

# A Smart Fitness Application for Pregnancy that Recommends Workout Plans based on Health Conditions

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**Abstract:** In today's life, health is of utmost importance. However, with the work schedule, intake of nutrients in daily routine is highly affected, and maintaining good health in this scenario becomes challenging. This challenge becomes more difficult to face when a woman goes through an n-number of physical and mental changes during the nine-month journey of giving birth to a new life. This journey aims at being happy and having a healthy baby, for which the mother needs to keep herself fit and healthy. However, with all the body's changes, it is not easy to continue with a regular fitness workout. Some applications recommend workouts based on the specific period in the pregnancy. However, every pregnancy is unique and needs a specific workout routine. A solution to this is a customized workout routine for every would-be mom based on the week of pregnancy, the medical conditions of the mother and child, and the target goals. This can be achieved by considering every possible medical condition and defining a solution for it. © 2022 The Author(s)

## 1. Introduction

Pregnancy is a state of a woman where one or more offspring develops in the woman's womb. The term of pregnancy is divided into three trimesters of approximately three months each. Each trimester stages the fetus's development and marks changes in the woman's body. In order to have the pregnancy end in a live birth, prenatal care improves these changes. Prenatal care consists of various activities and habits that lead to a good and healthy lifestyle, such as avoiding drugs, tobacco, alcohol, regular exercise, and regular physical examinations. However, in certain cases there could be complications in the pregnancy including high blood pressure disorders, gestational diabetes and severe nausea and vomiting.

Mobile phones are quickly becoming a popular new technology in the developing world. They have been shown to be effective instruments for improving the local population's quality of life. However, we cannot anticipate being able to adapt traditional mobile user interface design in localized mobile apps. Therefore, the major goal of this study was to figure out how to develop a user interface for a web app. Identifying the different aspects of pregnancy and the state of mind led me to work towards the betterment of the expecting mothers and provide them with a product that will bring them a peace of mind by controlling their anxiety, being healthy, and self-confident.

### 1.1. Related Work

A study carried out to review the experiences of the pregnant women explains women's experience of their physical body could be defined in three ways: "Public Event: 'Fatness' vs. Pregnancy", "Control: Nature vs. Self", and "Role: Woman vs. Mother" [9]. The "Public Event: 'Fatness' vs. Pregnancy" is concerning as it views the opinions of the women. The theme comprises of the way socially constructed ideals influence the woman's perception of her body and the public's involvement in the pregnancy. Some studies have also described as women perceiving socially constructed ideals to be thin, have shapely breasts and unmarked skin [9] [11] [5]. Although women acknowledge the changes the body go through during the pregnancy, but they still differentiate between the unacceptability of being fat versus the acceptability of being pregnant in the society [8]. Studies demonstrated that an increased breast size gave women an increasing body image satisfaction, whereas changes such as acne or stretch marks moved them away from this socially constructed ideal [3] [4].

According to industry research, there are a variety of platforms and applications available to meet the demands of expectant women. These apps offer nutritional advice as well as a look at the development of a fetus. The main disadvantage of these applications is that they do not consider the user's medical state or vitals.

Table 1. Available products and their limitations

Product Name	Description	Drawbacks
Ovia Pregnancy Tracker [13]	Contain a list of features including timeline of baby’s anatomical development, symptoms to watch for and information articles	App interface is cluttered & Exercises are not a part.
Baby2Body [1]	The app provides customized workout plans for each stage of the pregnancy, suggest meal plans and coach support with premium membership	The medical vitals are not considered when customizing a workout plan.
Prenatal Yoga: Down Dog [7]	It contains prenatal yoga for expecting mothers with options of coach voice	Only yoga is provided, other forms of exercises are not a part.
Prenatal & Postnatal Workout [14]	Workout is tailored to the stage of pregnancy	Individual health conditions are not considered.
Oh Baby! Pregnancy Exercise App [12]	New workout are provided everyday with time trackers	The stage of pregnancy and individual requirements are not considered.

The state of the user for the need of customized information forms the grounds for the need of a platform that recommends data based on individual needs. As the studies support a research and identify the solutions to similar problems there are certain software applications that are brought to the user to fulfil their needs in an efficient manner. Most of these application provide workout plans and nutrition charts based on the trimester that the woman is currently going through. The applications mentioned recommend fitness workouts specifically for a each trimester whereas the growth of a baby differs from week-to-week. This is the gap that the proposed solution will fill. The workout will be planned based on the week of pregnancy and customized for every individual’s physical health and medical condition.

