine learning gains substantial traction. These systems harness individual health data to offer tailored, evidence-based support for chronic conditions like metabolic syndrome. Recognizing the potential of these AI-driven systems, this research proposal aims to evaluate the efficacy of a personalized automated health guidance system in the management of metabolic syndrome. The primary objective is to ascertain how such a system can enhance adherence to lifestyle modifications, mitigate risk factors, and ultimately enhance the quality of life for individuals grappling with metabolic syndrome.

To achieve this objective, a randomized controlled trial will be conducted to compare outcomes between those receiving individualized automated health counseling and individuals receiving standard care. Metabolic syndrome's intricate web of risk factors, including waist circumference, triglyceride levels, lipid ratios, blood pressure readings, and fasting glucose levels, underscores its potential to precipitate grave health consequences. Nonetheless, early identification and proactive intervention hold the key to prevention. The advent of mobile health technology presents an avenue for the development of personalized patient guidance systems, facilitating efficient management of metabolic syndrome. This research endeavor strives to create such a system, empowering patients to monitor vital signs, receive customized guidance, and track their progress towards adopting healthier lifestyles.

The intricacy of metabolic syndrome's underlying etiology, which encompasses genetic and lifestyle-related factors, underscores the imperative of adopting a holistic and personalized approach to its management. In essence, the convergence of these initiatives underscores the urgent need for comprehensive, tailored solutions in the battle against metabolic syndrome. As the prevalence of lifestyle-related diseases continues to soar, the development of innovative healthcare systems holds the promise of significantly enhancing the lives of individuals grappling with chronic conditions like metabolic syndrome. This research endeavor aspires to contribute to the growing body of knowledge and technology that will shape the future of healthcare and revolutionize the landscape of chronic disease management.

1.2. Literature Review

1.2.1 The Component of Offering highest disease risk profiling through patient-data analytics.

Obesity and diabetes, two key components of the metabolic syndrome, have been increasing in prevalence in the US over the past decade. This research paper, titled "**Natural polyphenols in metabolic syndrome: Protective mechanisms and clinical applications**," reviews the scientific literature on the potential of natural polyphenols as a therapeutic approach for metabolic syndrome. The authors explore the biochemical pathways involved in the beneficial effects of natural polyphenols and discuss their clinical applications in the prevention and treatment of metabolic syndrome. The paper highlights the potential of natural polyphenols in improving insulin sensitivity, reducing blood pressure, and lowering cholesterol levels, and provides valuable insights into the potential of natural polyphenols as a therapeutic approach for metabolic syndrome in patients with persistent and severe mental illnesses[4] .

While metabolic syndrome (MetS) has been associated with bone health, it remains unclear whether the factors that contribute to the development of MetS also affect bone density. This study aimed to predict bone mass loss using machine learning based on factors related to MetS. The study analyzed data from 23,497 adults who visited a health screening center three times between 2006 and 2014. Machine learning algorithms were used to predict the occurrence of osteopenia based on data collected during the first visit. The study utilized four machine learning algorithms (logistic regression, support vector machine, random forest, and extreme gradient boosting) to create predictive models based on a unique feature set. The models' predictive performance was evaluated using metrics such as accuracy, sensitivity, specificity, precision, F1 score, and area under the receiver operating characteristic curve.

The longitudinal study involved participants over the age of 20 who had received at least one routine health screening at the Center during each of three three-year stages/periods (i.e., 2006-2008, 2009-2011, and 2012-2014). The study eliminated those patients who lacked BMD testing data or who were identified as having osteopenia or osteoporosis (T score 1) at baseline (i.e., 2006-2008). The last assessment session for participants who had repeated screenings within the three-year period was chosen for the analysis. As a consequence, during the course of the nine-year period, three surveys and examination measurements for each participant were gathered. 23,497 people in all (13,012 men and 10,485 women) who satisfied the inclusion requirements made up our study dataset. During the second and third stages, respectively, 1402 and 1805 participants in the study population were identified as having osteopenia or osteoporosis. The dataset was examined using a random under-sampling (1:1 match) strategy due to a relatively low positive rate, and machine learning models were used to address the imbalance issue. Figure 1.2.2.0 depicts a flow chart of the data gathering procedure used to recognize the research participants and specify the analysis dataset[5].

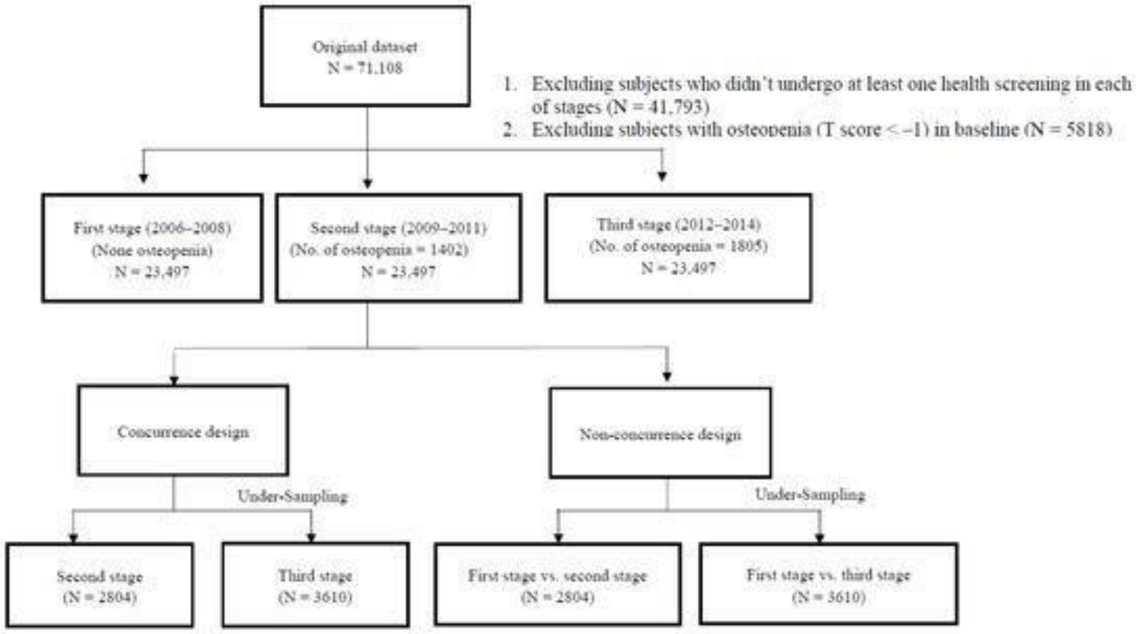


Figure 1:Flowchart of the data gathering procedure used to determine the analytical dataset and identify research participants..

Metabolic syndrome is a health condition characterized by the presence of multiple risk factors for cardiovascular disease, including high blood pressure, hyperglycemia, and dyslipidemia. These factors are related to insulin resistance and are believed to have a genetic component. The condition is often linked to weight gain, especially in cases of poor intrauterine growth or the accumulation of abdominal fat. Metabolic syndrome is common in individuals with partial lipodystrophy and spinal cord injuries, where muscle atrophy and a lack of subcutaneous adipose tissue may contribute to metabolic disturbances. Sleep disorders have also been found to cause metabolic disturbances by inducing neurohumoral changes and altering muscle fiber adaptation. Having metabolic syndrome increases the risk of developing both cardiovascular disease and type 2 diabetes, but it is a treatable condition. Reducing weight through diet, exercise, or anti-obesity medication can significantly reduce the risk of cardiovascular disease and lower the risk of developing diabetes by more than 50%. Some anti-diabetic medications have been found to improve insulin resistance, reduce lipids, and promote weight loss, making them potential treatments for metabolic syndrome[8] .

1.2.2 The Component of Tracking and Monitoring personalized Diet and Exercise Plans for Metabolic Health Optimization.

Metabolic syndrome is a complex health condition that affects a significant portion of the global population. Early detection and management of this syndrome is crucial to prevent the development of more severe health complications. In recent years, mobile patient guidance systems have emerged as a promising solution for managing metabolic syndrome by providing personalized guidance to patients.

One key aspect of these systems is monitoring and tracking. Monitoring involves the regular collection of health data, such as blood pressure, blood sugar levels, and weight, while tracking involves the analysis of this data over time to identify patterns and trends. By monitoring and tracking their health data, patients can gain a better understanding of their condition and make more informed decisions about their health.

The DIETOS Reminder module periodically reminds the user to update their profile, allowing the system to estimate the best food based on the user's current health status. The DIETOS History module detects possible incongruences related to newly entered values and stored data and provides the user with an automatic assisted procedure to manage their personal profile. Finally, the
DIETOS Foods Filter module advises the user on the foods compatible with their health status, specifying the correct quantity of each food that can be eaten without side effects. Unlike traditional recommender systems used in ecommerce, DIETOS builds a model for each profiled user, using their health information and food preferences, to suggest healthy foods. Overall, DIETOS provides a comprehensive and personalized diet management solution that can improve health outcomes. [1]

Metabolic syndrome is a prevalent and multifactorial health condition that poses a significant burden on individuals and healthcare systems worldwide. Early detection and effective management of this syndrome are crucial to prevent its progression to more severe and life-threatening conditions, such as diabetes, cardiovascular disease, and stroke. Recent advances in mobile patient guidance systems have shown promising potential for managing metabolic syndrome by offering personalized guidance to patients. Monitoring and tracking are crucial components of mobile patient guidance systems for managing metabolic syndrome. Regular monitoring involves the collection of various health data, including blood pressure, blood sugar levels, and weight, using mobile devices or wearables. On the other hand, tracking involves the analysis of the collected data over time to identify patterns and trends, providing patients with valuable insights into their health status and progress. By tracking and monitoring their health data, patients can be more engaged in their health management and make informed decisions about their lifestyle choices, medication adherence, and treatment plan adjustments [2].

Metabolic syndrome (MetS) is a multifactorial health condition that poses significant risks to individuals' physical and mental health-related quality of life (HRQoL). Various interventions have been explored to improve HRQoL, including lifestyle education on nutrition, physical activity, and healthy habits. This meta-analysis aimed to assess the effects of such a lifestyle intervention on HRQoL in adults with MetS. The study analyzed the Hedges' g and SF-36 score of observational, longitudinal, and randomized clinical trial (RCT) study designs. Seven RCTs were included in the meta-analysis, with a total of 637 study participants. The results showed significant improvements in both physical and mental dimensions of HRQoL scores in the intervention group compared to the control group, indicating that a lifestyle intervention significantly improves HRQoL in all its domains. These findings suggest that lifestyle interventions can be a useful approach for managing MetS and improving HRQoL in affected individuals. To examine the impact of a lifestyle intervention on the physical and mental HRQoL of individuals with MetS, this study conducted a meta-analysis of seven RCTs using the Hedges' g and SF-36 score. The results showed significant improvements in both physical and mental dimensions of HRQoL scores in the intervention group compared to the control group. These findings highlight the potential of lifestyle interventions in improving the HRQoL of individuals with MetS. However, further research is necessary to identify the most effective intervention strategies and assess their long-term impact on HRQoL. The study's findings suggest that lifestyle interventions should be considered as part of the management plan for individuals with MetS[3].

Metabolic syndrome (MetS) poses a significant risk to cardiovascular health and is also associated with other harmful conditions. In this literature review, the available evidence on the relationship between lifestyle changes and MetS is analyzed to provide recommendations for prevention and management. Weight loss through an energy-restricted diet and increased physical activity are effective strategies for preventing and treating MetS. A Mediterranean-style diet, which emphasizes the consumption of unsaturated fats, legumes, whole grains, fruits, vegetables, nuts, fish, and low-fat dairy products, along with moderate alcohol consumption, is an effective treatment option. Other dietary patterns, such as the Dietary Approaches to Stop Hypertension, new Nordic, and vegetarian diets, have also been suggested for MetS prevention. Smoking cessation, reduced consumption of sugar-sweetened beverages, meat, and meat products are also important. However, further research is needed to define the most appropriate therapies for MetS, as there are inconsistencies and gaps in the available evidence. In conclusion, adopting a healthy lifestyle is essential for preventing or delaying the onset of MetS and reducing the risk of cardiovascular disease and type 2 diabetes. The recommendations provided in this review should aid patients and clinicians in implementing effective lifestyle changes to prevent MetS and improve cardiometabolic health[4] .

1.2.3 The Component of Offering precision Health recommendations and suggestions based on Metabolic Syndromes.

Diabetes is on the rise among American Indian (AI) groups, which poses a significant public health risk. With concurrent improvements in excess weight and lower levels of exercise, the rate and frequency of diabetes have massively improved. In this article, they suggest a constructive approach for advising blood sugar level self-care to diabetics via artificial intelligence. Patients are encouraged to maintain a healthy routine to combat their blood sugar levels. They select smartphones as the platform to deliver intelligent personal care for AI individual patients to the almost universal usage of smartphones among the majority of AI tribes[1].

The system can provide tailored advice (for example, dietary patterns and regular exercise) according to the specific socioeconomic, social, as well as physiographic condition in general and especially to **Artificial intelligence - based** clients through embedding the existential resume of the Artificial intelligence-based customers with diagnostic obesity suggestions & recommendations. Mobile apps were used to achieve the proposed methodology. The efficiency of the system has been verified through research papers and classification and recognition confirmation.

A set of semantic rule sets and an annotation centralized repository serve as the foundation of the suggested system. The semantic level of expertise enhances patient characteristics with details on their diseases, interests, ethnicities, socioeconomic backgrounds, and characteristics of the environment. Today, a variety of recommendation systems have emerged to provide consumers with helpful healthy lifestyle suggestions for taking part in a particular task that will enhance their well-being, according to their present physical well-being and a collection of information obtained from their past and the histories of all other consumers who are equivalent to each other. We divide decision support systems into three different groups according to the techniques they employ: machine learning-based, interactive spam detection, and regulation methods.

They had developed two primary types of SWRL regulations for this venture: integer arithmetic policies and health piece of advice guidelines. The integer arithmetic method gathers accessible established information using equations like mathematical operations to infer implicit messages, including such definitions and values. The formula above, for instance, determines an Exergy efficiency (Estimated Power Needed) for just a non-active older man. The guideline that promotes well-being makes suggestions depending on cause-and-effect reasoning. This guideline, for instance, determines if a human's meal has more fat than is permitted.

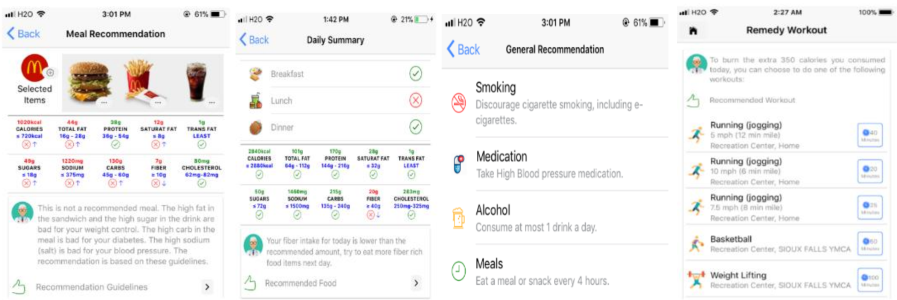


Figure 2:Some Screenshots of their Recommendation and suggestion System [1].

They found that in this cohort, the probability of getting Metabolic Syndromes increased with increasing BMI categories of normal weight, overweight, and obesity. This detected positive development resulted in a greater risk of mortality from all causes and CVD compared to males with body mass and metabolism. Nevertheless, when accounting for CRF, the greater risk of mortality was significantly reduced. despite one's body weight or the existence of Metabolic Syndromes, it seems that CRF has a neuroprotective effect against cardiac events. The quantity of exercise needed to get the amounts of CRF that were beneficial in this research is 30 min of moderate exercise on most days of the week, which is the amount of exercise presently suggested for wellness. Consequently, despite being overweight and having metabolic problems, our findings emphasize the value of continuing to lead an active lifestyle. Considering the increased risk of dying, individuals with low CRF levels should be the primary objective of health promotion efforts **[2] .**

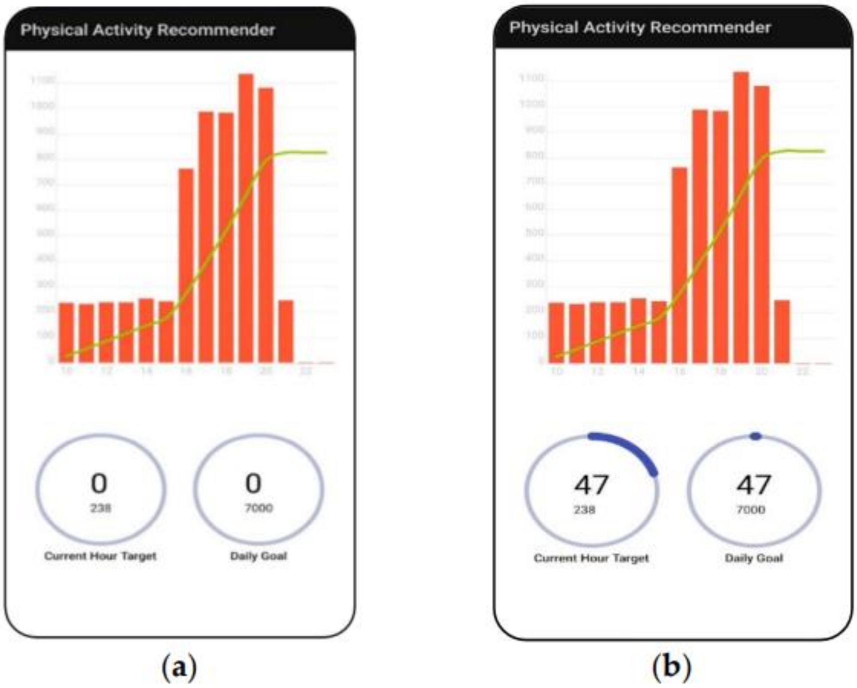


Figure 3:screenshot of a) suggested exercise schedule, b) progress monitor for steps[8].

