An Integrated Application for Tracking, Maintaining Health and Fitness

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Abstract: ***Health and fitness are two such important things in everyone's life today. Everyone wants to see themselves fit and healthy so that can lead a happy disease-free life without any worry. But sometimes this cannot be achieved by few. Unhealthy and unfit can lead to many types of disease, one such disease is described in this work. Gestational diabetes refers to type of disease that is caused to pregnant women. Due to uneven diet and no proper exercise this disease can affects the pregnancy of the women. It can be controlled by doing regular workouts, having a proper diet, keeping the track of steps walked, nutrition intake, etc. In order to develop motivation among the people motivational videos are added in the application so that they can view it and give them with a clear dedication of maintaining a good health and bringing fitness to life. The user-interface of the application discussed in this project is light and can be easily understandable, easy to use for the users. The data-set was created by consulting to doctor who helped to understand the nutrition and fitness related conditions for each trimester and how a healthy body can be maintained.***

Keywords: GDM, Gestational diabetes, Low glycemic index food, Pregnancy, Tri-semester.

I. INTRODUCTION

The Application is developed in order to help the pregnant females who are suffering from a type of diabetic known as gestational diabetes. It's a disease that can cause a harm to the lady's health and can cause problem to her pregnancy. The main objective is to develop an application that provides the user with the different fitness tips to help them to stay fit. This is achieved by analyzing the data provided by the user and identifying the different behavioral patterns and clinical condition of the patient. The users are required to create their profile once after they login and track their health condition themselves just by various means such as diet and fitness plan, steps count, calorie intake and motivational videos.

II. MOTIVATION

Even though, many applications were built for diabetic treatment and care for the diabetic effected people. All of them either concentrates only on fitness management of the user by keeping track about their activities and suggesting the workouts user has to take up for maintaining blood sugar level.

Or it concentrates only on diet management of the user like amount of food to be consumed and type of food to be taken, thereby it suggests to maintain proper diet for the diabetic patient. These applications, gives importance to diet plan, calorie tracker and nutrition log. It gives convenient method of food log. It usually predicts more success with weight loss, but sometimes we cannot know whether the weight loss could reduce the risk of diabetes or not. It's about many aspects which includes food we eat regularly, behavior we choose, how one will manage his stress, the way we move and the way we rest. So, we thought of coming up with an application which gives platform for both fitness suggestion and diet recommendation for all types of diabetic patient.

Some examples of the industrial application for the same are:

1. **Fooducate** - this application helps the users to decide which food is good for maintaining blood sugar in a healthy range by providing it's user with the nutrition contents of the food. This application also helps the user to track their daily nutrition intake and achieve their targeted goal. This application focuses on maintaining the diet of its user.
2. **My Net Diary Calorie Counter Pro** - this application syncs with the fitness band and helps the user to track their glucose level, blood pressure, total carbs count etc. This application focuses on the fitness management of their user.
3. **OneDrop** - this application comes with mobile-application, blue-tooth enabled blood glucose enabled and test strips. The main drawbacks of this application is that the user must use the glucose meter of the same company and the users are also not allowed to enter the glucose level manually.

III. LITERATURE SURVEY

This section focuses on the surveying and collecting the relevant details of the papers related to the work. The main focus driven by article [1] is on the personalized healthcare of the patients. Personalized healthcare uses Artificial Intelligence (AI) techniques to the collected dataset to improve disease progression technique, disease prediction, patient self- management and clinical intervention. In article [1] machine learning largely depends on the available dataset and available algorithms to classify the data into some categories either through supervised learning or unsupervised learning. Humans do take wrong decisions as we human also depend on our acquired knowledge to make a decision.

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The decision we make sometimes involves emotion, on the contrary computers will not have that. We humans can be biased to make a decision based on our ethical values, perception towards the world, political and religious value and self identity. These factors can emerge in the available dataset which the computers will be used to train to make a decision. Hence it is a challenge to ensure the dataset which will be used for machine learning is free from human biases as much as possible. Overcoming these shortcomings in IoT and ML can further enhance personal healthcare.

