FITCONNECT: AN INTELLIGENT MOBILE APPLICATION TO AUTOMATE THE EXERCISE TRACKING AND PERSONALIZATION USING BIG DATA ANALYSIS

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ABSTRACT

In recent times with the pandemic, many people have been finding exercise as an outlet. However, this situation has made it difficult for people to connect with one another and share their progress with friends and family. This paper designs an application to utilize big data, a social media network, and exercise tracking [1][2]. The program aims to help people connect with others to support one another in their fitness journey. Through various experiments we demonstrated that the application was effective in connecting users with each other and overall improving their fitness experience. Additionally, people of all experience levels in fitness were generally satisfied with the performance of FitConnect, with those of higher experience being less satisfied than those with lesser experience. This application will facilitate getting into fitness through positive means for any person who wants to pursue a healthy lifestyle, whether in the walls of their house, a swimming pool, or a gym [3].

KEYWORDS

Big Data, Social Community, Exercise Tracking.

1. INTRODUCTION

Fitness has consistently remained a prevalent topic because it can better or maintain the health of people. Additionally, exercising serves as an outlet for people to relieve stress and get away from the tough things in their life. With the situation of the 2020 pandemic creating a nerve-racking environment, fitness has become increasingly popular across the world as a way to deal with this stressful situation. However, similar to starting any other kind of hobby, many people may not know where to start in this endeavor. The world of health and fitness is extremely vast, with an overwhelming amount of information that may seem daunting to some, making it difficult to enter this world. In addition, all this information often conflicts with one another over how to carry out the optimal fitness plan through different exercises, training intervals, and more. One of the goals of this application is to improve the accessibility of this knowledge and make it easy for beginners to start. By having a support system of others in the fitness industry, those who are beginners will have an easier time getting started with working out and be more motivated to continue. Additionally, people of all levels will be able to easily access advice and support one another in their fitness journey.

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People have used various methods in order to start in their exploration of fitness [4]. Many applications already exist which allow the user to create workout plans and track their previous exercises. They can access charts and data to see their progress of the weight they lifted and the muscle groups used. Additionally, this application allows users to add friends and track their workouts, however, the friend system does not go much further than this, which is one of the first issues. Users cannot communicate with friends or share progress with one another, which makes the entire friend system seem meaningless. Another practical problem is that some users may find it hard to understand certain terms or features upon first using the program, especially for beginners. The database of exercises is so vast, yet it may be difficult for those who are new to fitness. Another issue is that many of the application's useful features are locked and can only be accessed through a subscription. For some this payment may not seem like an issue, but for people who are new to fitness this may act as a barrier to furthering their health. Various experiments were done in order to determine how effective social connections were for fitness. One study designed a mobile game that was based around physical activity to see how users interacted and played in a group [5]. The results discovered that physical activity rates increased by 15% when using the app compared to when the individuals would work out alone. The competitive drive and cooperation between people increased and played a role in increasing exercise.

Our method is a fitness application, Fitconnect, that allows users to connect with other friends and create personalized workout plans. The program uses big data to gather information on the user's friends, workouts, and other information. The data collected by the users is stored inside of a Firebase database. This Firebase features a user authentication system that can allow people to access their accounts safely with email verification. Additionally, the application uses a social community to allow users to view posts and add friends to build a community and help gain support. Ideally, a user would be able to look to their more experienced friends for help by communicating with them to come up with an optimal workout plan or any fitness advice. These features are packed into an easy-to-access system that is extremely navigable. Ideally, if users were having trouble with anything, they could seek help from their friends. While other applications only allow people to collaborate in person, FitConnect aims to allow people to exercise together and gain inspiration remotely as well. Combining these features of different applications into one, it encourages users to exercise more in large groups at a time, as different friends will lift each other up and increase the competitive drive. This app assists users in furthering their fitness journey and keeping them motivated to exercise more, furthering their health and overall well-being, all from the safety of home.