The application opens daily step objective is represented by the left circular toolbar, and their daily movement objective is represented by the circular navigation bar. The smooth curves & graphs are generated automatically based on the time of day. The arc shows the mean step objective for each hour, while the graph displays the daily step counting goal for the hours needed. A specific suggestion to the individual user on the pattern inside the prior week has been made using the patient's daily step count that is kept in the Present in significant amounts. Demonstrates the step-counting status monitor, which records the user's steps via tracker sensors. To reduce user interaction, this program operates quietly. The prediction model provides information about the daily steps, movement differential, and total movements after each period of the day in addition to additional characteristics. Users want the applications to make recommendations regarding their actions depending on how they are feeling [6]. The recommendations may be items that are already included in the application, like perusing uplifting articles, receiving health advice, or keeping up with the latest information, or they might be items that customers have already enjoyed or marked as items that have succeeded for them.

Health and lifestyle are important factors that affect both good health and disease, disability, and even premature death. The current urban lifestyle is characterized by insufficient physical activity, junk food, and excessive stress levels, all of which undermine people’s well-being. Long-term effects of this lifestyle include health issues and diseases like diabetes, high blood pressure, obesity, strokes, and cardiovascular disease. This wellness app can learn about the subject, categorize her or him by analyzing some of her or his unique traits (physical attributes and lifestyle), and provide tailored recommendations to improve her or his well-being. By tracking the evolution of the defined features over time, the application can also provide feedback on their efficacy and act as a motivator for the client to pursue their wellness objectives**[9]**. **utilizing goals setting tools** - This is done to persuade them to choose to change their behavior or to keep it changed. This is accomplished through the employment of a reasoning module, which evaluates the wellness performance *indicators and determines what kinds of recommendations are required to guide the user toward the adoption of appropriate behaviors. For instance, if the Time spent per Week on Physical Activity Index is too low about recommendations, the app can advise increasing the amount of time spent engaging in physical activity.*

1.2.4 The Component of Handling Health Profile data and personalizing Health recommendations.

References to several research studies and journals were used to perform the literature survey. Here, a number of prominent studies are mentioned.

The current era is marked by the ubiquitous usage of mobile applications for managing weight and diet. However, it is noteworthy that the most popular apps have not been subjected to clinical experimentation and lack medical evidence to support their claims. Therefore, there is a crucial need for further research to assess the effectiveness of such apps for weight and diet management. Additionally, there is a scarcity of food recommender systems that offer users nutritional information regarding suitable food options while considering individual physiological status and environmental factors. This gap in research suggests the need for an adaptive diet monitoring and personalized food suggestion system, such as DIETOS, to bridge this gap and provide valuable insights to users regarding their dietary choices[1] .

DIETOS uses an adaptive questionnaire to ask users questions in order to infer their health state. The system gathers and examines information about the anthropometric, physiological, and clinical characteristics of users, including their age, gender, blood pressure, blood sugar levels, and medications. For the purpose of determining the user's health profile and protecting the user's privacy, the system automatically aggregates the data. A dynamic adaptive questionnaire is created by DIETOS using an automated process, allowing the user to choose the response rather than entering it in. The technology correctly identifies users' health profiles by selecting only pertinent questions linked to their actual health state. The technology then gives the user precise dietary guidance based on both their current health condition and the foods in the database that match that status. Also, DIETOS offers a reminder feature that prompts users to update their profiles on a regular basis. Based on the user's current state of health, the system can recommend the best foods by saving all modifications they make. The system creates a model specifically for each profiled user without needing to combine any of the health data from other profiled users. Lastly, to provide proper security during transmission and storage, the database is encrypted to safeguard the data kept within[1] .

The increasing availability of a diverse range of food options and changing lifestyles have led to an upsurge in the number of individuals facing challenges in making healthier dietary choices. This problem is further compounded by the escalating incidence of chronic diseases such as obesity and diabetes, which are largely attributed to unhealthy dietary habits. In response to this growing concern, various efforts have been made to provide effective solutions that address the issue of healthy eating. One such solution is the development of a recommender system that not only offers recipe recommendations tailored to the user's preferences but also takes into account their health status. This system could potentially provide an effective means of reducing the risk of chronic diseases by helping users make informed and healthier food choices[2] .

This system operates by allowing users to input their daily routine and food preferences, which are then used to generate personalized recipe recommendations. These recommendations not only aim to achieve a balance of calories but also prioritize the combination of healthy eating with the user's individual preferences. To ensure the quality of the recommendations, the authors employed a Content-Based Filtering approach, utilizing a modified version of the Matrix Factorization Technique.

To initiate the interaction with the system, users are required to log in using a standard login interface. If the user is a first-time user, they will need to register with the system. During this registration process, the system prompts the user to provide personal profile information, including height, weight, and daily routine activities. This information is then utilized to estimate the user's daily caloric needs.

The prevalence of obesity and related health conditions, including high blood pressure and cardiac disease, continues to affect a significant proportion of the global population. Meanwhile, the popularity of location-based services (LBS) and recommender systems is increasing due to advancements in mobile technology. However, there is currently a lack of suggestion systems in the health domain that focus on promoting healthy lifestyle choices. Fit You is a real-time LBS that generates dynamic recommendations based on the user's current location and health condition, utilizing preferences derived from user history and health information obtained from a biometric profile. Fit You builds upon a top-performing contextual suggestion system from the TREC 2012 and 2013 Contextual Suggestion Tracks, offering a novel approach to promoting healthy behavior[3] .

The user's health profile for the Fit You system includes several biometric measurements, such as age, gender, height, weight, neck, forearm, waist, hip, wrist, prevailing health conditions, and exercise preference (light, medium, or intense). Users can update their health profile as needed. However, to experiment using the TREC dataset, health profiles had to be randomly sampled, with the assumption that health profiles and interests are independent. Biometric measurements are then calculated based on the health profile, including Body Mass Index (BMI), Body Fat Percentage (BFP), and suggested weight using the J.D. Robinson formula, which takes into account weight, height, and other body circumference measurements. Users can choose to accept the suggested weight or manually set a target weight for themselves. These biometric measurements provide a foundation for the Fit You system to generate personalized recommendations for healthy lifestyle choices[3] .

Figure 4:screenshot of Mobile ui

This research paper proposes a novel approach to personalizing mobile fitness apps using reinforcement learning. The authors argue that current mobile fitness apps lack personalization and fail to provide personalized recommendations that align with the user's fitness goals and preferences. To address this issue, the authors propose a personalized fitness app that uses reinforcement learning to provide tailored recommendations to each user.

The proposed approach uses a reinforcement learning algorithm to learn the user's fitness goals and preferences based on their past behavior and feedback. The app then uses this information to generate personalized workout plans and recommendations, such as exercise routines, diet plans, and other relevant fitness tips. The app continuously learns and updates its recommendations based on the user's feedback and performance, providing increasingly accurate and personalized recommendations over time.

The authors conducted a user study to evaluate the effectiveness of their approach. The results showed that users who used the personalized fitness app had higher levels of engagement, satisfaction, and adherence compared to users who used a non-personalized fitness app. The authors conclude that their approach can significantly improve the user experience of mobile fitness apps by providing tailored recommendations that are aligned with the user's fitness goals and preferences[4] .

Clinical nutrition faces a significant challenge in translating the growing number of findings emerging from basic nutritional science into meaningful and clinically relevant dietary advice. Personalized and unbiased nutritional solutions for individuals or population sub-groups require consideration of many factors, from nutrigenomics to deep phenotyping. A comprehensive framework involving basic, clinical scientists and health professionals is necessary to implement these new findings at the population level. Given the overwhelming increase in the prevalence of obesity and related metabolic disturbances, such as type 2 diabetes and cardiovascular diseases, tailored nutrition prescription presents a promising approach for both the prevention and management of metabolic syndrome. This review aims to discuss recent works in the field of precision nutrition, analyzing the most relevant aspects that affect an individual's response to lifestyle/nutritional interventions. Advances in the analysis and monitoring of dietary habits, food behaviors, physical activity/exercise, and deep phenotyping will be discussed, along with the relevance of novel applications of nutrigenomics, metabolomics, and microbiota profiling. Recent findings in the development of precision nutrition will also be highlighted. Finally, this review will examine results from published studies that provide examples of new avenues to successfully implement innovative precision nutrition approaches [5] .

This study utilized artificial intelligence methods to establish an association model between metabolic syndrome and the traditional Chinese medicine (TCM) constitution based on individual physical examination data. The objective of the study was to provide guidance for medicated diet care. The study collected basic demographic and laboratory data from a health examination database in a regional hospital in northern Taiwan. Artificial intelligence algorithms, such as logistic regression, Bayesian network, and decision tree, were used to analyze and construct the association model between metabolic syndrome and the TCM constitution. The study found that the phlegm-dampness constitution (90.6%) had the highest risk of metabolic syndrome among TCM constitution classifications, and high cholesterol, blood glucose, and waist circumference were significantly correlated with the phlegm-dampness constitution. The study also discovered that patients with metabolic syndrome were older and shift work was a risk indicator. Based on the association model, metabolic syndrome can be predicted through the TCM constitution, and relevant medicated diet care schemes can be recommended for improvement. In conclusion, this study provides an innovative approach to predicting and mitigating metabolic syndrome through the TCM constitution. The findings suggest that nursing staff can provide nonprescription medicated diet-related nursing guidance information based on the prediction and assessment of the TCM constitution to increase the public's knowledge and methods for mitigating metabolic syndrome[7].

1.3 Research Gap

1.3.1 The Component of Offering highest disease risk profiling through patient-data analytics.

While there have been significant advancements in medical technology and data analytics, there is still a lack of effective and efficient systems for analyzing medical reports related to metabolic syndrome. Specifically, there is a need for a system that can accurately identify key data points and integrate machine learning or artificial intelligence algorithms that can analyze and interpret the data. Furthermore, the current methods for analyzing medical reports related to metabolic syndrome often require a significant amount of time and resources, which can be a barrier to effective patient care. This gap highlights the need for a comprehensive report analysis/scanning system that can efficiently and accurately analyze medical reports related to metabolic syndrome while also providing healthcare providers and patients with actionable insights that can inform treatment plans and improve health outcomes.

To address this gap, research will need to focus on developing a report analysis/scanning system that is specifically designed to meet the needs of patients with metabolic syndrome. This system will need to integrate advanced machine learning and artificial intelligence algorithms that can accurately analyze medical reports and provide healthcare providers and patients with insights that are tailored to their specific needs. Additionally, your research will need to focus on developing a user-friendly interface that can easily present the results of the analysis to healthcare providers and patients, as well as identifying potential barriers to implementation and developing strategies to overcome these barriers. By addressing these gaps, your research will play a critical role in improving patient outcomes for people with metabolic syndrome.

	Mobile apps for pediatric obesity prevention and treatment, healthy eating, and physical activity promotion: just fun and games [9]	Effectiveness of a Smartphone Application for the Management of Metabolic Syndrome Components Focusing on Weight Loss: A Preliminary Study [10]	Natural Polyphenols in Metabolic Syndrome: Protective Mechanisms and Clinical Applications [4]	Mobile phone applications and their use in the self-management of Type 2 Diabetes Mellitus: a qualitative study among app users and non app users [11]	Our proposed application
Integrate with mobile app	YES	YES	NO	YES	YES
Report analyzing In application	NO	NO	YES	NO	YES
Get in specifically data in users	NO	NO	YES	NO	YES
Using for metabolic syndrome	NO	YES	YES	NO	YES
Using algorithms gives better results.	NO	NO	NO	NO	YES

Table 1:Research gap 1

1.3.2 The Component of Tracking and Monitoring personalized Diet and Exercise Plans for Metabolic Health Optimization.

Nevertheless, the DIETOS system has a major flaw in that it only provides broad recommendations for people's diets without considering their unique requirements and health situations. This discrepancy calls for a more individualized strategy to food management, particularly for the high-maintenance individuals who suffer from metabolic syndrome. This research goal is to fill this void by creating a Customized Mobile Patient Guidance System that allows for precise monitoring of metabolic syndrome and prompt diagnosis and treatment. The theory behind this method is that it will lead to better health outcomes by giving patients more precise and time-saving instructions for managing their diets[1] .

Features	My Behavior [2]	DIETOS [1]	Proposed System
Personalized health feedback	✔	✔	✔
Physical activity tracking	✔	✔	✔
Dietary behavior tracking	✔	✔	✔
Integration of recommendation algorithms	✔	✖	✔
Use of sequential decision making algorithm	✖	✖	✔
User preference incorporation	✔	✖	✔
Calorie loss maximization	✖	✖	✔
Easy adoption of suggestions	✔	✖	✔
Statistical evidence of effectiveness	✔	✖	✔

Table 2:Research gap 2

1.3.3 The Component of Offering precision Health recommendations and suggestions based on Metabolic Syndromes.

Many models for recommendation systems for metabolic syndromes have been used in past research papers. However, it has some problems. I can also introduce novelties in advance. The literature review indicates that the identification of the issue with the existing system has been greatly aided by earlier studies. There are many drawbacks to not having an appropriate recommendation system for metabolic syndromes:

1. Clients may well not get an actual diagnosis or treatment services in the absence of a sound recommender. This can result in the metabolic syndrome being treated too slowly or ineffectively, which can cause major side effects like heart illnesses and strokes.[2],[3],[8].
2. Without a recommender, patients could not get the right care that is suited to their particular needs. Poor treatment results, such as inefficient patient care, insufficient management of risk variables, and lower quality of life, may result from this.[3],[8].
3. Without a mechanism for making recommendations, health professionals would find it difficult to recognize and effectively treat metabolic syndrome. Due to lengthier hospitalizations, repeated physician appointments, and pointless medical testing, this may result in higher healthcare expenses[7],[10].
4. With the right recommender, people can get instruction on managing their medications as well as lifestyle changes like diet and exercise. Users might not completely comprehend the value of

controlling metabolic syndrome or the best way to do so in an efficient manner without this instruction.[2]

5. Not user-friendly [7],[11].
6. Not user attractive [9], [1].

I have planning offer some essential ways to apply my part.