## 2. System Design

The result of designing pages for applications are not always the best. There is a difference between the look and feel of the product and what the user actually needs to accomplish. In order to generate this process an alternative is to create user flows and focus on the needs of the user to complete certain tasks in the most effective manner [10].

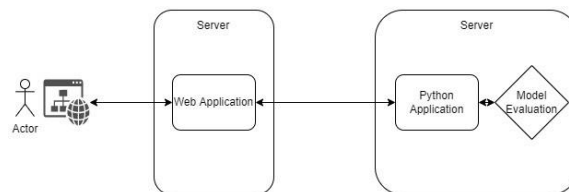


Fig. 1. System Architecture Diagram

Figure 1 shows the architecture for the proposed application. The application can be accessed via a web browser based on a laptop, mobile or tablet. A device that supports web browsers will be able to access the application. The real system under development is broken down into multiple high levels of functionality using a component diagram. Within the system, each component is responsible for a single explicit goal and only communicates with other important pieces on a need-to-know basis.

### 3. Design Approach

The methodology followed to implement a solution for the stated problem is the design thinking approach. This approach should ideally lead to solving the problems and creating new ideas. The goal is to develop ideas that convince the end-user and consider the user's point of view along with the market and being product oriented. Core features of design thinking include the abilities to:

- tackle difficulties that aren't well-defined or 'wicked'
- embrace techniques that are solution-oriented
- reasoning that is both abductive and fruitful
- sketching and prototyping are examples of nonverbal, graphic/spatial modeling medium.

#### 3.1. Empathize

The first stage of the Design Thinking process is to gain an empathetic understanding of the problem that is to be solved. The questionnaire to understand the users created results with respect to inputs received [2].

#### 3.2. Define

During the Define stage, the information gathered in the Empathize stage is put together. This is the stage to define the problem as a problem statement in a human-centered manner. The Define stage helps the designers to gather great ideas to establish features, functions, and any other elements that will allow solve the problems.

#### 3.3. Ideate

By the ideate stage problem statement is well defined and it's time to 'think outside the box' [6]. There are various techniques for the ideation process like brainstorming, storyboards, mind-mapping etc. During this process the team could come up with multiple ideas and the goal is to identify the most appropriate and efficient solution to solve the problems identified.

#### 3.4. Prototype

The prototype phase is the stage where the ideas evolve into low scale, inexpensive versions of the solutions ideated. The process includes designing from sketching to developing prototypes that can be used for testing in the next stage. The prototype gives the user the real feel of interacting with the system or the end product.

#### 3.5. Test

Designers precisely test the complete product using the solutions identified during the prototyping phase. This is the final stage of the design thinking model, but in an iterative process, the results gathered during the testing phase are then used to redefine one or more problems.

### 4. Implementation

Developing a software or an application for the user is a process of creating, designing, deploying and maintaining the application. After executing each step of the design thinking approach of understanding the users, defining a problem statement and ideating a solution, the prototype phase can be extended into development of the initial product concept. To deliver the user with the most accurate look and feel of the product it is essential to create a working software that can be offered to the users in the testing phase. The implementation of the application is based on the components of ReactJS. React is generally used in the development of single page applications however it primarily focuses on state management and rendering to the DOM.

The application consists of two main components -

1. Landing Page - The landing page provides a navigation through the application. It is divided into 3 sections of Home, Process and workout Categories.
2. Dashboard - The dashboard component of the application is the main component that exposes the features proposed for the solution. The component is divided into two sections - workout plans and health predictions.

## 5. System Results

The system output results in the list of videos recommended based on the category the videos are tagged as and mapped with the overall health prediction. The videos are categorized as low, medium and high meaning if the user has a low risk health prediction then the videos with category low will be recommended for the user to use them as a workout plan. Similarly, health prediction between 35% and 65% are categorized as medium videos and those above 65% are recommended for higher health prediction.