Article [2] mainly focuses on the introduction of Big-data in health care. It emphasis the benefits of using Streaming analytics, Internet of things and machine learning in diabetes management with a case study. It also analyses the Impact of data analytics in healthcare. The presence of Big data analytics, Machine learning and Internet of has reduced costs of treatment significantly. Predictive Analytics can predict future outbreaks of epidemics, and avoid preventable diseases. It can also improve patient experience, including generation of faster test results; greater clinical collaboration. The world is in the midst of digital revolution where machine are helping patients .The cloud connects people and data analytics is helping healthcare by extracting useful insight and delivering high quality result to medical personals equipped with more care. The digital world is in new era where more focus is on improving quality of health rather than disease. Big Data Analytics, Machine Learning, Cloud Computing, Deep Learning and Internet of Things are the future of medicine .The healthcare industry should be open to embrace it. Article [3] mainly focuses on reducing the risk factor, which may occur during the period of pregnancy. Where, it was found that there is high chance of a person getting permanent type 2 diabetes if they are negligible towards physical and diet practices during their pregnancy period. As a method, 100 women are randomly chosen for condition and lifestyle modification program. Those who are allocated had to undergone some physical activities and healthy eating. They were also given guidance through telephone support. In six months, as an outcome the modified program have successfully translated the women who have had GDM. But, this method cannot be applied more large number of people. Although, giving all these features in a single platform as an application will definitely do. Article [4] mainly focuses on designing a model which can prognosticate the likelihood of diabetes in patients with maximum accuracy. It concentrates on gestational diabetes. Three machine learning classification algorithms namely Decision Tree, SVM and Naive Bayes are used to detect diabetes at an early stage. One of the important real-world medical problems is the detection of diabetes at its early stage. In this study, systematic efforts are made in designing a system which results in the prediction of disease like diabetes. During this work, three machine learning classification algorithms are studied and evaluated on different measures. In article [4] they have concluded that in future, the designed system with the used machine learning classification algorithms can be used to predict or diagnose other diseases. The work can be extended and improved for the automation of diabetes analysis including some other machine learning algorithms. Article [5] talks about the utilization of and limitations to practice in improving the administration and decreasing potential intricacies from type 1 and type 2 diabetes (T1D and T2D) in kids, young people, and grown-ups. It additionally gives information supporting the viability of activity assessment and solution programs in advancing cardiovascular well-being.

Some standard activities were polished by type 1 and type 2 diabetic grown-ups and kids. Clinical assessment with proper demonstrative examinations before expanding physical movement or starting an activity program. Recommended practice projects ought to incorporate both oxygen-consuming and opposition practices and ought to be ideally intended to improve both cardio respiratory wellness and nearby muscle wellness. Subsequently, practices had recuperated some diabetic patients. In any case, both eating routine and physical activities would recuperate the patients all the more viably.

IV. METHODOLOGY

Data-set was obtained from a well-known gynecologist. The diet used in this application was suggested for gestational diabetic patient after consulting the doctor. According to her, contingent is on every trimester of pregnancy. She proposed that low-fat and low-glycemic index foods to be prescribed for diabetic pregnant women along with the other dietary habit for non-gestational patients. She also explained the use of advice for the diet by giving her patients some accidents. Diabetes developed during pregnancy has also been found to have more chances of continuing even after birth. The type of diabetes is referred to as type 2 diabetes.

A. First Trimester

The following tables shows diet suggestions for first trimester. During these first 13 weeks there are a lot of changes happening. In fact, baby should weigh one ounce by the end of the first trimester, and have arms and legs. They will also begin to shape fingernails, toenails, and reproductive organs. It's making mother feel tired. In this trimester, sensation of vomiting will be more frequent. The baby eats what the mother eats, and the baby needs vitamins and minerals to sustain its tiny brain and bones developing. In particular, calcium, protein, iron, meat, whole grain, vegetables, fruits and more liquid foods are the nutrients required during the first trimester to sustain a healthy pregnancy. Whereas a food with a low glycemic index can keep sugar levels in check. Usually, consuming a diet that provides a wide range of nutritious foods and supplementing with a prenatal vitamin will meet such increased nutrients with low fat needs.

B. Second Trimester

Below table shows diet suggestion of second trimester. Mother should keep on eating a healthy diet throughout the second trimester. Following nutrients are most important: Iron helps move oxygen throughout the body. Throughout pregnancy iron provides the developing baby with oxygen. Protein is also important for the growth of the uterus and breasts of the mother. Calcium helps shape the baby's bones and teeth, and plays a part in the smooth functioning of muscles, nerves and circulatory system.

During pregnancy, folate is important because it helps prevent neural tube defects, including spina bifida, and decreases the risk of premature labor. Vitamin D helps to shape the bones and teeth of a growing infant.