I have planned to apply,

- individualized advice
- diet plans
- Customized food and physical activity advice (With AI, nutritional and activity advice can be created or customized for those with metabolic syndrome. Ai systems can produce specialized suggestions by examining patient data, including biological details, metabolic profiles, and activity levels, and taking into consideration each person's particular needs and preferences.)
- daily reminders.
- AI-based risk prediction algorithms (AI can be utilized to construct appropriate risk forecasting models for prediabetes. These algorithms can combine a wide range of patient data, including demographic data, lifestyle factors, and biomarkers, to give tailored risk evaluation and inform prevention treatments.)
- inspirational messages
- specialized guidance for fitness Persons.
- AI-powered analyzer (Compared to conventional approaches, AI can aid in the earlier and more precise diagnosis of metabolic syndrome. Ai systems, for instance, can examine MRI or CT scans of the body to look for indicators of illnesses connected to metabolic syndrome, including a condition known as fatty liver.)
- medication schedules and other lifestyle modifications.
- AI-based drug development (AI can be used to find novel medications or reuse ones that are already on the market to treat obesity in metabolic syndrome. For instance, AI systems can examine enormous chemical collections to find those with potential therapeutic qualities or can find new pharmacological targets according to the established biological mechanisms of medical therapies.)
- the system will be able to modify and improve its suggestions.
- Creating more precise risk forecasts (By examining massive data of medical and genetic data, Ai systems can be utilized to create more precise risk statistical models) by using **goal-setting tools and tracking technologies.**

	Previous	Our system
Used technologies and predicting disease.	Only using Deep learning or Machine learning [8],[11],[12] and electronic health records to diagnose disease [10].	Using **Machine learning, Deep Learning and Artificial Intelligence, tacking technologies and goal setting tools.**
Scalability range	previous mobile apps give health recommendations based only one disease [1],[11],[12].	My system gives health recommendations based **5 diseases including.** • **Low HDL and high LDL levels (Cholesterol)** • **Abdominal obesity** • **elevated triglycerides level** • **high blood pressure** • **Elevated plasma glucose level.**
Predicting the weight of the disease	Not used proper predicting method [12].	My system Gives health recommendations and suggestions based on the risk Weight of the prediction. **Found five accurate formulas with the special doctors and nutritionists** to predict the weight of the disease. **ABDOMINAL OBESITY** Percentage Rate = ((Age Value / Age Threshold) * Age Weight) + ((Weight Value >= Weight Threshold) * Weight Weight) +((Height Value >= Height Threshold) * Height Weight) **CHOLESTOROL LEVEL** Percentage Rate = ((Age Value / Age Threshold) * Age Weight) + ((fbs Value >= fbs Threshold) * fbs Weight) +((thalach Value >= thalach Threshold) * thalach Weight) **HIGH BLOOD PRESSURE** Percentage Rate = ((Age Value / Age Threshold) * Age Weight) + ((fbs Value >= fbs Threshold) * fbs Weight) +((thalach Value >= thalach Threshold) * thalach Weight) **HIGH BLOOD SUGAR** Percentage Rate = ((Age Value / Age Threshold) * Age Weight) + ((BMI Value / BMI Threshold) * BMI Weight) + ((Glucose Value >= Glucose Threshold) * Glucose Weight)

		TRYGLISARIDE LEVE Percentage Rate = ((Age Value / Age Threshold) * Age Weight) + ((BMI Value / BMI Threshold) * BMI Weight) +((TG Value >= TG Threshold) * TG Weight)
Use predicting Levels.	Past research did not use proper predicting levels	**In my system gives suitable health recommendations from using Low , Medium and High levels .** Abdominal obesity ❑ low than (-2.5) = give low health recommendations ❑ (-2.5) to (4.0) = give medium health recommendations ❑ more than (4.0) =give high health recommendations Cholesterol ❑ low than 15 = give low health recommendations ❑ 15-25 = give medium health recommendations ❑ more than 25 =give high health recommendations High blood pressure ❑ low than 15 = give low health recommendations ❑ 15-25 = give medium health recommendations ❑ more than 25 =give high health recommendations High blood Sugar ❑ low than 15 = give low health recommendations ❑ 15-25 = give medium health recommendations ❑ more than 25 =give high health recommendations Triglyceride level ❑ low than 15 = give low health recommendations ❑ 15-25 = give medium health recommendations ❑ more than 25 =give high health recommendations

Table 3:Research gap 3

1.3.4 The Component of Handling Health Profile data and personalizing Health recommendations.

Research /Product	Scanning medical reports to obtain the user's medical history to the health profile.	Providing dietary plan / Dining suggestions	Providing fitness plan	Having a chatbot feature
Personalizing Mobile Fitness Apps using Reinforcement Learning[10]	NO	NO	YES	NO
DIETOS: a recommender system for adaptive diet monitoring and personalized food suggestion[1]	NO	YES	NO	NO
FitYou: Integrating Health Profiles to Real-Time Contextual Suggestion[3]	NO	YES	YES	NO
Health-aware Food Recommender System [2]	NO	YES	NO	NO
METABOLIC MATE	YES	YES	YES	YES

Table 4:Research gap 4

1.4 Research Problem

1.4.1 The Component of Offering highest disease risk profiling through patient-data analytics.

Finding out how effective such a system is in managing illness and improving health outcomes for those with metabolic syndrome may be the research topic for a tailored automated health guidance system for those with the condition.

A cluster of symptoms known as metabolic syndrome raises the risk of heart disease, stroke, non-alcoholic fatty liver disease, peripheral vascular diseases, MI, and type 2 diabetes. The illness is typically characterized by symptoms such as elevated blood pressure, high blood sugar, excess body fat around the waist or BMI, and elevated cholesterol or triglyceride levels. The typical treatment for metabolic syndrome includes medication and lifestyle changes such dietary and exercise adjustments. However, it can be difficult for many people to continue adhering to these interventions.

The aim of the study is to investigate if employing an automated, customized health guidance system can support individuals in managing their metabolic syndrome by providing them with the knowledge and assistance they require to improve their health outcomes. The research would examine how successful the system is in terms of adherence to lifestyle modifications, adjustments in vital signs, a reduction in the risk of complications, and an increase in quality of life.

The aim of the study is to evaluate the effectiveness of the personalized automated health guidance system in assisting individuals with metabolic syndrome to control and better their condition while also obtaining tailored, real-time, and evidence-based assistance.

Creating a complete system that can quickly and properly assess medical information pertaining to metabolic syndrome is the aim of your study. This system will need to be created with the ability to recognize important data points and incorporate machine learning or artificial intelligence algorithms that can understand and analyze the data. Your research's objective is to determine the most efficient methods for scanning and analyzing these reports and to create a user-friendly interface to deliver the findings to healthcare professionals and patients.

Research will also need to address possible issues with report analysis and scanning, such as data security and privacy, the lack of or incompleteness of data, and ensuring that the system can interface with current healthcare infrastructure. In order to accomplish these objectives, you might need to undertake a review of the most recent academic publications to find the finest techniques and cutting-edge tools for report analysis and scanning. The report analysis/scanning system must also work well with the other elements of the personalized automated health advice system; therefore, you will need to work closely with the other team members to make sure of this.

In addition to developing the report analysis/scanning system, your research will also need to evaluate the effectiveness of the system in improving patient outcomes. This evaluation will need to include identifying key metrics that measure the impact of the system on patient adherence to lifestyle changes, changes in vital signs, the risk of complications, and improvements in quality of life. To measure these metrics, you may need to conduct a randomized controlled trial or a retrospective study of patients who have used the personalized automated health guidance system.

Overall, your research will Play critical role in the development of a personalized automated health guidance system for people with metabolic syndrome. By developing a comprehensive report analysis/scanning system, you will help ensure that patients receive the best possible care and support, which will ultimately lead to improved health outcomes and a better quality of life.

1.4.2 The Component of Tracking and Monitoring personalized Diet and Exercise Plans for Metabolic Health Optimization.

The necessity for an efficient and individualized strategy for the early detection and management of metabolic syndrome is the driving force for the proposed research project. The risk of acquiring cardiovascular disease, type 2 diabetes, and other chronic illnesses is greatly increased in people with metabolic syndrome, a group of interrelated medical issues. The development of these long-term conditions can be averted with the early diagnosis and treatment of metabolic syndrome.

For patients to keep track of and properly deal with the risk factors associated with metabolic syndrome, there are currently too few resources accessible. Seeing a doctor or keeping track of symptoms on one's own at regular intervals is a common practice, although it can be inconvenient for patients and may not yield useful insights for treatment. Inadequate diagnosis and treatment of metabolic syndrome can contribute to the onset of chronic illness and higher medical expenses.

This research gap will be filled by the proposed Customized Mobile Patient Guidance System for Early Diagnosis and Treatment of Metabolic Syndrome, which would offer a tailored and effective method for keeping tabs on and lowering risk factors associated with metabolic syndrome. Patient information will be analyzed by machine learning algorithms and scanned reports to provide custom diet, exercise, and medication plans. As a result, patients will have a better chance of avoiding serious health complications and experiencing a more favorable outcome from treatment.

1.4.3 The Component of Offering precision Health recommendations and suggestions based on Metabolic Syndromes.

The term "metabolic syndrome" refers to a group of related illnesses, such as high blood pressure, high blood sugar, excess body fat around the waist, and excessive cholesterol or serum triglycerides, rather than a single disease. The biggest issue with metabolic syndrome is how much more likely it makes people get catastrophic illnesses like type 2 diabetes, heart disease, and stroke. Significant disability, a decline in quality of life, and early mortality can all result from these illnesses. Also, individuals with metabolic syndrome frequently have insulin resistance, which indicates that their systems have trouble adequately utilizing insulin, resulting in elevated blood sugar levels and a higher risk of developing insulin. Although the precise cause of the metabolic syndrome is unknown, it is thought to be a result of a genetically predisposed condition as well as environmental variables such as poor diet, inactivity, and obesity. Metabolic syndrome is often treated with drugs to control specific risk factors, such as high blood pressure or high cholesterol, as well as lifestyle changes like increased exercise and a nutritious diet.

A lack of appropriate ideas and recommendation systems for metabolic syndrome can result in several problems, such as:

1. Accurate diagnosis is more likely without an AI-based health recommendation system, which increases the risk of delayed or ineffective treatment. This can significantly worsen a patient's health state and perhaps lead to fatalities.

2. Because everyone has different health needs, a one-size-fits-all approach to healthcare is ineffective. Based on a person's medical history, lifestyle, and other health-related data, an AI-based health recommendation system can offer tailored advice.

3. Due to their numerous duties, doctors and other medical experts may not have enough time to thoroughly review the available medical data and formulate the most appropriate suggestions. Large amounts of data can be promptly analyzed by an AI-based health recommendation system to give healthcare professionals pertinent insights and recommendations.

4. Healthcare practitioners may rely on trial-and-error techniques that can result in expensive and needless testing and treatments in the absence of an AI-based health recommendation system. By offering more precise and effective diagnoses and treatment plans, artificial intelligence can help lower healthcare expenses.

5. The lack of AI-based health recommendation systems can make access to healthcare in some locations even more difficult. Patients in places without access to medical facilities or staff can receive remote diagnosis and treatment thanks to AI-based technologies.

Some Real-world health issues:

- Cardiovascular disease: The chance of developing cardiovascular diseases, such as heart disease and stroke, is increased by metabolic syndrome. This is due to the possibility of blood vessel damage and atherosclerosis when high blood pressure, high blood sugar, and abnormal cholesterol or triglyceride levels are present [11].

- Diabetes type two - Metabolic syndrome poses a considerable risk for the onset of diabetes type two. The metabolic syndrome's high blood sugar levels can eventually cause insulin resistance and diabetes [13].

- Non-alcoholic fatty liver disease (NAFLD) [5] - The metabolic syndrome is linked to a higher chance of developing NAFLD, a condition in which extra fat accumulates in the liver. This may result in liver scarring and inflammation, which could ultimately cause liver failure.

- Sleep apnea- Metabolic syndrome is associated with a higher chance of developing this illness, which causes frequent pauses in breathing while you sleep. This may result in unsatisfactory sleep and other health problems [14].

- Chronic kidney disease and end-stage renal disease are two kidney diseases that are more likely to occur as a result of metabolic syndrome. [12], [4].

- Heart failure is one of the metabolism syndrome's most prevalent side effects. Cardiovascular disease, which can cause a stroke or heart attack, is more likely to occur in those with metabolic syndrome. Almost 650,000 Americans lose their lives to cardiovascular disease each year in the U.S., according to the American Heart Association. [11]

As a result, it's critical to have appropriate metabolic syndrome suggestions and suggestion systems to enhance health outcomes, raise awareness, deliver effective treatment, enhance the quality of life, and save healthcare costs.

High blood pressure, excessive blood sugar, increased body fat around the waist, and abnormal cholesterol or triglyceride levels are all symptoms of metabolic syndrome. A higher risk of cardiovascular disease, type 2 diabetes, and early death is linked to metabolic syndrome. Depending on the population and the particular illness under consideration, different metabolic syndromes have different fatality rates. For instance, it is thought that around one-third of adults in the United States have metabolic syndrome, which is linked to a higher risk of death. According to a 2019 study that was published in the Journal of the American College of Cardiology, people with metabolic syndrome had a 1.5 to 2 times higher chance of developing cardiovascular disease and a 1.2 to 1.5 times higher risk of dying from any cause [11].

The fatality rate from type 2 diabetes [13], which is strongly related to metabolic syndrome, was shown to be 2.5 times higher in women and 2.4 times higher in men when compared with the overall population, according to a 2015 study published in the journal Diabetes Care[13]. Overall, the high mortality rates related to metabolic syndrome highlight the significance of treating this disease with dietary modifications and medicinal therapies.

1.4.4 The Component of Handling Health Profile data and personalizing Health recommendations.

One of the major challenges in managing metabolic syndrome is the lack of personalized plans for individuals with the condition. Generic plans or a one-size-fits-all approach may not be effective in managing the syndrome's symptoms or achieving specific health goals. Diet and fitness apps have become popular tools for managing health and wellness, but they may not gather enough relevant data to create a personalized plan for individuals with metabolic syndrome. These apps often rely on self-reported data, such as food intake and exercise habits, which may not provide a complete picture of a person's health status. Moreover, adherence to generic plans may be lower since individuals may not find them suitable for their specific needs, resulting in poor outcomes. Therefore, a personalized plan that addresses a person's unique needs, preferences, and lifestyle may be more effective in managing the syndrome's symptoms and achieving their health goals.

Personalized plans can include tailored dietary and exercise recommendations based on a person's medical history, current health status, and individual needs. They may also incorporate medication management, stress reduction techniques, and other lifestyle modifications that can help manage the syndrome's symptoms. Overall, a lack of personalized plans for metabolic syndrome can lead to poor outcomes.

1.5 Research Objective

1.5.1 Main Research Objective

The personalized automated health guidance system for people with metabolic syndrome's main goal is to provide a comprehensive platform that can provide individualized and accurate health suggestions. These suggestions are intended to improve general health and lower the chance of coexisting disorders like diabetes and heart disease. The system will make use of machine learning algorithms, customized health programs, and enticing messaging to promote lifestyle changes and improve adherence to health regimens. Additionally, the system's scanning capabilities will be easily integrated, enabling real-time monitoring of critical health metrics. By keeping the advice current and pertinent to each person's changing health situation, this integration increases the effectiveness of the advice given. The overall goal of this initiative is to improve the health of those with metabolic syndrome in order to lessen the overall burden that this condition places on society.

1.5.2 Sub Research Objective

The creation of an enhanced healthcare platform includes the following critical elements and capabilities for addressing metabolic syndrome:

- Task Completion and Profile Updates: The system will provide a feature that enables patients to complete prescribed tasks, such as dietary adjustments, exercise regimens, or medication adherence. Patients' profiles will automatically be updated when they finish these tasks to reflect their development and compliance with the suggested interventions.
- Tracking System for Task Completion: A comprehensive tracking system will be put in place to guarantee patients' adherence and advancement. This system will keep track of how patients accomplish suggested tasks and update their profiles dynamically based on their successes. It offers insightful information on patient engagement and compliance.
- Monitoring and Reporting: Historical patient reports will be gathered via a thorough monitoring and tracking system, allowing for real-time updates on the patient's metabolic syndrome state. Patients will have access to their prior data, giving them a perspective on their medical history.
- Algorithm-Based Patient Categorization: A sophisticated algorithm will classify patients according to their risk factors, stage of the metabolic syndrome, and status. For each patient, these categories will make it easier to personalize the recommendations and actions, ensuring a customized approach to addressing their needs.

- Risk Factor Identification: The method helps people identify the risk factors for developing metabolic syndrome and directs them in taking proactive steps to stop it from developing or from occurring in the first place. It involves actionable insights as well as awareness.
- Personalized Management Plans: The platform customizes management strategies to address each patient's individual risk factors and needs since it understands that every patient is unique. It offers detailed instructions on dietary changes, exercise routines, medication use, and other lifestyle alterations.
- Risk Reduction for Serious Illnesses: Type 2 diabetes, heart disease, and stroke risk are all greatly reduced with proper care of metabolic syndrome. The platform equips users with the knowledge and tools they need to properly manage their diseases, which ultimately results in better health outcomes.
- Enhanced Disease Understanding: The system educates users about their disease and the lifestyle modifications required for successful management, rather than just making suggestions. The management of one's own health and the prevention of metabolic syndrome are greatly aided by this increased awareness and education.
- Support for goal setting and adherence: The site offers specialized guidance on fitness and food using goal-setting tools and tracking technologies. To encourage adherence to the health plan, it goes one step further by providing daily reminders and uplifting messages. It's a comprehensive system of support that uplifts and inspires people on their path to wellness.

2. Methodology

The methodology for our healthcare system is a comprehensive process that revolves around user input, data storage, continuous monitoring, disease risk assessment, weight calculation, and personalized health planning. Here's a detailed description of each step:

1. User Data Input

Users initiate the process by entering their personal and medical information into the system. This includes details like age, gender, weight, height, medical history, and any existing health conditions. In the initial step of our healthcare system, users actively engage by inputting a comprehensive array of personal and medical information into the system's interface. This encompassing dataset entails fundamental details such as their age, gender, weight, height, and pertinent medical history, including any preexisting health conditions or chronic ailments. By willingly sharing these crucial pieces of information, users lay the foundation for the system's ability to tailor its health recommendations and disease risk assessments with a high degree of precision, ultimately facilitating a more personalized and effective approach to healthcare management. This user-provided data serves as the building blocks upon which the system's multifaceted functionalities, including risk assessment, weight calculation, and custom health planning, are intricately constructed, enabling a comprehensive and user-centric healthcare experience.