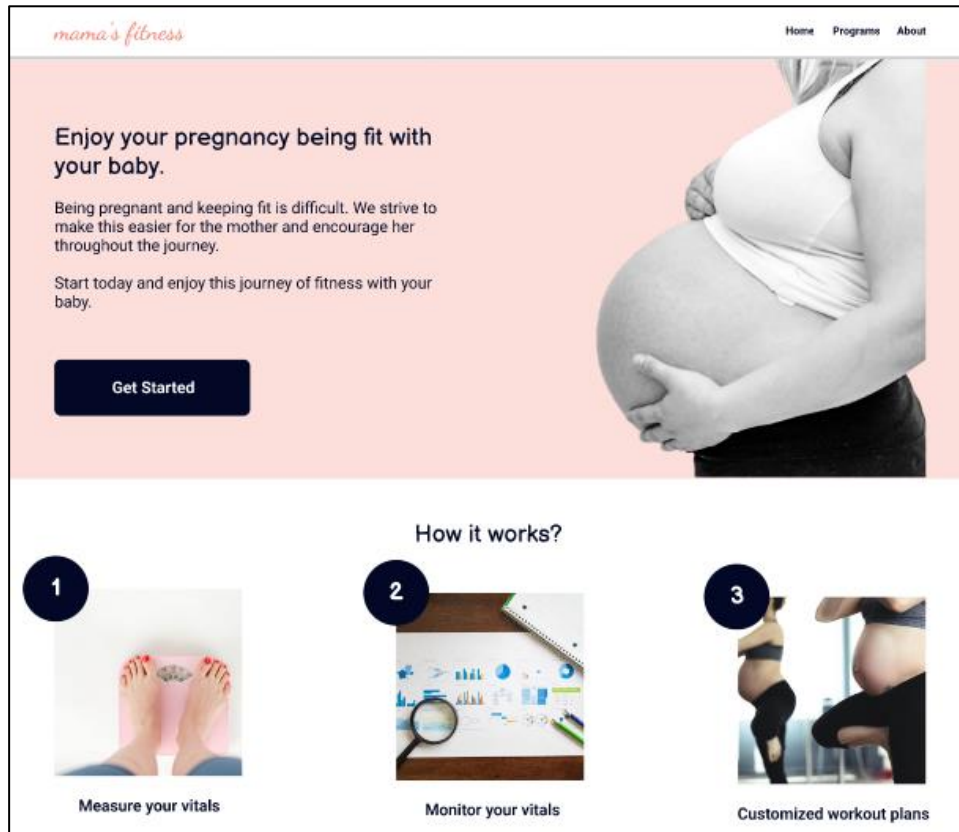


Fig. 2. First view of the application

Fig. 3. The activity page of the application

The videos with low category mostly consists of high intensive workouts such as aerobics and cardio where the pregnant woman has normal medical vitals and is generally advised to perform normal physical activities. The videos with medium category are less intensive and more towards a relaxing form such as Yoga, and low categories consists of meditation or regular physical activity like walking. Figure 2 shows the landing page for the application that gives and overview of the process.

The Figure 3 depicts the panel to enter the values to recommended videos based on the gestational age that is 32 weeks i.e. third trimester and a safe zone health prediction of 30%. For this prediction the user initially navigates through the landing page to the main dashboard or activity page. On the activity page the user can either search and sort through the videos or proceed to enter medical vitals and trigger a health prediction and obtain the list of videos relevant for their health and state of pregnancy.

## 6. Evaluations

The application is evaluated based on the results of the usability testing performed on a group of users. The application has been tested using the remote usability testing method with the moderator.

### 6.1. Testing Process

The aspects of a usability process consist of the following -

1. Plan - A testing plan defines the testers, tasks, moderator and the flow of the testing.
2. Create user tasks - Depending on the features to be tested of the application a list of tasks is created and converted into scenarios for the testers to give a real situation.
3. Recruit tester - While selecting or recruiting the testers it is important to target the end user, this includes the tester demographics. While recruiting the testers a questionnaire was generated to identify relevant testers.

4. Facilitate Testing - To test the application a remote moderated environment is opted considering the geo- graphical restrictions. The platform used is MS Teams where screen sharing was used to enable the tester to view the application.

In remote moderated testing the user should be observed closely for their experiences and also the moderator should engage with user without prompting much. Recording a remote testing session is useful for later studies.

### 6.2. Results

The inputs of the testers was recorded using the data logger excel sheet. The idea is to log the observations with a short hand during the moderation as it is difficult to take in multiple inputs at the same time. The data logger allows the moderator to create the participants list, tasks or scenarios and a satisfaction questionnaire for the system usability score. The SUS score is calculated considering the questionnaire, task score and confidence rate.