In two applications of FitConnect, we demonstrate how the combination of the features on this program helps to increase the activity levels of users. First, we can show the usefulness of our approach by accessing various data from the Firebase as well as the number of interactions of users on the application. For instance, we can collect data of the number of workouts from individual profiles of users. Additionally, we can utilize the amount of activity on the app, specifically the total time on the app as time progresses. We can also utilize the usage of the social media features, such as the number of friends as the user continues to use the app as well as the number of interactions with these friends. Second, we can use this data and see its progression over time to find various patterns and make a conclusion. For instance, we can analyze if the participants will do more workouts at a higher frequency and for a longer time over a period of a few weeks. Alternatively, we can survey various users based on different exercise experience levels to provide feedback on how effective FitConnect was in facilitating fitness. Finally, we can compare our analysis to other fitness-related studies and applications to see if Fitconnect is the best method.

The remainder of the paper is organized as follows: Section 2 will give the details of the various obstacles and challenges that we faced while designing the experiment and carrying out this research. Section 3 will then talk about the way we solved these problems and overcame the challenges aforementioned in Section 2. Section 4 discusses the experiment and its findings, and after it will analyze the results to place it into the bigger picture of things. Section 5 follows and will present related research and work done in this field, and Section 6 will give the final comments and point out the future of this particular research.

2. CHALLENGES

In order to build the project, a few challenges have been identified as follows.

2.1. User doesn’ t use the social media feature

While the social media feature is a large part of the application, some users may not necessarily use that aspect. Instead, they may only use the app to create a workout plan and keep track of their fitness journey by themselves. The question now for this situation is what do we do with the data of this user? Since the experiments are based on how effective the integration of social media is in encouraging people to exercise more, all the data from this user is essentially pointless. The application aims to lessen or prevent this scenario from occurring by making it easier to connect with others and add friends on the app. We intend to allow users to more efficiently use the features of the app to encourage interaction [6].

2.2. Keeping the users motivated

Often, with fitness applications and many other apps in general, one of the standing issues is retaining user interest and keeping them motivated [7]. Some companies try to “gamify” their application, using points and reward systems to keep the users inspired. However, these attempts often fail in keeping interested. The best method in keeping the attention of people is by having change, constantly having users ride the high of something new. In the case of our application, changing the app is difficult because it may affect the outcomes of our data, and it is hard to manage with all the other aspects of the research paper. The social media function aims to keep users’ attention with its constantly changing posts and addition of new friends without drastically changing the app and affecting the experiment.

2.3. Managing the data in an efficient manner

Another challenge lies in dealing with the data in an efficient manner as more users begin to join and create workout plans. Each user has hundreds of different data points stored in the database from login information, workout plan, split days, friends, posts created, the likes/comments on those posts, and more. As the research continues, more and more people will join the app, and the current users will continue to add to the app through their workouts. The database can quickly get flooded with data, and it will be difficult to manage all of this in an optimal way. By organizing the types of data into different classes and even having different sub classes, we can extract the data points necessary for a certain experiment, no matter how many users there are. There may also be an issue with the stability of the firebase, depending on the popularity and usage of the app itself.

3. SOLUTION

FitConnect is a fitness application that allows people to create and track their workouts as well as adding and interacting with friends on the app [8]. This friend building is done through a social media system that allows users to interact with other users through chatting, sharing, and posting [9]. FitConnect has three components that provide users with an efficient performance: the accessible front end design of the application, the Firebase database, and the user authentication system [10]. The front end application is divided into four different parts to make it easily accessible. The home page contains posts from friends, the plan page allows the user to view and edit their custom-made workout plan. Any previous workouts on past days will be displayed and show the various statistics of the workout, such as the weight lifted, time ran, and repetitions. The friends page allows users to search for a certain friend or add new ones. Finally, the profile page allows users to edit their own social media profile and create their own posts. The Firebase writes all the data that users input such as their workout plans, user information, and more straight into the database. The information is separated into different classes and maps to allow for easy access. Firebase also contains a user authentication system which verifies the identity of the person logging in, protecting the user's account information. The following sections will go into detail on the various components of FitConnect and how they transfer data with one another.