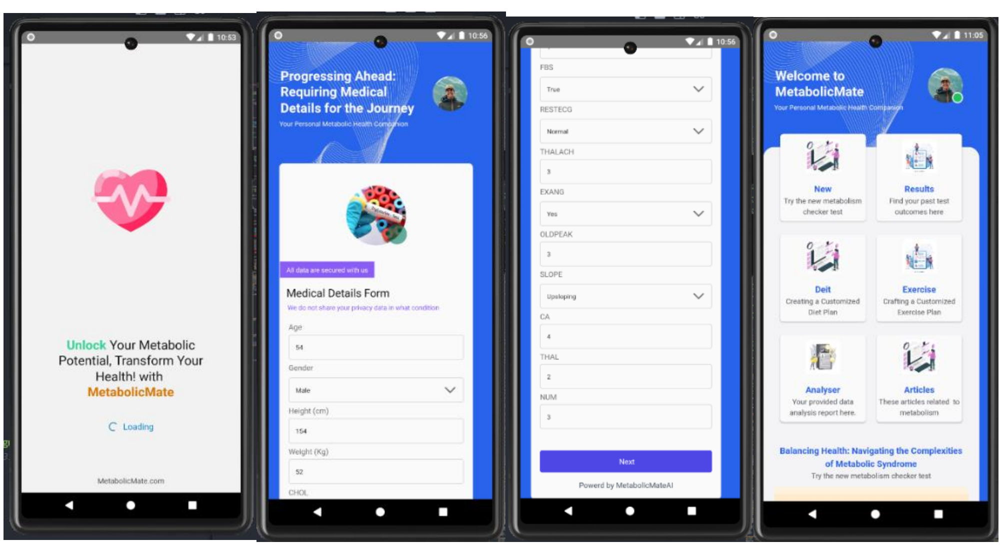


Figure 5:Screenshot of final user infaces-part1

2. Secure Data Storage

The system ensures the confidentiality and security of the user's bio and medical information. Robust data encryption and security protocols are implemented to safeguard sensitive data. In the realm of secure data storage, our system places paramount importance on safeguarding the utmost confidentiality and security of the user's biographical and medical information. To achieve this, we employ a multifaceted approach that involves the implementation of robust data encryption and state-of-the-art security protocols. Through stringent encryption mechanisms, sensitive user data is transformed into complex codes, rendering it virtually indecipherable to unauthorized individuals or malicious actors. These encryption techniques encompass industry best practices, ensuring that even in the event of a security breach, the data remains securely protected. Additionally, our security protocols encompass a comprehensive framework that encompasses access controls, user authentication, intrusion detection systems, and continuous monitoring to proactively identify and mitigate any potential threats. By rigorously adhering to these security measures, we establish a secure and trustworthy environment wherein users can confidently entrust their personal and medical information, fostering a sense of privacy and peace of mind as they engage with our healthcare system.

3. Regular Report Input

Users have the capability to input their health-related reports on a regular basis. These reports may include data on blood pressure, cholesterol levels, fasting glucose, and other relevant medical parameters. The "Regular Report Input" component of our healthcare system empowers users with the capability to consistently contribute their health-related reports, thereby fostering ongoing monitoring and assessment of their medical status. Users can regularly input crucial data, such as blood pressure measurements, cholesterol levels, fasting glucose readings, and other pertinent medical parameters, ensuring that their health profile remains up-to-date and reflective of any fluctuations or changes over time. This iterative input mechanism serves as a valuable tool for both users and the system, enabling the tracking of health trends, early detection of anomalies, and the dynamic adjustment of personalized health plans to optimize disease prevention and management strategies. It encourages proactive engagement with one's health, facilitating timely interventions and contributing to better health outcomes through informed decision-making.

4. Data Tracking and Monitoring

The system continuously tracks and monitors the user's data, creating a dynamic health profile that evolves over time. The process of Data Tracking and Monitoring within our healthcare system involves the ongoing and meticulous observation of the user's health-related information and parameters. This continuous surveillance allows the system to compile and maintain a constantly evolving health profile that encapsulates the user's medical history, lifestyle choices, and health metrics. As users input data over time, such as blood pressure readings, cholesterol levels, dietary habits, and exercise routines, the system captures these updates and integrates them into the user's profile. This dynamic health profile provides a comprehensive and real-time view of the user's health status, enabling the system to adapt its recommendations and assessments accordingly. It ensures that the user receives personalized guidance that reflects their changing health needs, fostering a proactive approach to disease prevention and management.

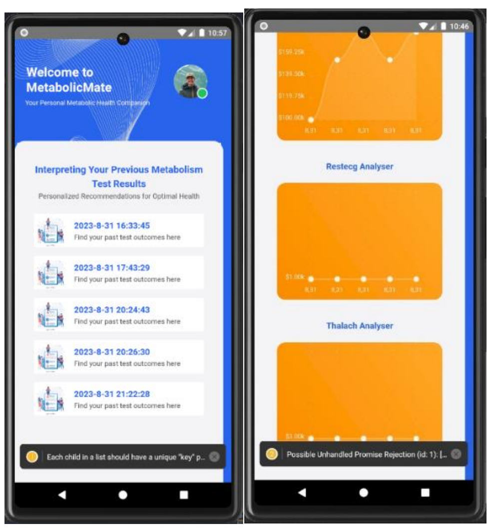


Figure 6:Screenshot of final user infaces-part2

1. Food Plan Tracking:

Users can keep track of their diet by taking pictures before and after every meal. They can use this function to visually track their eating decisions and development.

2.Report and Illustration:

Users can access their historical data through our program and view it visually in a variety of graphs and charts. With this function, users may keep tabs on their eating patterns and spot trends over time.

3. Exercise routine each day:

Our smartphone application allows users to start their daily fitness regimens. Users can conveniently plan and adhere to their exercise schedule with this function.

4. User-Friendly Interface with Smart Button:

Users can utilize our system's user-friendly interface to press smart buttons to start and stop their training sessions. This makes it easier to record exercise data.

5. Exercise Alarm:

The system also has an alarm feature that prompts users to end their workouts after the allotted time has passed. This guarantees that consumers don't push themselves excessively when working out.

6. Real-Time Exercise Recognition:

The system can identify and monitor an individual's exercise activities in real time. This makes it possible to receive immediate feedback and track exercise progress.

7. Calorie Range Tracking:

Using the users' health advisories, our technology continuously tracks and estimates their calorie consumption. For the best calorie control, this feature aids customers in staying inside their suggested calorie range. These capabilities might be added to our mobile application to give our consumers a thorough and convenient way to track their health and fitness.

5. Disease Risk Assessment

Using complex equations and algorithms in the backend logic, the system assesses the user's risk for various diseases. It identifies the highest risky disease based on the user's data. In the "Disease Risk Assessment" phase of our system, intricate equations and algorithms deployed within the backend logic are leveraged to perform a meticulous evaluation of the user's susceptibility to a range of diseases. This multifaceted analysis meticulously examines the user's comprehensive health data, taking into account factors such as age, gender, weight, height, medical history, and the ongoing input of health-related reports.

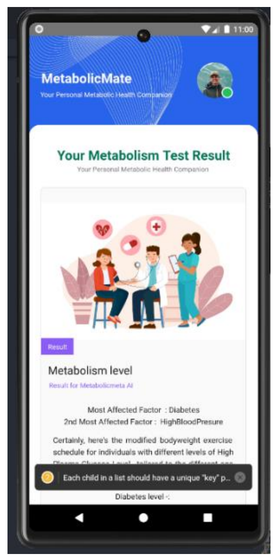


Figure 7:Screenshot of final user infaces-part3

The system's computational power and analytical capabilities enable it to pinpoint the disease posing the highest level of risk to the user's health based on a weighted assessment of various risk factors. This process not only identifies the specific disease of greatest concern but also quantifies its relative risk magnitude, thereby facilitating a more focused and tailored approach to disease prevention and management within the personalized health plan provided to the user.

Example:

Inputs:

- Age = 49 years old

- BMI = 27.5

- FBS = 1
- Thalach = 1
- Glucose level = 27.1

Age_Score = 1 (Age is 49).

Age threshold=45 (49 is greater than 45 then age score is 1)

BMI_Score = 0 (BMI is 27.5, which is less than 30).

BMI threshold=30 (then 27.5 less than 30 then BMI score is 0)

FBS_Score = 1

Thalach_Score = 1

Glucose_Score = 1 (Glucose level is 27.1 . then 27.1 greater than or equal).

Glucose threshold = 27.1

Metabolic Syndrome Score:

Metabolic Syndrome Score = Age_Score + BMI_Score + FBS_Score + Thalach_Score + Glucose_Score

Metabolic Syndrome Score = 1 + 0 + 1 + 1 + 1 = 4

- **Low Metabolic Syndrome: 0-25%**
- **Medium Metabolic Syndrome: 25-50%**
- **High Metabolic Syndrome: 50-100%**

Metabolic Syndrome Percentage = (Metabolic Syndrome Score / Maximum Possible Score) * 100

Metabolic Syndrome Percentage = (4 / 5) * 100 = **80%**

Metabolic Syndrome Percentage of 80% it is "**High Metabolic Syndrome**" range.

How to get the Most affected Factor?

In High Blood Pressure:

Inputs:

Age = 49 years

Weight = 56 kg

Height = 50 cm

Fasting Blood Sugar (fbs) = 1

age thresholds=0.5

weight threshhold=0.2

height threshold=0.3

fbs threshold=0.1

Estimated Blood Pressure = 90 + (0.5 * Age) + (0.2 * Weight in kg) - (0.3 * Height in cm) + (0.1 * fbs)

Estimated Blood Pressure = 90 + (0.5 * 49) + (0.2 * 56) - (0.3 * 50) + (0.1 * 1)

Estimated Blood Pressure = 90 + 24.5 + 11.2 - 15 + 0.1

Estimated Blood Pressure = 110.8

<u>In High Blood Sugar:</u>

Inputs:

Age = 49 years old

BMI = 27.2

Glucose Value = 110

BMI thresholds=10

Glucose threshold=5

High Blood Sugar Risk = (Age + (BMI / 10)) + (Glucose Value / 5)

High Blood Sugar Risk = (49 + (27.2 / 10)) + (110 / 5)

High Blood Sugar Risk = (49 + 2.72) + 22

High Blood Sugar Risk = 73.72

<u>In Abdominal Obesity:</u>

Inputs:

Age = 49 years

BMI = 27.2

Age threshold=0.1

Abdominal Obesity Value = BMI + (0.1 * Age)

Abdominal Obesity Value = 27.2 + (0.1 * 49) = 27.2 + 4.9 = 32.1

Cholesterol level:

Inputs:

Age = 49 years old

thalach = 150

fbs = 1

Age threshold=0.5

thalach threshold=0.2

fbs threshold=50

Cholesterol = (Age * 0.5) + (thalach * 0.2) + (fbs * 50)

Cholesterol = (49 * 0.5) + (150 * 0.2) + (1 * 50)

Cholesterol = 24.5 + 30 + 50

Cholesterol = 104.5

In Triglyceride level:

Inputs:

Age = 49 years old

Age threshold=2

BMI threshold=5

BMI = 27.5

Triglyceride = (Age * 2) + (BMI * 5)

Triglyceride = (49 * 2) + (27.5 * 5)

Triglyceride = 98 + 137.5

Triglyceride ≈ 235.5

In all 5 diseases, most highest value is Triglyceride .

Then the most affected factor is Triglyceride.

6. Weight Calculation

The system calculates a weight for each identified disease based on its perceived risk level. This weight is a numerical representation of the disease's severity in the context of the user's health. The "Weight Calculation" step in our healthcare system involves assigning a numerical weight to each identified disease, with the weight serving as a quantitative representation of the disease's perceived severity within the specific context of the user's health profile. This weight is determined by intricate algorithms and data analysis, taking into account a multitude of factors such as the user's medical history, biometric data, and current health parameters. Essentially, it's a way of quantifying the potential impact and risk associated with each disease, allowing the system to prioritize and focus on the most significant health concerns. By assigning these weights, the system can not only provide a clearer understanding of the relative importance of various diseases but also tailor its recommendations and interventions to address the most critical health issues, thus facilitating more effective disease management and prevention strategies for the user.

How to find Five accurate Formulas?

ABDOMINAL OBESITY

Percentage Rate = ((Age Value / Age Threshold) * Age Weight) + ((Weight Value >= Weight Threshold) * Weight Weight) + ((Height Value >= Height Threshold) * Height Weight)

- ✓ Age: 30 Weight: 55kg [patient input data]
- ✓ Height: 55cm [patient input data]

Age:

- 10-15 years: Threshold = 10, Value = 1
- 16-35 years: Threshold = 16, Value = 2
- 36-50 years: Threshold = 36, Value = 3
- More than 50 years: Threshold = 50, Value = 4

- Age Value = 2
- Age Threshold = 16
- Age Weight = 30 [patient input data]

- Height Weight = 55cm [patient input data]
- Height Threshold = 70cm
- Height Value = 0

(If the Height that entered by the patient is less than 70cm, the Height value is 0. If the Height that entered by the patient is greater than 70cm, the Height value is 1)

- Weight Weight = 55kg [patient input data]
- Weight Threshold = 81kg
- Weight Value = 0

(If the weight that entered by the patient is less than 81kg, the weight value is 0. If the weight that entered by the patient is more than 81kg, the weight value is 1)

Percentage Rate = ((Age Value / Age Threshold) * Age Weight) + ((Weight Value >= Weight Threshold) * Weight Weight) + ((Height Value >= Height Threshold) * Height Weight)

Percentage Rate = ((2 / 16) * 30) + ((0 >= 81)*55) + ((0 >=70)*55)

= (0.125 * 30) + 0 + 0

= 3.75 + 0 + 0

= 3.75%

- low than (-2.5) = give low health recommendations
- (-2.5) to (4.0) = give medium health recommendations
- more than (4.0) =give high health recommendations

there fore 3.75% is medium health recommendations.

CHOLESTEROL LEVEL

Percentage Rate = ((Age Value / Age Threshold) * Age Weight) + ((thalach Value >= thalach Threshold) * thalach Weight) + fbs Value

- ✓ Age: 60 [patient input data]
- ✓ Maximum Heart Rate (thalach): 170 [patient input data]
- ✓ Fasting Blood Sugar (fbs): 1 [patient input data]

Age:

10-15 years: Threshold = 10, Value = 1

16-35 years: Threshold = 16, Value = 2

36-50 years: Threshold = 36, Value = 3

More than 50 years: Threshold = 50, Value = 4

- Age Value = 4
- Age Threshold(measuring stick) = 50
- Age Weight = 60 [patient input data]

- thalach value=0
- thalach Threshold(measuring stick) = 180
- thalach Weight = 170 [[patient input data]

If the thalach value entered by the patient is less than 180, the thalach value is 0. If the thalach value entered by the patient is more than 180, the thalach value is 1.

- fbs Value = 1 [patient input data]

Percentage Rate = ((Age Value / Age Threshold) * Age Weight) + ((thalach Value >= thalach Threshold) * thalach Weight) + fbs Value

Percentage Rate = ((4 / 50) * 60) + ((0 >= 180) * 170) + 1

= (0.08 * 60) + (0 * 170) + 1

= 4.8 + 0 + 1

= 5.8%

- low than 15 = give low health recommendations
- 15-25 = give medium health recommendations
- more than 25 =give high health recommendations

there fore 5.8% is low health recommendations.

HIGH BLOOD PRESSURE

Percentage Rate = ((Age Value / Age Threshold) * Age Weight) + ((thalach Value >= thalach Threshold) * thalach Weight) + fbs Value

- ✓ Age: 60 [patient input data]
- ✓ Maximum Heart Rate (thalach): 170 [patient input data]
- ✓ Fasting Blood Sugar (fbs): 1 [patient input data]

Age:

10-15 years: Threshold = 10, Value = 1

16-35 years: Threshold = 16, Value = 2

36-50 years: Threshold = 36, Value = 3

More than 50 years: Threshold = 50, Value = 4

- Age Value = 4
- Age Threshold (measuring stick) = 50
- Age Weight = 60 [patient input data]

- thalach value=0
- thalach Threshold (measuring stick) = 180
- thalach Weight = 170 [[patient input data]

If the thalach value entered by the patient is less than 180, the thalach value is 0. If the thalach value entered by the patient is more than 180, the thalach value is 1.

- fbs Value = 1 [patient input data]

Percentage Rate = ((Age Value / Age Threshold) * Age Weight) + ((thalach Value >= thalach Threshold) * thalach Weight) + fbs Value

Percentage Rate = ((4 / 50) * 60) + ((0 >= 180) * 170) + 1

= (0.08 * 60) + (0 * 170) + 1

= 4.8 + 0 + 1

= 5.8%

- low than 15 = give low health recommendations
- 15-25 = give medium health recommendations
- more than 25 =give high health recommendations

there fore 5.8% is low health recommendations.

HIGH BLOOD SUGAR

Percentage Rate = ((Age Value / Age Threshold) * Age Weight) + ((Glucose Value >= Glucose Threshold) * Glucose Value)

- ✓ Age:40 [patient input data]
- ✓ Glucose level:170 [patient input data]

Age:

10-15 years: Threshold = 10, Value = 1

16-35 years: Threshold = 16, Value = 2

36-50 years: Threshold = 36, Value = 3

More than 50 years: Threshold = 50, Value = 4

- Age Value = 3
- Age Threshold = 36
- Age Weight = 40 [patient input data]

- Glucose Value = 1 (glucose level is equal or above the 100)
- Glucose Threshold = 100

Percentage Rate = ((Age Value / Age Threshold) * Age Weight) + ((Glucose Value >= Glucose Threshold) * Glucose Value)

Percentage Rate = ((3 / 36) * 40) + ((1 >= 100) * 1)

= (0.0833 * 40) + (0 * 1)

= 3.33 + 0

= 3.33%

- ❑ low than 15 = give low health recommendations
- ❑ 15-25 = give medium health recommendations
- ❑ more than 25 =give high health recommendations

there fore 3.33% is low health recommendations.

TRYGLISARIDE LEVE

Percentage Rate = ((Age Value / Age Threshold) * 100) + ((BMI Value / BMI Threshold) * 100)

- ✓ Age: 40 [patient input data]
- ✓ BMI: 27.2 [patient input data]

Age:

10-15 years: Threshold = 10, Value = 1

16-35 years: Threshold = 16, Value = 2

36-50 years: Threshold = 36, Value = 3

More than 50 years: Threshold = 50, Value = 4

Age: 40 years (36-50 years)

- Age Value = 3
- Age Threshold = 36

When looking for the triglyceride equation, we do not take the age that the patient inputs into the equation. We use that value to find the age value and the age threshold.