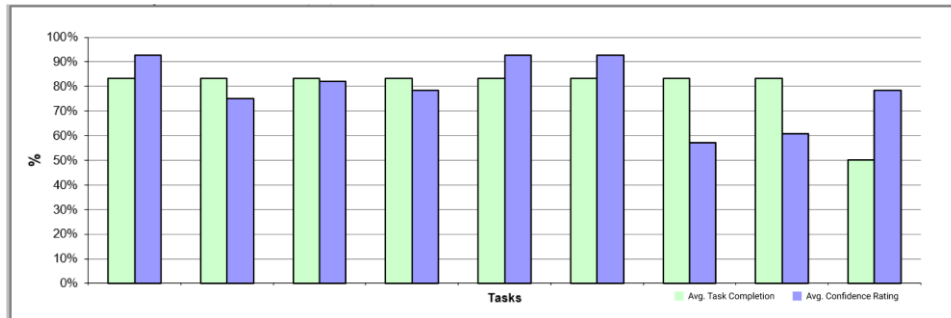


Fig. 4. The average task completion and confidence rate of the user representatives

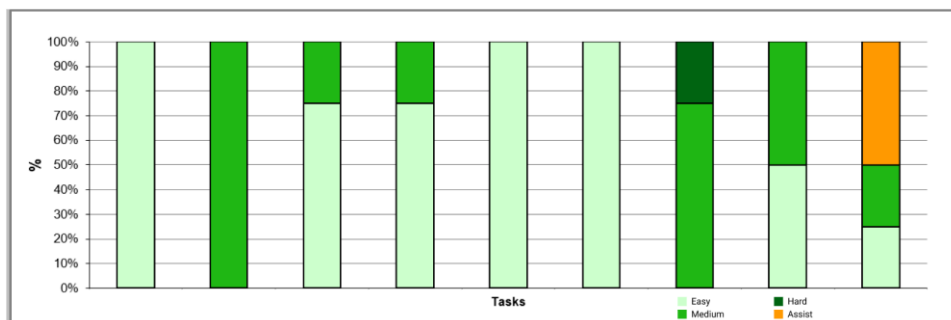


Fig. 5. The task performance of test users

The graph shows the average percentage of the tasks completed by the tester based on the Score for each task and the average confidence rate is calculated on the Confidence value defined by the tester.

### 6.3. User Tasks and Improvements

Based on the inputs received from the users and difficulties faced while navigating through the application, the prototype phase was revisited and improvised to incorporate the user feedback and improve their experience. The key tasks and features incorporated are -

- Navigate through the dashboard - To move on to the dashboard page from landing page sections.
- Get customised exercises - The user needs to enter the medical vitals in the panel and get a health prediction. Based on the health prediction the exercise videos are being recommended.

- Search Video List - Based on the users need the individual will be able to search using key words.
- Sort - The list of videos can be sort based on category and difficulty level.

## **7. Discussions**

In this research the question identified to define the form of information required to maintain good health during the difficult journey of pregnancy is answered. The format of information chosen is video to provide the appropriate guidance of fitness during pregnancy. The larger problem that is being addressed is the solution to provide information or fitness related videos considering the health and medical vitals of the expecting mother. To deliver a user-friendly solution an application was initiated with an approach of human-centered design. The application is developed and evaluated using the Usability Testing methods as mentioned in Section 6. In this the recommendation of videos is based on the range of the health prediction percentage calculated considering the medical vitals. Although the system recommends videos considering the range of output, a machine learning algorithm can be implemented to view the videos of the users' interest or term of the pregnancy based on the activity history. The recommendation of fitness videos is only based on prediction range and levels in the data. Using a collaborative-filtering algorithm as a recommendation system will enable the user to view videos relevant to the individual without the range predictions of the medical vitals. Based on the input of the user representatives the application can also integrate with multiple features such as nutrition tracker, baby development and a social platform to connect with other mum-to-be.

## **8. Conclusion and future Scope**

The research presented current state-of-the-art principles in pregnancy fitness and body image difficulties, as well as an online application that allows users to work toward the goal of staying healthy during the delicate journey of pregnancy. According to the findings, women have postpartum body image concerns as a result of the criteria established in the notion of a good or desirable body. Based on the testing mentioned in Section 6, the practical component of this thesis validated that the application built is user-friendly. Fitness video recommendations are a stand-alone tool that may be combined with other aspects of pregnancy, such as dietary trackers, baby growth, and a social platform. The goal was to develop a solution that is based on user-centered design principles and to apply what students have learnt in school. According to the study, the application aimed at expecting women provides generic information and guidance, but their individual medical conditions are not taken into account. The application is designed to take into account individual medical vitals in order to deliver relevant information and workout regimens to the user. The research question specified is to produce a user-centered design for a web application that allows expecting women to get exercise recommendations based on their pregnancy stage and medical vitals.

The proposed solution is for a web application platform. However, the idea can be extended to an application with features supporting the pregnant women regarding health care, nutrition and post-partum care. Also, it can be provided as a service to existing applications as a proposed feature that can be incorporated.

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