Such essential fatty acids support heart, brain, skin, immune system and central nervous system. Anyone pregnant should drink at least eight to twelve glasses of water a day to prevent dehydration and its complications. Fruits and vegetables always add more nutrition to the mother.

C.Third Trimester

Table shows food items suggested for third trimester. DHA is essential during the third trimester for proper development of the fetal brain and retina. Calcium, which is necessary for building bones and teeth. Vitamin D is required to remove calcium from the bones. While the pregnancy progresses, the iron intake for fetal growth increases in proportion to the fetal weight, with much of the iron increasing during the third trimester. Protein that is needed to sustain maternal tissue and fetal growth in the third trimester. Folic acid is necessary to prevent infant neural defects. Vegetables are a rich source of vitamins and ham is a thiamine booster helping to release energy from the meal. Munching on seeds and nuts should provide you with ample thiamine, omega-3 essential fatty acids, and proteins. Wholegrain cereals which help keep the energy level all day long and prevent constipation.

Type	Quantity to be Consumed	Description
Dairy Products	150-200 mg per day	Milk, Yogurt
Iron	27-35 mg per day	Meat (Chicken, Salmon, Lean beef, fish), Eggs, Beans and lentils, Whole Grain (Brown Bread, oat meals).
Chlorine	5-10 mg per day	Red Meat, Eggs.
Protein	40-70 mg per day	Lean meat, Tofu, Fish, Eggs, Poultry, Legumes or beans, Nuts and seeds.
Calcium	150-200 mg per day	White Beans, Nuts and seeds, Eggs, Almonds, Dairy Product, Greens (Kale, Spinach), Juices, Breakfast Cereals.
Vitamin B12	2.6-5 mg per day	Poultry(Chicken), Wholegrain bread, Fortified cereals, Dark green leafy vegetable, Cooked sea food.
Vitamin C, B6	10-25 mg per day	Poultry (Chicken), Wholegrain bread, Fortified cereals, Dark green leafy vegetable, Cooked sea food.
Whole Grains	28-30 mg per day	Brown Rice, Oats. Fruits Any fruit juice or smoothie, Raw fruit like orange, grapes, tangerine.
Vegetables		Any vegetable smoothie
Unsaturated Fats		Olive oil, peanut oil.
Fluids		8-12 glasses of water every day, green tea.

TABLE I: First Trimester

Type	Quantity to be Consumed	Description
Carbohydrates	150-200 mg per day	Whole grain pasta, Brown rice, Whole grain bread, Oat meal, Sweet potato with skin, Whole grain cereals, Sweet corn, Dairy Milk (Milk, Yogurt), Beans.
Iron	27 mg per day	Lean meat, Leaf green vegetables, Cooked sea food, Nuts, Beans and lentils, Whole grain, Fortified breakfast cereals.
Protein	1.52 gram per kg of body weight	Lean meat, Nuts, Eggs, Fish, Beans and lentils.
Calcium	1000 mg per day	White Beans, Eggs, Almonds, Dairy Products.
Folate	400-800 microgram per day	Black eyed peas, Legumes, Fortified Cereals, nGreen leafy vegetables.
Vitamin D	600 International Unit per day	Olive Oil, Egg yolks, Fish, UV exposed mushrooms, Fortified juices.
Omega-3 Fatty Acids	1.4 gram per day	Flax seeds, Chia seeds, Fish.
Fruits		Banana, Watermelon, Strawberries.
Vegetables		Cauliflower, Spinach, Broccoli, Asparagus.
Fluids		8-12 glasses of water every day, Green tea

TABLE II: Second Trimester

Type	Quantity to be Consumed	Description
Magnesium	3.5-5 mg per day	Nuts and Seeds, Legumes, Whole grain bread, Raw cacao, Dark Chocolate, Whole Grains, Seafood, Dairy Product, Beans.
Iron	27 mg per day	Meat, Dairy Prod-ucts, Eggs, Beans, Whole grains.
protein	26 mg per day	Lean meat, Tofu, Fish.
Calcium	1000 mg per day	Dairy products, Beans, Eggs, Almonds, Greens, Juices, Fortified Breakfast Cereals.
Folate	800 microgram per day	Black eyed peas, Legumes, Fortified cereals, Dark leafy vegetables.
Vitamin C, B6, B12	50 mg per da	Orange, Beans, Sweet Limes, Almond, Chickpeas
DHA	100-200 mg per day	Algae, Flax seeds, chia seeds, Eggs, Fish, Fortified Milk, Folic acid rich food.
Vegetables		Any vegetable smoothie.
Fruits		Any fruit juices or smoothie, Raw fruit, Orange.
Nuts		Almond, Peanut, Macadomia, Pis-tachio, Walnut.
Whole grain cereals		Healthy homemade cereals, Rustic garlic cereals, Kellog's All-Bran Originals, General Mill's cherios, Fibre one original.
Fluids		8-12 glasses of water every day.