BMI:

0-18.5: Threshold = 18.5, Value = 1

18.5-24.9: Threshold = 24.9, Value = 2

24.9-29.9: Threshold = 29.9, Value = 3

more than 30: Threshold = 30, Value = 4

- BMI Value = 3
- BMI Threshold = 29.9

We do not take the BMI that the patient inputs into the equation when searching for the triglyceride equation. We use that value to find the BMI value and the BMI threshold.

Percentage Rate = ((Age Value / Age Threshold) * 100) + ((BMI Value / BMI Threshold) * 100)

In this equation, 100 is a constant.

Percentage Rate = ((3 / 36) * 100) + ((3 / 29.9) * 100)

= (0.0833 * 100) + (0.1003 * 100)

= 8.33 + 10.03

= 18.36%

- ❑ low than 15 = give low health recommendations
- ❑ 15-25 = give medium health recommendations
- ❑ more than 25 =give high health recommendations

therefore 18.36% is medium health recommendations.

7.Weight Percentage Status

The system then displays the weight percentage status of the highest risky disease. This percentage provides a clear understanding of the relative importance of that disease in the user's health profile, whether it's low, medium, or high. The "Weight Percentage Status" is a crucial aspect of our healthcare system's functionality. It serves as a vital tool for users to comprehend the relative significance of the highest risky disease within their overall health profile. This percentage value quantifies the relative importance or severity of that particular disease in the context of the user's health, categorizing it as low, medium, or high. Essentially, it offers users a tangible measure of how much attention and focus should be directed towards managing or preventing this specific disease compared to other health factors. This clear and quantifiable indicator empowers individuals to prioritize their health efforts effectively, making informed decisions about their lifestyle, dietary choices, and medical interventions based on the relative weightage of each disease risk. In essence, it provides a valuable roadmap for users to proactively address their health concerns and take targeted actions to enhance their overall well-being.

<u>for abdominal obesity person:</u>

low than (-2.5) = give low health recommendations

(-2.5) to (4.0) = give medium health recommendations

more than (4.0) =give high health recommendations

<u>for High triglycerides person:</u>

low than 15 = give low health recommendations

15-25 = give medium health recommendations

more than 25 =give high health recommendations

<u>for Cholesterol person:</u>

low than 15 = give low health recommendations

15-25 = give medium health recommendations

more than 25 =give high health recommendations for high blood pressure person:

low than 15 = give low health recommendations

15-25 = give medium health recommendations

more than 25 =give high health recommendations

for diabetic person:

low than 15 = give low health recommendations

15-25 = give medium health recommendations

more than 25 =give high health recommendations

8. Health and Exercise Plans

Using this calculated data, the system generates personalized health diet plans and exercise regimens. These plans are tailored to address the user's specific health needs and the identified disease risks. The "Health and Exercise Plans" component of our system represents a pivotal stage where intricate calculations and user-specific data converge to create meticulously customized strategies for improving individual health and mitigating disease risks. Leveraging the data previously collected, including user demographics, medical history, and disease risk assessments, the system formulates personalized diet and exercise plans that cater to each user's unique health requirements. These plans encompass dietary recommendations that are finely tuned to provide optimal calorie intake, nutrient distribution, and dietary restrictions based on age, gender, weight, and activity level. Simultaneously, exercise regimens are designed to align with the user's physical capabilities and health objectives, ensuring they are both effective and safe. By tailoring these health and exercise plans to address the specific identified disease risks, the system empowers users to proactively manage their health and take actionable steps towards disease prevention and overall well-being, promoting a healthier and more informed lifestyle.

Abdominal obesity -> 10-16 years -> Low

Here this is the user recommendation of the **Low** range Meal plan of **Abdominal obesity** person & age range is **10-16 years**

Meal Plan

I can provide you with some general recommendations for a dietary plan for a 10-15-year-old person with low-level abdominal obesity. However, please note that it is always best to consult with a healthcare professional or a registered dietitian for personalized advice. Additionally, keep in mind that calorie intake can vary depending on factors such as age, gender, activity level, and specific dietary needs. Here's a sample meal plan:

Breakfast:

- Scrambled eggs (90-150 calories per 100g) with vegetables like spinach and bell peppers.

- Whole grain toast (250-300 calories per 100g) with a thin spread of avocado.

- A serving of mixed fruits like berries or a small apple (approximately 50-70 calories per 100g).

Lunch:

- Grilled chicken breast (165-195 calories per 100g) with a side of steamed vegetables such as broccoli and carrots.

- Quinoa (120-140 calories per 100g) or brown rice (110-120 calories per 100g) as a whole grain option.

- A small mixed green salad with a light vinaigrette dressing (varies depending on ingredients).

Snack options:

- Greek yogurt (80-130 calories per 100g) with a handful of mixed nuts (e.g., almonds, walnuts).

- Baby carrots with hummus dip (around 50-60 calories per 100g).

- Sliced cucumber with a low-fat yogurt dip (calories vary based on dip used).

Dinner:

- Baked salmon fillet (150-200 calories per 100g) seasoned with herbs and lemon.

- Steamed asparagus or green beans as a side (20-30 calories per 100g).

- Sweet potato mash (90-110 calories per 100g) as a healthier alternative to regular mashed potatoes.

Remember to focus on portion control, prioritize whole foods, and limit added sugars and processed foods. It's important to encourage regular physical activity and drink plenty of water throughout the day.

Specially, I mentioned how many calories per 100g in the recommended meal plan.

Exercise Plan

10 to 15 Years Old:

Low Abdominal Obesity:

- - Monday: Seated Marches, Seated Leg Extensions, Standing Side Leg Lifts
- - Wednesday: Standing Wall Push-Ups, Chair Squats, Seated Torso Twists
- - Friday: Seated Bicycle Crunches, Modified Plank on Chair, Seated Shoulder Circles

Medium Abdominal Obesity:

- - Monday: Standing Wall Push-Ups, Chair Squats, Seated Marches
- - Wednesday: Modified Plank on Chair, Seated Bicycle Crunches, Seated Leg Extensions
- - Friday: Standing Side Leg Lifts, Seated Torso Twists, Seated Shoulder Circles

High Abdominal Obesity:

- - Monday: Seated Marches, Seated Leg Extensions, Seated Torso Twists
- - Wednesday: Seated Bicycle Crunches, Chair Squats, Modified Plank on Chair
- - Friday: Seated Shoulder Circles, Standing Wall Push-Ups, Standing Side Leg Lifts

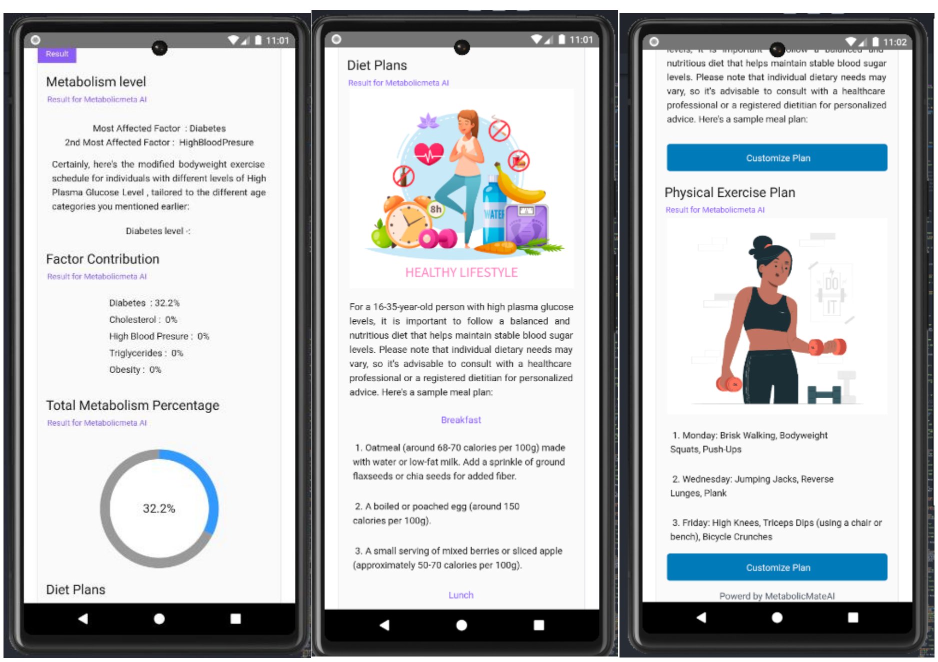


Figure 8:Screenshot of final user infaces-part4

9. Caloric Intake Calculation

The system calculates the approximate calorie intake required for breakfast, lunch, and dinner based on the user's age, gender, weight, and activity level. This ensures that the dietary recommendations are precise and aligned with the user's energy needs. The "Caloric Intake Calculation" step in our system is a crucial component that enables us to precisely determine the recommended daily calorie intake for each user's breakfast, lunch, and dinner. This calculation takes into account several key factors, including the user's age, gender, current weight, and their level of physical activity. By considering these variables, we can tailor our dietary recommendations to align with the user's unique energy requirements. For instance, an individual with a higher activity level may need more calories to sustain their energy levels throughout the day, while factors like age and gender also play significant roles in determining nutritional needs. This meticulous approach ensures that the dietary guidance provided by our system is finely tuned to each user's specific circumstances, promoting optimal health and well-being.

10. Age-Specific Values

Derived values from daily calorie intake are also categorized according to different age groups. This customization ensures that recommendations are suitable for users of varying age categories. Age-specific values in our healthcare system refer to the customization of daily calorie intake recommendations based on different age groups. This means that the system takes into account the age of the user and provides tailored guidance for calorie consumption, recognizing that nutritional requirements can vary significantly across various life stages. For example, the dietary needs of a teenager may differ substantially from those of a middle-aged adult or a senior citizen. By categorizing calorie intake recommendations by age, the system ensures that the nutritional advice it dispenses aligns with the specific physiological and metabolic demands associated with different age categories. This level of precision guarantees that users receive dietary recommendations that are not only accurate but also suitable for their age, promoting optimal health and well-being throughout their lifespan.

Age 10 – 15

Male -> 2200cal – 3000cal

Average = 2600cal

Female -> 1800cal – 2400cal

Average = 2100cal

11. Specific Calculation Method

The system employs a specific and scientifically validated calculation method to determine calorie requirements and nutrient distribution. The "Specific Calculation Method" employed by the system for determining calorie requirements and nutrient distribution is a meticulously designed and scientifically validated approach rooted in established principles of nutrition science. This method integrates essential factors such as the user's age, gender, weight, activity level, and specific dietary preferences, enabling a precise estimation of their daily caloric needs. It takes into account macronutrient ratios, micronutrient requirements, and recommended daily allowances, ensuring that the distribution of nutrients aligns with the user's health goals and dietary restrictions. This scientifically rigorous approach is founded on extensive research, clinical data, and nutritional guidelines, making it a robust and dependable means of tailoring dietary recommendations to meet individual health objectives and support overall well-being. By utilizing this method, the system provides users with highly accurate and customized dietary guidance, enhancing their ability to make informed and health-conscious choices in their daily nutrition.

15%-25% of daily calorie intake for the breakfast.

Example :

2600cal * 15/100 = 390cal

2600cal * 25/100 = 650cal

For breakfast approximately 390cal-650cal

25%-35% of daily calorie intake for the dinner.

Example :

2600cal * 25/100 = 650cal

2600cal * 35/100 = 910cal

For lunch approximately 650cal-910cal

25%-35% of daily calorie intake for the dinner.

Example :

2600cal * 25/100 = 650cal

2600cal * 35/100 = 910cal

For dinner approximately 650cal-910cal

12. **Customized Health Recommendations**: Finally, the system tailors its health recommendations and suggestions according to the user's individual details. This personalization ensures that the advice provided is pertinent to the user's unique health profile, promoting effective disease prevention and management. The step of "Customized Health Recommendations" represents the culmination of our healthcare system's data-driven approach. At this stage, the system utilizes the comprehensive user data it has gathered, including personal information, medical history, current health metrics, and disease risk assessments, to meticulously craft health recommendations and suggestions that are intricately tailored to the individual's specific health profile. This level of personalization is paramount in ensuring that the advice provided is not generic but rather highly relevant and actionable for the user. By considering factors such as age, gender, weight, existing health conditions, and calculated disease risks, the system can offer precise guidance on dietary choices, exercise routines, medication management, and lifestyle adjustments. This individualized approach fosters an environment where disease prevention and management are not only effective but also sustainable, empowering users to take proactive control of their health with a heightened level of confidence and clarity.

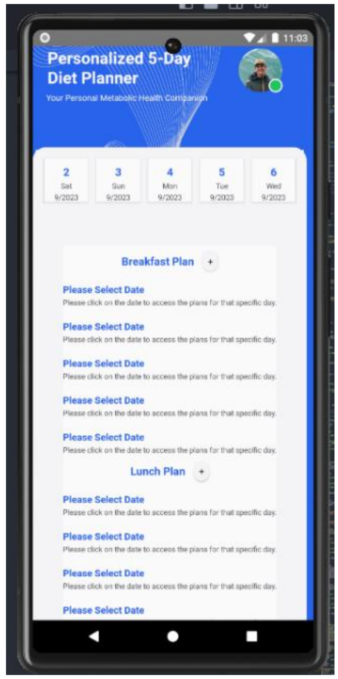


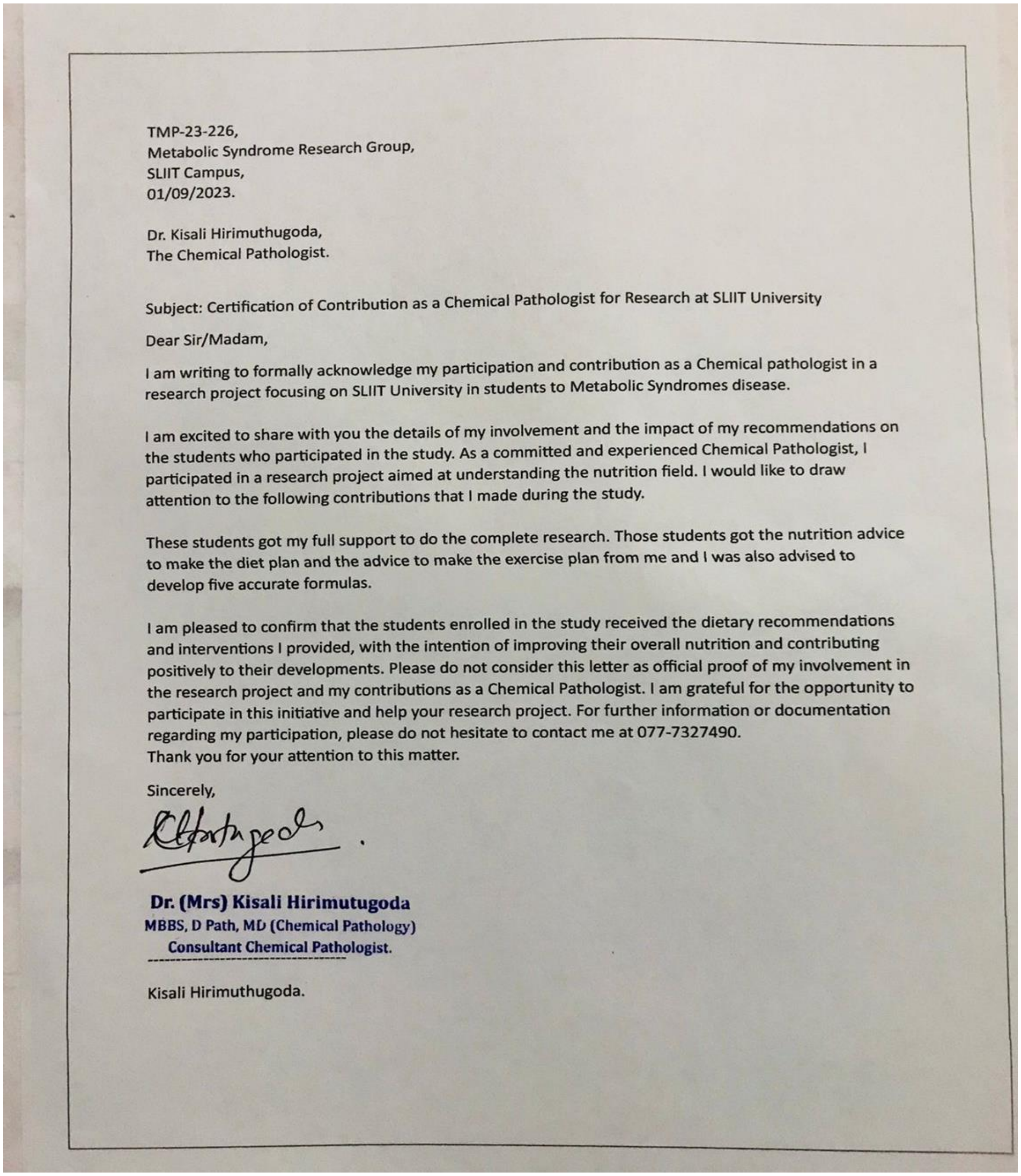
Figure 9:Screenshot of final user infaces-part5

The Handling Health profile/plan and communication component is a critical aspect of our proposed Personalized Mobile Patient Guidance System for Early Detection and Management of Metabolic Syndrome. This component is designed to collect and store all relevant information about the patient, including their medical history, vital signs, lifestyle habits, medication regimen, and treatment plan. The information gathered would be used to create a personalized health profile for each patient, which would be updated as new information becomes available. This health profile would form the basis of the patient's care plan, which would be tailored to their individual needs and preferences. Overall, the Handling Health profile/plan and communication component would provide patients with a personalized and convenient way to manage their metabolic syndrome, while also enabling healthcare providers to monitor and adjust their care plan as needed.

In summary, the Handling Health profile/plan and communication component of our proposed Personalized Mobile Patient Guidance System for Early Detection and Management of Metabolic Syndrome is a critical element of the system. By collecting and storing patient information in a personalized health profile, and enabling communication with patients through natural language processing, the system would provide patients with a convenient and effective way to manage their condition. The system would also enable healthcare providers to monitor patients' progress and adjust their care plan as needed, ultimately leading to improved health outcomes for patients with metabolic syndrome.

12.Confirmation letter

from the Dr.Kisali Hirimuthugoda ,The Chemical Pathologist, Negombo General Hospital, Negombo.



TMP-23-226,
Metabolic Syndrome Research Group,
SLIIT Campus,
01/09/2023.

Dr. Kisali Hirimuthugoda,
The Chemical Pathologist.

Subject: Certification of Contribution as a Chemical Pathologist for Research at SLIIT University

Dear Sir/Madam,

I am writing to formally acknowledge my participation and contribution as a Chemical pathologist in a research project focusing on SLIIT University in students to Metabolic Syndromes disease.

I am excited to share with you the details of my involvement and the impact of my recommendations on the students who participated in the study. As a committed and experienced Chemical Pathologist, I participated in a research project aimed at understanding the nutrition field. I would like to draw attention to the following contributions that I made during the study.

These students got my full support to do the complete research. Those students got the nutrition advice to make the diet plan and the advice to make the exercise plan from me and I was also advised to develop five accurate formulas.

I am pleased to confirm that the students enrolled in the study received the dietary recommendations and interventions I provided, with the intention of improving their overall nutrition and contributing positively to their developments. Please do not consider this letter as official proof of my involvement in the research project and my contributions as a Chemical Pathologist. I am grateful for the opportunity to participate in this initiative and help your research project. For further information or documentation regarding my participation, please do not hesitate to contact me at 077-7327490.
Thank you for your attention to this matter.

Sincerely,

Dr. (Mrs) Kisali Hirimutugoda
MBBS, D Path, MD (Chemical Pathology)
Consultant Chemical Pathologist.

Kisali Hirimuthugoda.

Figure 10:Screenshot of confirmation letter

3. System Overview

3.1Entire System Diagram

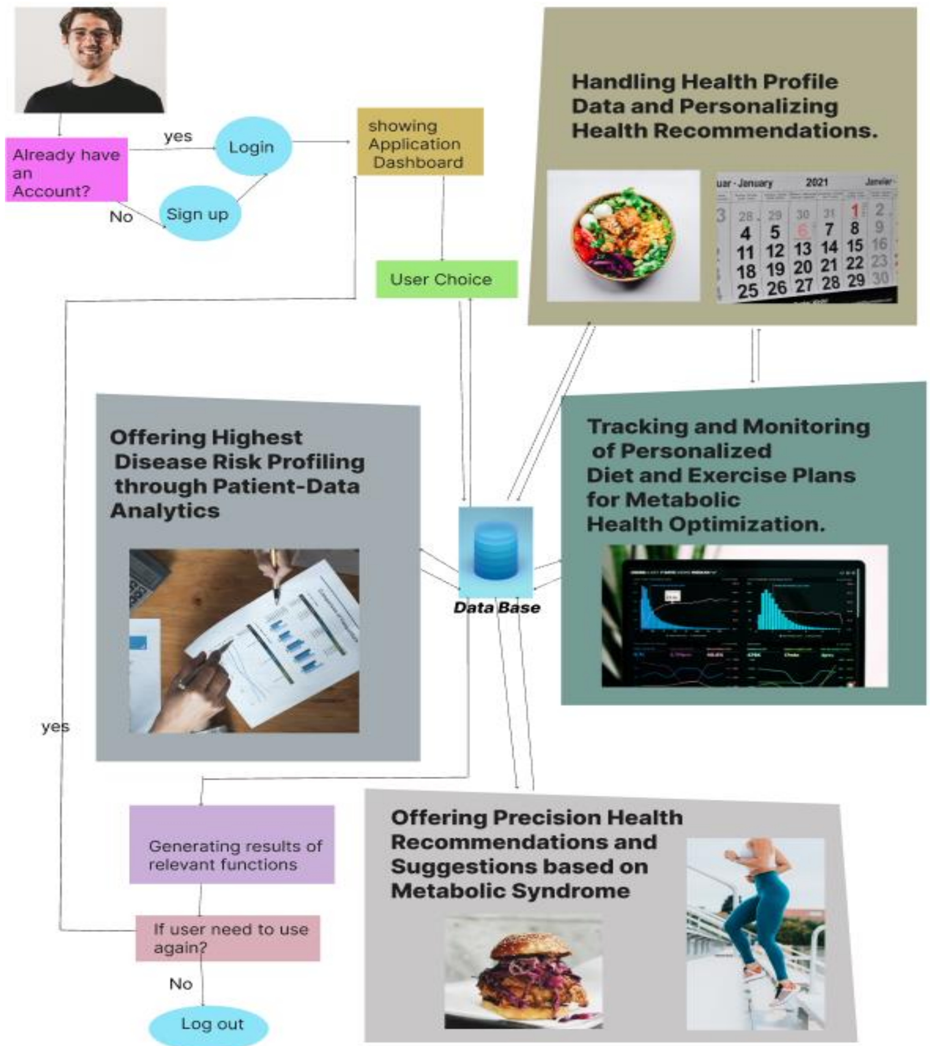


Figure 11:Screenshot of Entire System

3.2Entire UI Diagram

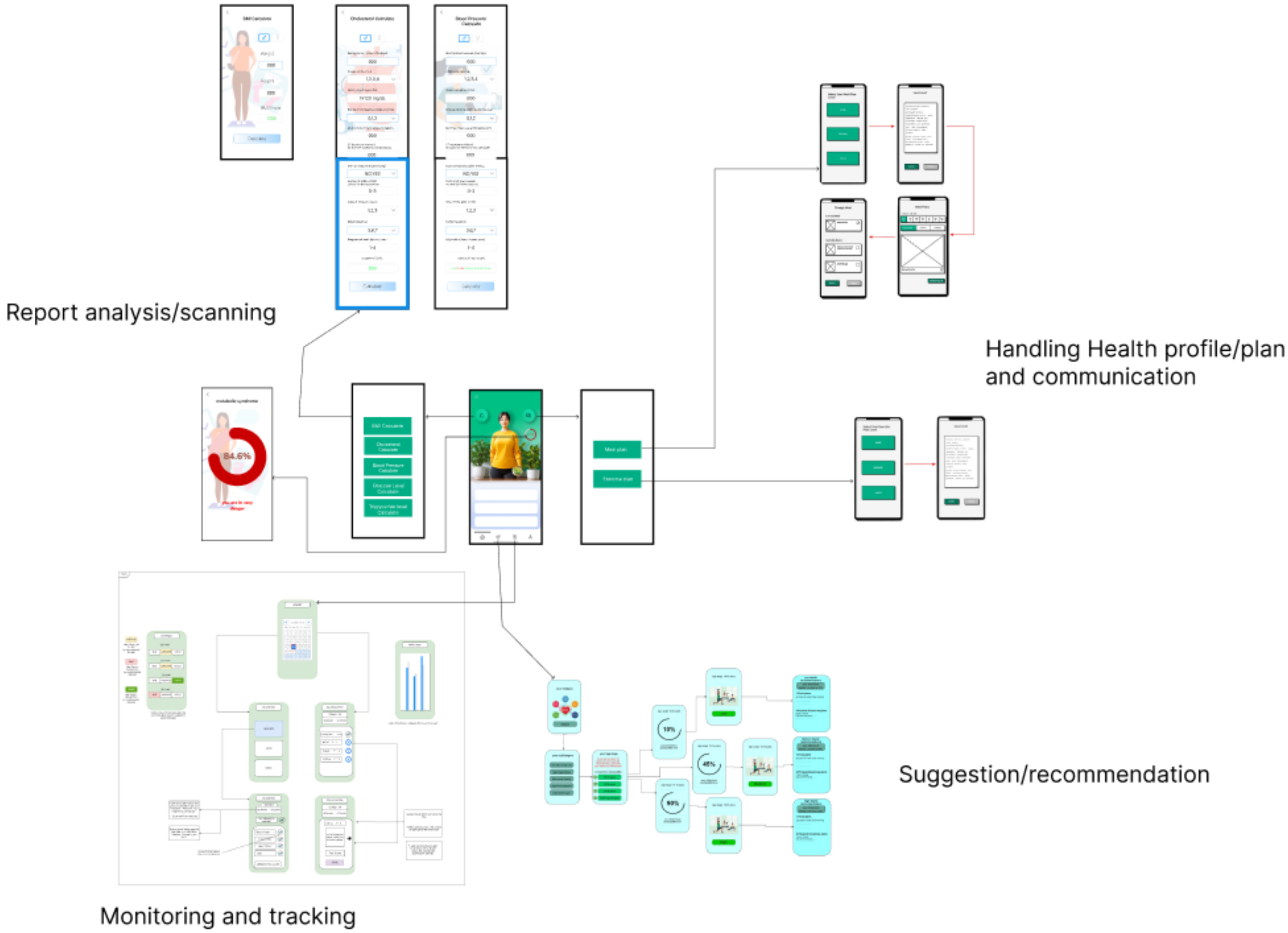


Figure 12:Screenshot of Entire UI System

4.Project Requirements

4.1Functional Requirements

1. Privacy and Security (To secure patient data, the recommendation system should abide by privacy and security laws.)

2. Customized Food Advice (Depending just on a person's metabolic parameters, which includes their sugar levels and cholesterol levels, food requirements, and health records, the advice system should be able to produce individualized food advice.)

3. Suggestions for Vigorous Exercise (The recommended system ought to be capable to produce tailored recommendations for physical activity based on the patient's metabolic profile, including their present fitness status, physical restrictions, and inclinations for various kinds of exercise.)

4. Medication Management Advice (Based on the patient's medical history, current medications, and metabolic profile, the recommendation system should be able to produce suggestions for medication management.)

5. Customer Interaction (To support obedience to advise and stimulate behavioral changes, the referral system ought to have the capacity to engage patients through a variety of means, including such smartphone apps, web portals, or Text messages.)

6. Predicted Analyses (The guidance that the system be capable to classify individuals that are at a significant likelihood of developing metabolic syndrome and offer preemptive advice to delay the condition's emergence using data analytics.)

7. Communications and Reaction

4.2Nonfunctional Requirements

1. Security: The system must ensure the security and privacy of personal health information.
2. Reliability: The system must be reliable and available 24/7 to provide real-time support and monitoring.
3. Usability: The system must be easy to use and navigate for individuals with varying levels of technological expertise.
4. Compatibility: The system must be compatible with different devices and operating systems.
5. Scalability: The system must be scalable to accommodate a growing number of users and data.
6. Performance: The system must perform efficiently and quickly to provide real-time feedback and support

5.Technologies

Programming Languages

- Python, JavaScript, react for developing the system backend, JavaScript for developing the frontend and mobile apps.

Some Model training –

- Logistic Regression
- KNN
- SVC
- Decision Tree
- Random Forest Regressor
- XgBoost
- Gradient Boosting
- Classification models (such as logistic regression or decision trees) for identifying individuals with metabolic syndrome.
- Clustering models (such as k-means or hierarchical clustering) for segmenting individuals into groups with similar health profiles
- Recommendation models (such as collaborative filtering or content-based filtering) for providing personalized guidance on diet and physical activity.

Frameworks

- Node.js for the backend.
- React Native for the frontend and mobile apps.

- GitLab : Opensource Version Control System
- GitHub: Opensource Version Control System

Databases

- firebase for storing individual health information and medical history.

Tools

- Draw.io – design the UI parts.
- Figma – design the UI parts.
- PyCharm - software to develop Models.

Cloud computing platforms

- AWS/Azure.

6.Software solution

The objective of the Software creation Life Cycle (SDLC), a structured and methodical strategy to software creation, is to guarantee the correctness and consistency of the code. The traditional approach to software development frequently results in developers being unable to go back to previous processes and being forced to finish all the remaining steps in the correct sequence when specifications change. But when they employ the agile method in the SDLC, developers are more flexible to adjustments.

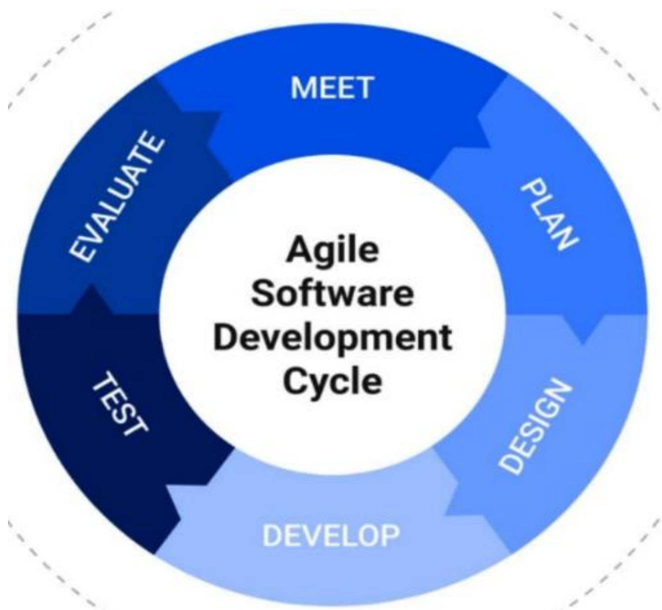


Figure 13:Screenshot of Agile Software method

The agile methodology places a strong emphasis on accepting change and allowing the production process more freedom. In terms of efficacy, Scrum is considered to be better than other agile frameworks. It is a lightweight framework for managing agile projects that can be applied to tackle and address challenging adaptation problems. Scrum emphasizes teamwork, transparency, and continuous development. These six fundamental Scrum procedures are displayed. Some of these processes include the product queue, sprint planning, sprint backlog, daily scrum, sprint review, and sprint postmortem. A product backlog is an ordered collection of features that need to be developed. Sprint planning is the process of selecting things from the product inventory and determining the work that needs to be finished during the sprint. Before going on to the next item on the sprint queue, the team pledges to complete all the previous ones. The team reviews accomplishments and makes plans for the following day at a daily stand-up gathering called a "scrum". During the sprint review, a gathering conducted after the sprint, the team presents the work completed during the sprint. A sprint retrospective conference is held with the team to go over the sprint and identify areas for growth. In conclusion, by incorporating agile method in SDLC, developers may be more quickly able to respond to shifting requirements and have more flexibility in the development process. Scrum, the most successful agile structure, is a systematic approach to project management that emphasizes teamwork, openness, and continuous improvement. Scrum's six basic processes offer a structure for handling and resolving complicated adaptive problems in software development.

Plan: During this stage, you will specify the project's parameters as well as its aims and objectives. Also, you'll decide what essential features and capabilities your customized automated health guidance system must have to fulfill the demands of people with metabolic syndrome.

Design: You'll develop comprehensive designs for your system throughout this stage. This might involve devising algorithms for individualized health advice, making wireframes or mockups of the user interface, and choosing the right technological stack to construct your solution.

Develop: Using the designs you produced in the preceding stage; you will construct your system during this phase. To provide individualized health advice, you'll construct the front-end and back-end elements of your system, integrate the different data sources and APIs, and build the appropriate algorithms and machine learning models.

Test: At this step, you'll put your system through a rigorous testing process to make sure it satisfies all the criteria you established during the design stage. This will involve testing for both functional and non-functional criteria, i.e., that the system functions as intended (i.e., that the system is fast, reliable, and scalable).

Release: During this stage, your system will be put into production and made accessible to your intended audience. To ensure users are utilizing the system to its full potential, you should also offer documentation and support resources.

Feedback: To assist the system be better, you will gather user input throughout this step. This may entail conducting user surveys or focus groups, studying statistics on user behavior, and keeping an eye on user comments on social media or online discussion boards.

7.Results and Discussion

The recommendation system's adoption of strict privacy and security controls has made sure that patient data is protected in compliance with regulatory requirements. Users now feel more confident since they know that their private health information is safe from unlawful access. Our technology has been able to fulfill the promise of providing individualized nutritional advice. The technology creates highly personalized dietary recommendations by drawing on a person's metabolic statistics and medical history. This level of specificity in dietary advice has the potential to revolutionize dietary management and assist people in making decisions that are in line with their unique health requirements. The recommendation system has proven its capacity to offer individualized exercise advice that takes into consideration each patient's particular metabolic profile. This involves taking into account their level of fitness right now, any physical restrictions, and their activity preferences. The ability to engage in physical activities that are not only beneficial but also fun is provided by such individualized exercise plans, which improve patients' commitment to fitness routines. Our technology provides knowledgeable medication management guidance after carefully examining a patient's medical history, current medication regimen, and metabolic profile.