TABLE III: Third Trimester

Food To Be Restricted	Potatoes, Candy, Soda, Fish with high level mercury, including shark, sword fish, tile-fish, Unpasteurized dairy products, Ready to eat meat and sea foods, Junk foods, Avoid caffeine as such as possible like coffee, Processed Food, Sugary Drinks, Alcoholic Drinks

TABLE IV: Food to be Restricted

D. Food to Be Restricted

Table-IV shows list of food item to be avoided during gestational diabetic period. Alcohol should be avoided throughout pregnancy, because there is no known level of safeness. All forms of alcohol can be harmful and can cause: miscarriage, stillbirth, and FASDs. FASDs are disorders that cause physical, behavioral, and mental handicaps. Gestational pregnant women with diabetes may ingest some small quantities of caffeine. Experts agree that consuming 150 to 300 mg per day is healthy, but the American Pregnancy Association recommends that pregnant women avoid as much caffeine as possible.

E. Fitness

Exercise during the gestational pregnancy cycle has many benefits, such as enhancing sleep, minimizing swelling or backaches caused by pregnancy, promoting labor and delivery, delivering endorphins that can make mother feel happier and more energetic, and helping to get figure back quicker after childbirth. Workout at the user's own speed, and for baby should not be over-exercised. Warm-ups and cool-downs are important for every workout. Adequate stretching before and during physical exercise can warm the muscles, improve strength, help decrease muscle aches and joint pain, help avoid injury and encourage overall well-being in everyday life for the person. Rolling shoulder rolls forward in three rotations and then back in three rotations to relieve muscle tightness. Raising hand above one's heart level will decrease the stiffness of finger joints and help minimize swelling, if any. Squats are an ideal resistance exercise during pregnancy to maintain the strength and range of motion in the muscles of the knees, glutes, heart and pelvic floor. Squats can help improve flexibility when done correctly, and they have the ability to assist with the birthing process.

Forward, back taps will help lower back gently strengthen, decrease hip and lower back pain, and help with round ligament pain. Kick butt squats and knee raise helps keep body strength strong. Practicing the right butt and leg exercises regularly will improve the muscles that help sustain the extra weight the user carries. Walking for thirty minutes at least per day on flat land will help in easy movement.

Month of Pregnancy	Workout Suggestion
First	Warm up, Base Move, Hand Raise, Shoulder Rolls, Squats side, up and down, Knees Raise, V raise, Cool down exercise, 30 minutes of walk on flat land.
Second	Warm up, Base move, Knees Raise, Slow Jacks, Shoulder Rolls, Lunges, Leg raise up, 30 minutes of walk on flat land.
Third	Warm up, Base Move, Knees Raise, Side move, Back Wind Mills, Back Lunges, Cool down stretches, 30 minutes of walk on flat land.
Fourth	Warm up, Base move, Squats, Forward taps, Back taps, Squats with temporary weights, Arm Stretch, Cool down Stretches, 30 minutes of walk on flat land.
Fifth	Warm Up, Base move, Forward Squats, Side squats with leg raise, Shoulder Rolls, V raise, Kick back squats, Side squats, Cool down Stretches, 30 minutes of walk on flat land
Sixth	Warm Up, Base Move, Squats, Side Move, Back Lunges, V Raise, Side Move, Cool down stretches. 30 minutes of walk on flat land.
Seventh	Warm Up, Base move, Butt Kicks, Hand Raise Squats, Back Lunges, Functional Moves, Cool Down Stretches, 30 minutes of walk on flat land.
Eighth	Warm Up, Base Move, Squats up and down, Pelvic muscle exercises, back lunges, Cool down Stretches, Floor exercises, 30 minutes of walk on flat land.
Ninth	Warm up, Base Move, Squats up and down, Pelvic Muscle Exercises, Cool down and Stretches, Floor Exercises, 30 minutes of walk of flat land.