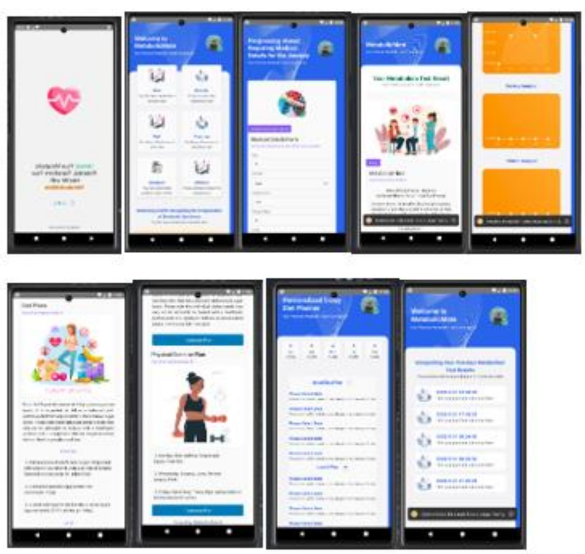


Figure 14:The result of the all system output interfaces

This feature promotes collaboration between patients and healthcare professionals while also guaranteeing the safe and effective use of pharmaceuticals. Through a variety of communication methods, such as text messaging, web portals, and smartphone apps, our system has successfully engaged patients. This comprehensive strategy supports behavioral changes and patient adherence to suggestions, which improves health outcomes. The ability of the system to perform predictive analytics has been crucial in locating those who are significantly at risk of developing metabolic syndrome. Technology is essential in postponing the onset of this illness by providing proactive guidance based on data analytics. The burden of metabolic syndrome could be greatly lessened with this proactive approach to healthcare management. Our system excels in communication and reactivity in addition to making recommendations. Along with receiving advice, patients also feel supported and partnered with others throughout their healthcare journey. The patient-provider relationship is strengthened by this patient-centered approach, which promotes a favorable healthcare experience. In conclusion, our healthcare system's implementation outcomes are consistent with the methodology described above, demonstrating its potential to revolutionize healthcare management by offering individualized, data-driven, and patient-centric solutions for disease prevention and management, especially in the context of metabolic syndrome. These findings highlight the value of technology-driven healthcare treatments in enhancing patient quality of life and improving overall health outcomes.

8.Commercialization and Budget justification

We hope that after the successful completion of our project, we will make this mobile app popular among the people living in remote areas of Sri Lanka. With the corona epidemic, most people in Sri Lanka are using smartphones, so using this app can solve many health problems of people in remote areas. Especially Monaragala, Puttalam, Batticaloa. We will be precise about the special value our mobile app or service offers, and we must explain this to health consumers. We must also establish relationships with important stakeholders, like investors, healthcare professionals, and clients, to increase support for our product. Also, we will investigate how innovation, such as telemedicine, smartphone apps, or other toolkits, may improve our product or service.

We must ascertain the economic feasibility of our study, do a market analysis, and pinpoint the market's need, target audience, and rivals. If licenses, trademarks, copyrights, or any other intellectual property protections are required, we must obtain them as soon as feasible. We must write a thorough business plan including our project's strategy, finances, and business model. We must also look for funding possibilities like grants, venture funding, angel investors, or other sources of funding that are suitable for our idea.To advertise our smartphone application, we will aim to gather a group of specialist doctors, mobile engineers, and other medical professionals. We will also construct a functional prototype of our health mobile application or service that can be evaluated and improved. For our metabolic syndrome medical counseling mobile app to be effective and secure, we must perform clinical studies and gather data. It's time to publish our product (a mobile app for metabolic syndrome health assistance) and begin introducing it to clients once we have finished all of the required stages.

9. Testing and Implementation

- Unit Testing

Selected for the purpose known as "unit testing" involves testing individual software components. When developing an application, unit testing is done on the software product. An individual component might be a technique or a specific function.

- Integration Testing

Integrity testing is used to identify issues with how integrated units interact with one another. Integration testing is carried out after the unit testing of all the components.

- Functional Testing

Functional testing is a sort of testing that aims to determine if each application feature functions by the needs of the program. To determine whether a function's output is in line with the end user's expectations, each function is compared to the associated requirement.

- Non-Functional Testing

All aspects not covered by functional tests are checked during non-functional testing. It covers the software's functionality, usability, scalability, and dependability. We carry out non-functional testing to confirm that the end users' interest is upheld.

- System Testing

System testing entails evaluating the entire system. The system's functionality is tested by integrating all modules and components to see if it performs as intended. Following Integration Testing comes System Testing. This plays a vital role in creating a high-quality product.

10.Work Breakdown chart

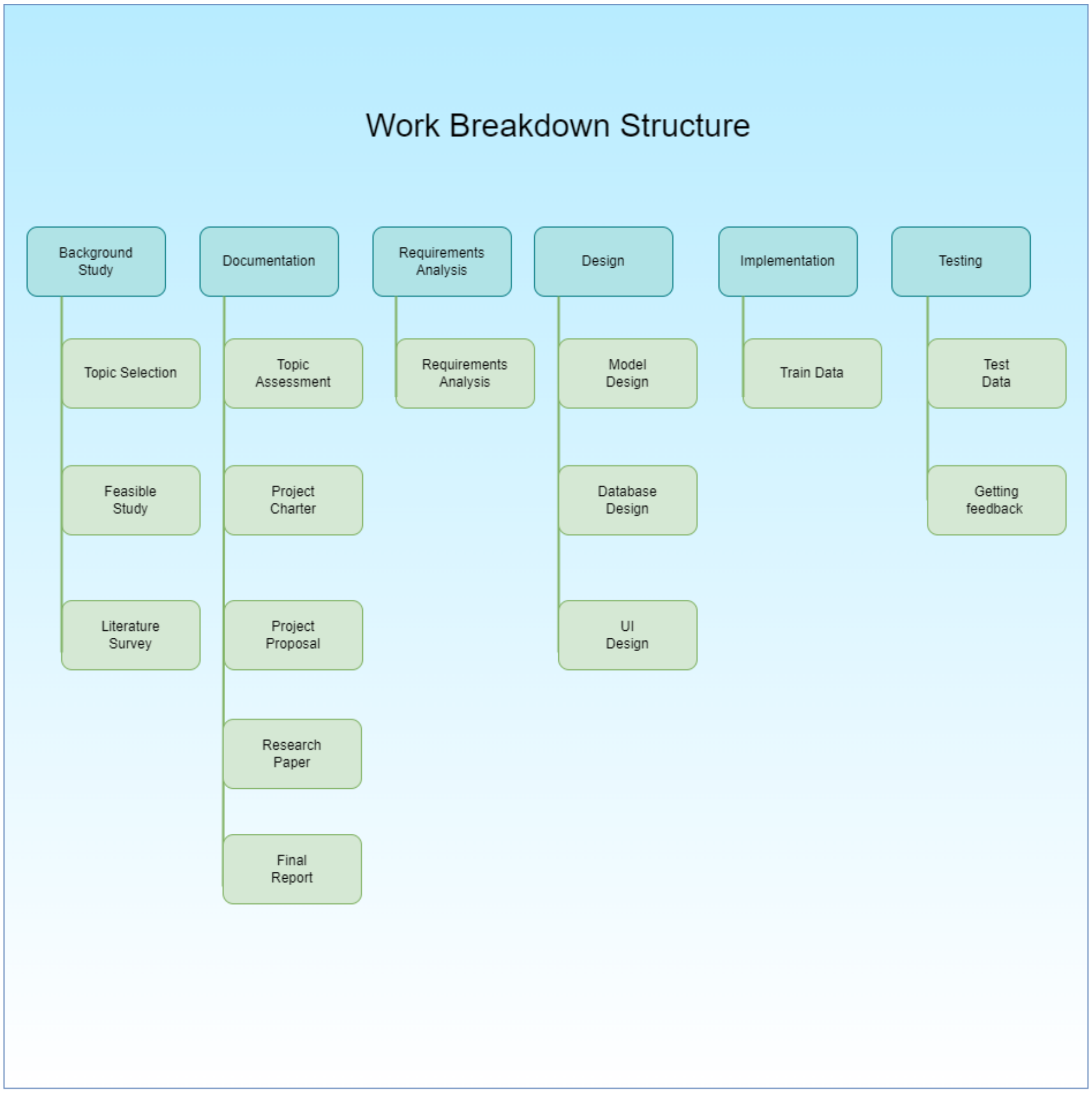


Figure 15:work Breakdown chart

11.Gantt chart

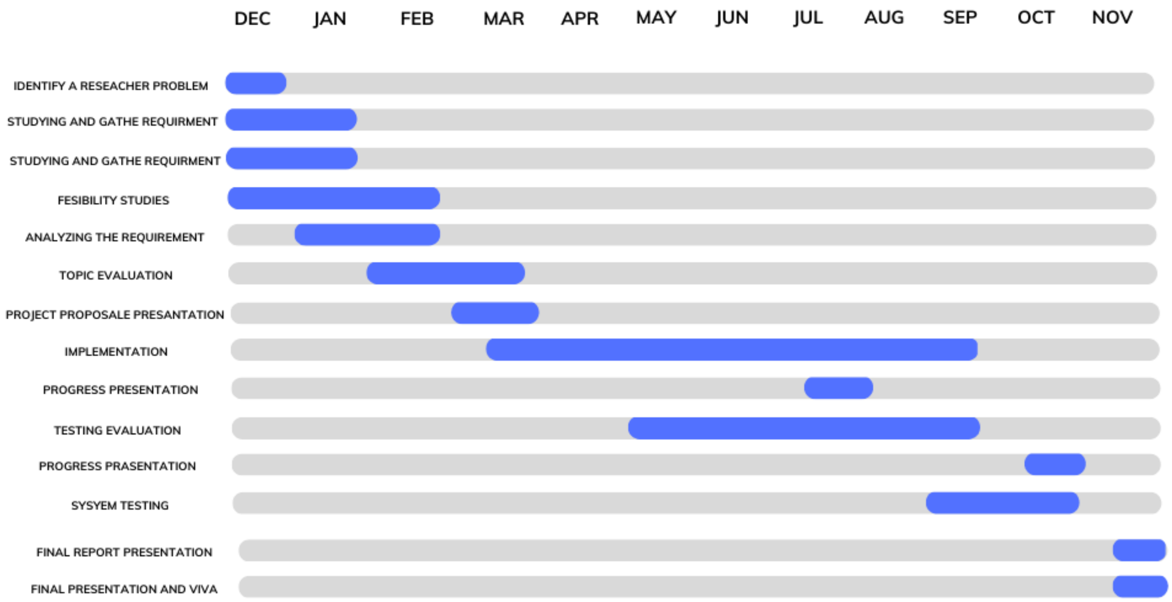
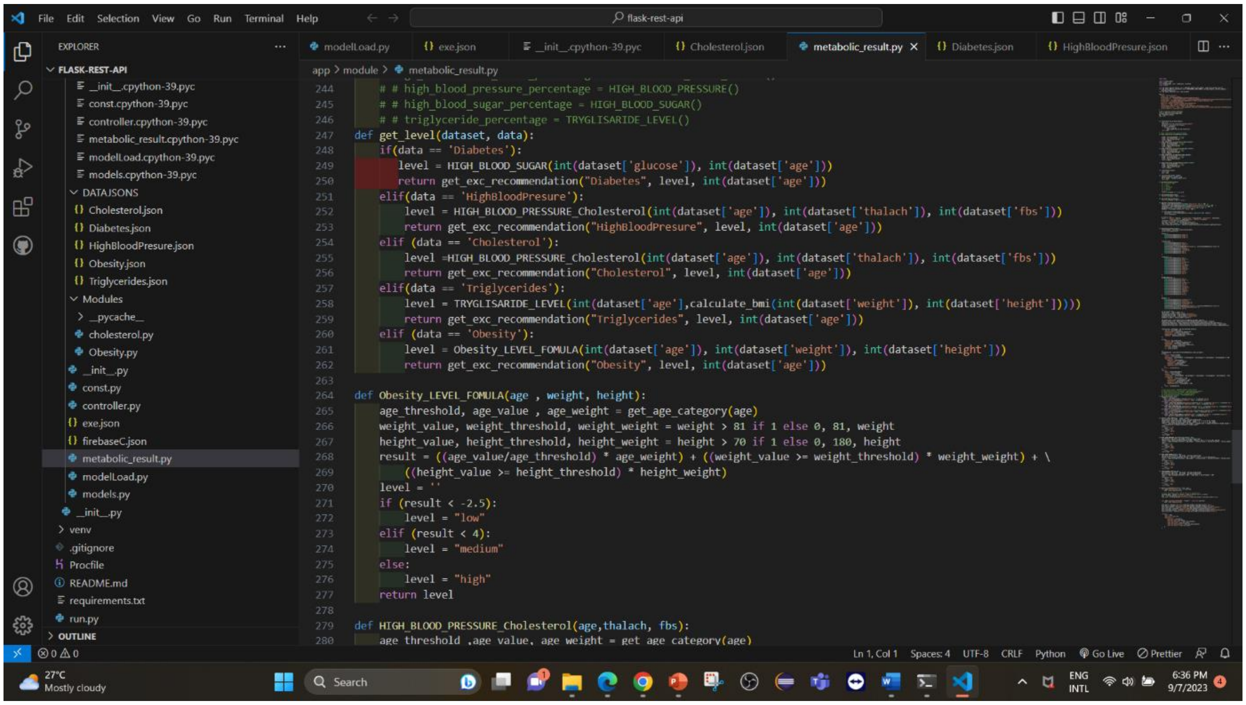
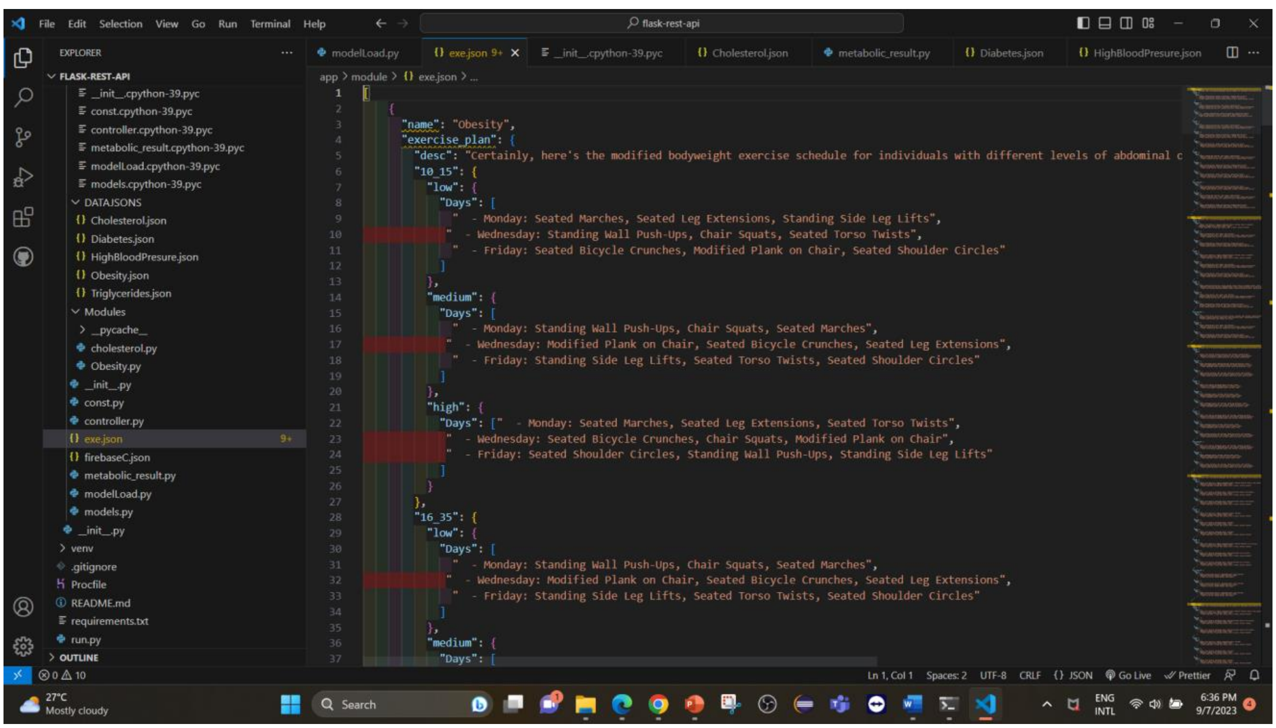