TABLE V: Workout Suggestions

Fig. 1: Flowchart of the Application with All Modules

V. IMPLEMENTATION

When the users start the app initially, they will be prompted with the login screen and asked them to login before they can proceed to the main menu of the app. However, they can also register new accounts at the registration screen if they are not the existing users. After performing either one of the actions, they will be redirected to the main menu with different modules such as Profile, diet suggestion, fitness recommendation as well as chat with the doctor. The complete flow of the system can be referred to Figure 5.3 that is being shown above.

A. Connections

The database used for application is google Firebase. Firebase provides a variety of ways for authenticating the users, various different other services like cloud storage, analytics, real-time data storage etc., as shown in figure – 2. This application uses the email-authentication service to authenticate user to login and create an account. The details of the users are stored in the firebase it as the user inputs it during the creation of the account as shown in figure – 3.

B. An Overview To Android Application

1) Login Page: Before commencing the use of any kind of services that the application is going to provide to its' users, the user is required to login using unique username and password that are confidential to the application server only as shown in figure – 4.

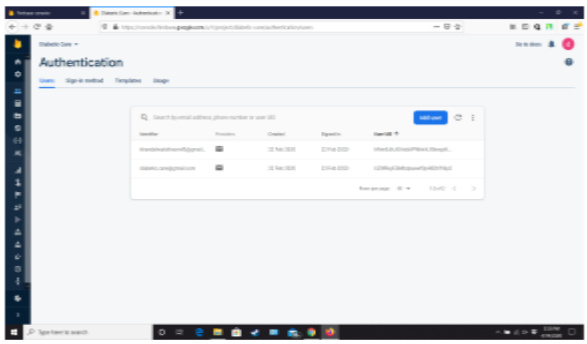

Fig. 2: User Details

Fig. 3: Login Page

C. *Profile Creation*

The users after login are required to set up their required goal by entering the number of steps targeted to walk and calorie they required to burn.

D. *Steps Tracker*

The user can track number of steps walked by them in order to complete the target set by them using this interface.

E. *Diet Tracker*

The user can add food as their requirement and can tack the calorie intake as per the goal set by them during the process of setting up the goal.

F. *Calorie Tracker*

The user can use this interface in order to track their nutrition intake in order to keep themselves fit and healthy

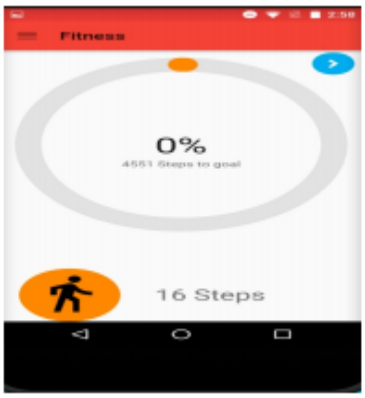

Fig. 4: User Interface to Track Steps

VI. RESULT

The application focuses mainly on keeping gestational diabetic users healthy and feeding. A single platform where features such as profile formation, step tracker, motivational videos, calorie tracker, advice on diet and fitness are offered. The baby eats what mother eats, the baby needs different types of vitamins and minerals to sustain its body development. In particular, food suggested for each trimester has its own importance to support healthy pregnancy. Whereas a food with low glycemic index can keep sugar level in check. Usually, consuming a diet that provides a wide range of nutritious foods of supplements with a prenatal vitamin will meet such increased nutrients with low fat needs for gestational diabetic users. Exercise during the gestational pregnancy cycle has many benefits, such as enhancing sleep, minimizing swelling or backaches caused by pregnancy, promoting labor and delivery, delivering endorphins that can make mother feel happier and more energetic, and helping to get figure back quicker after childbirth. Suggested workouts are need to be performed at the user's own speed, and for baby should not be over exercised. Adequate stretching before and during physical exercise can warm the muscles, improve strength, help decrease muscle aches and joint pain, help avoid injury and encourage overall well-being in everyday life for the person.

VII. CONCLUSION AND FUTURE WORK

As a result, this project will provide it's users a complete integrated platform for tracking as well as maintaining their health. The users can not only get benefit by keeping tracks but also will be able to know their each day updates tracked. The users need not to use different application for different purpose from diet plan to tracking health, all these functionalities are provided in this application itself. As a future work one can add different options for the login like google enabled login, login using phone number and others. New features like email notification, message alert can also be added in this application. Apart from these the developers can further add the relevant features that can help the users to use this application in a more productive way instead of using different application for different purposes.

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