Figure 16:Gantt chart

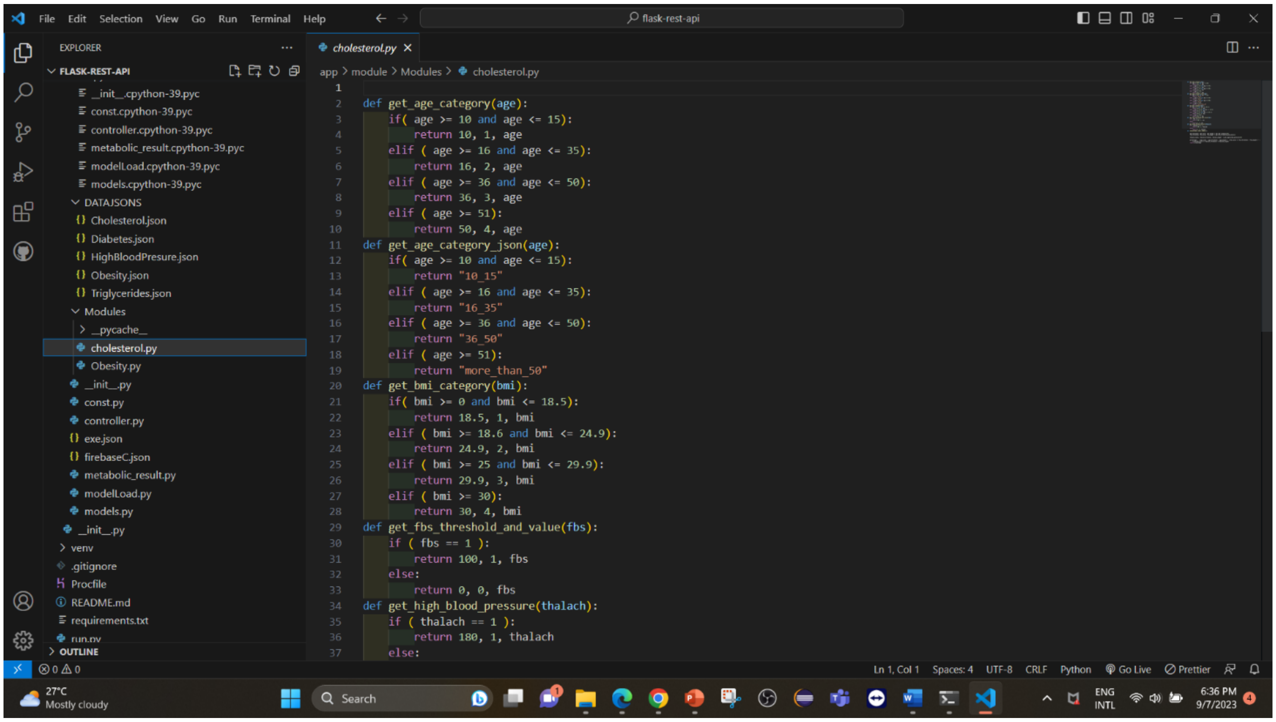
Appendixes



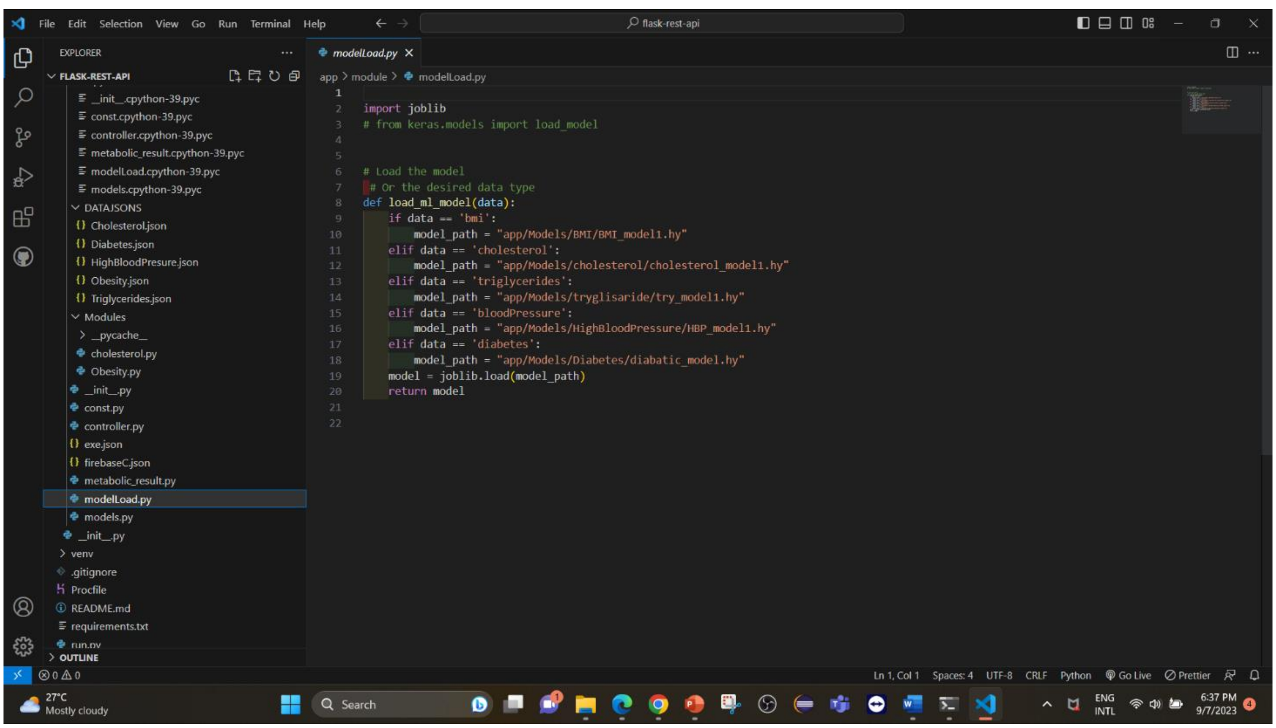
Appendix 1:Screenshot of code 1



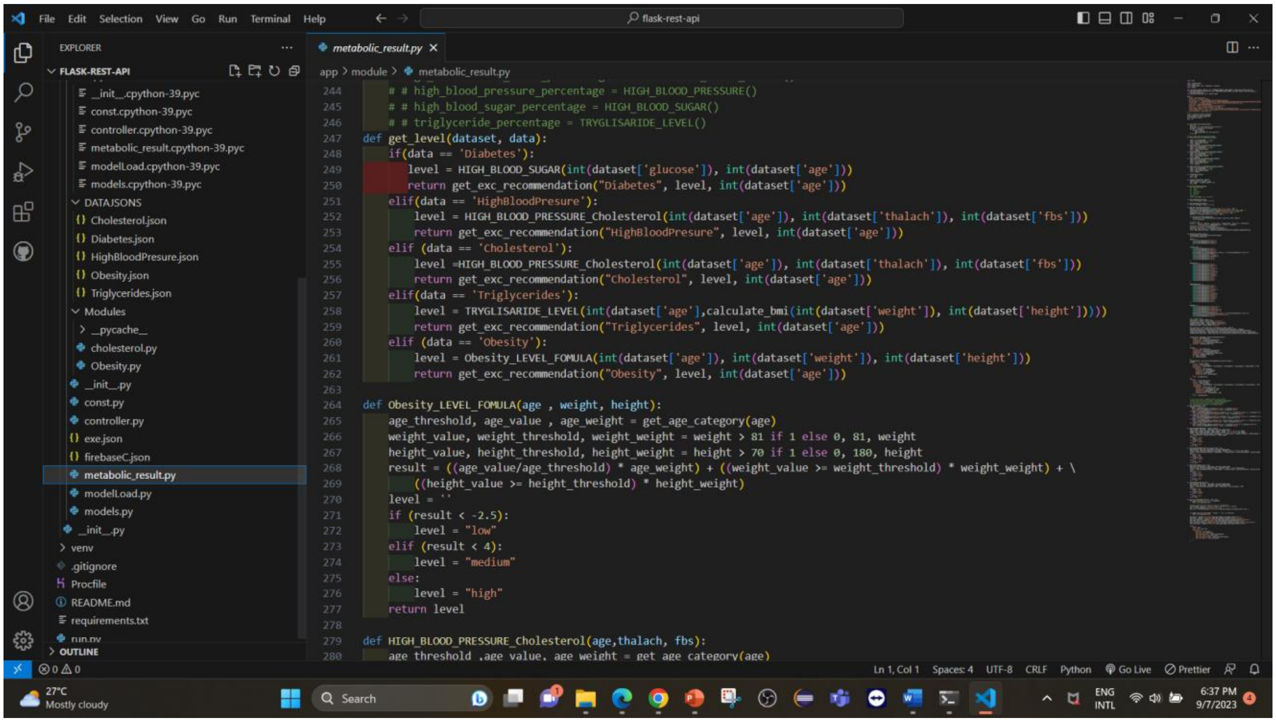
Appendix 2:Screenshot of code 2



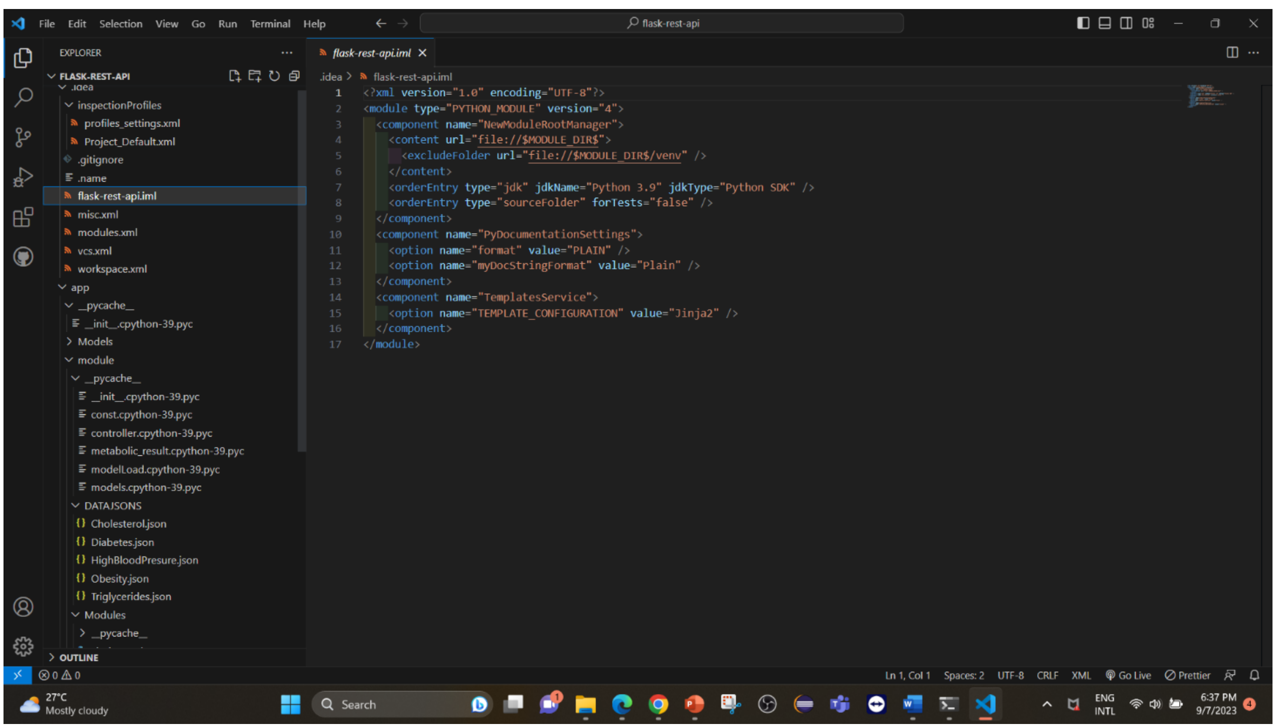
Appendix 3:Screenshot of code3



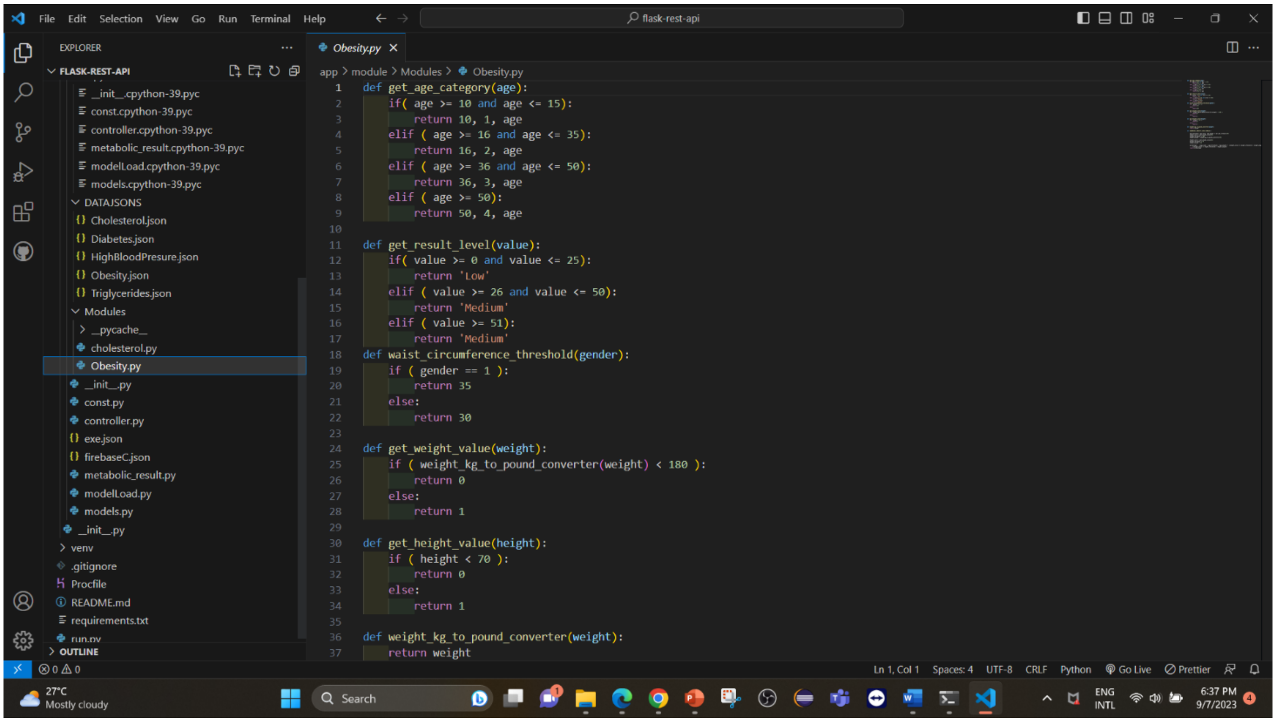
Appendix 4:Screenshot of code4



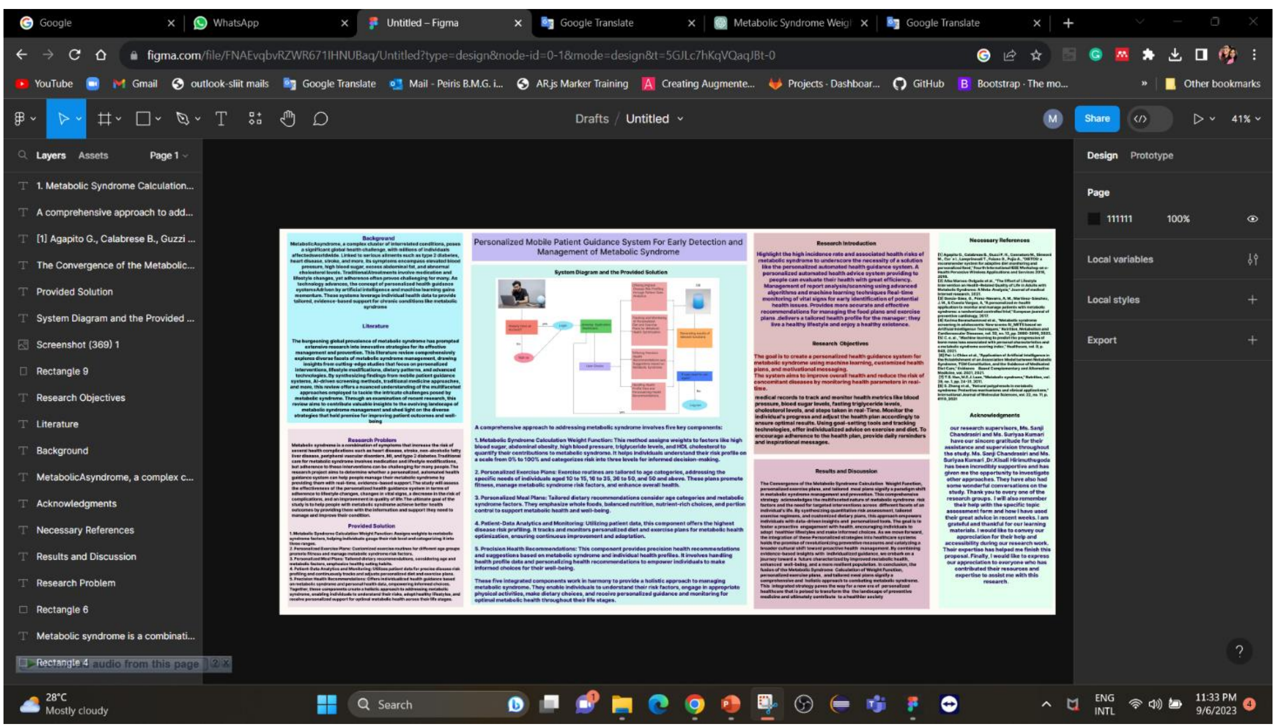
Appendix 5:Screenshot of code5



Appendix 6:Screenshot of code6



Appendix 7:Screenshot of code7



Appendix 8:Screenshot of Poster

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