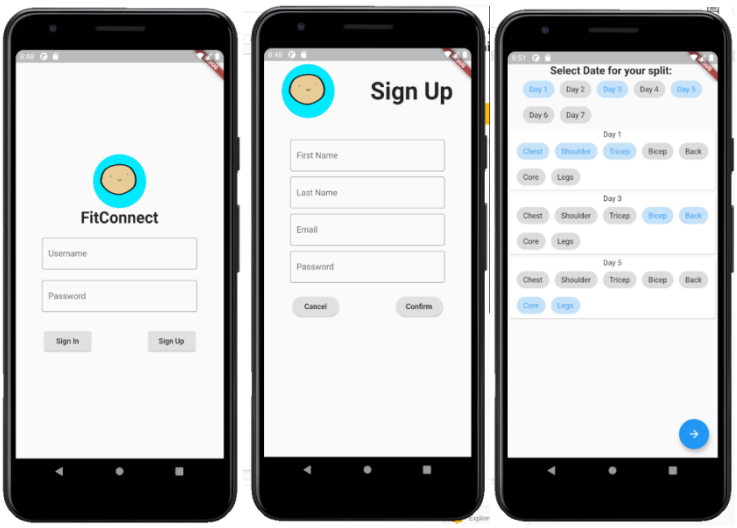

Figure 1. Account Creation

Upon first opening the app, users will be given the option to log in or create a new account. When creating an account, they will be used to provide an email for the authentication system, input various information about themselves, and create an initial workout plan, which can later be edited.

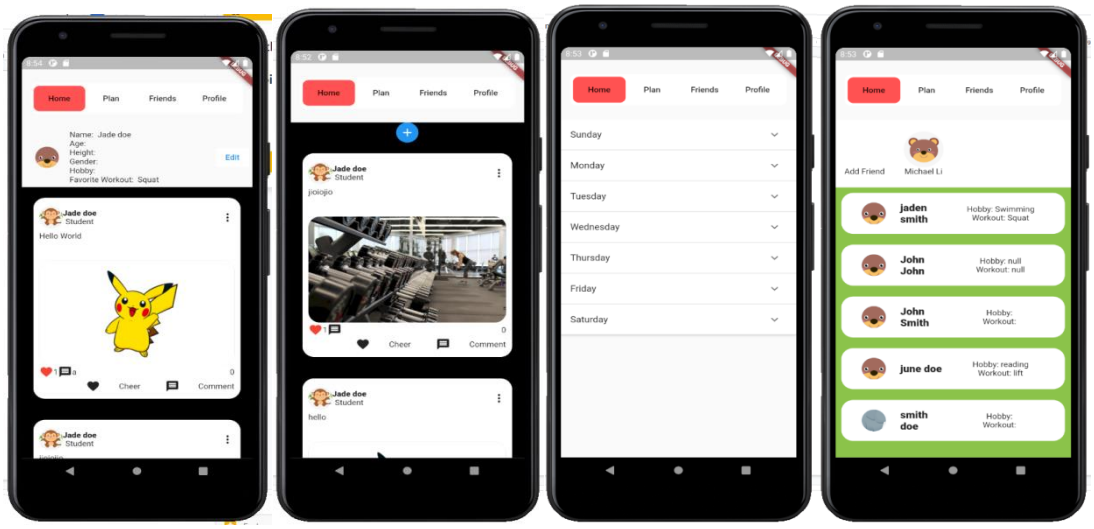

Figure 2. Application Pages

Once logged in, the home page will first appear, with a navigation bar at the top separated into four different pages: Home, Plan, Friends, and Profile. The Home plan contains all posts from friends added, the plan displays the users' previously created workout plan and allows users to start an exercise session, users can interact with and add friends on the Friends page, and the Profile page contains the users' own information and own posts. All of the data shown in these pages are stored in the Firebase as well.

```
return ExpansionPanelList(
  expansionCallback: (int index, bool isExpanded){
    setState(() {
      dailyExercises[index].isExpanded = !isExpanded;
    });
  },
  children: dailyExercises.map<ExpansionPanel>((DailyExercise exercise){
    return ExpansionPanel(
      headerBuilder: (BuildContext context, bool isExpanded){
        return ListTile(title: Text(exercise.day));
      },
```

Figure 3. Capture Device Screenshot

FitConnect was created with the software development program Flutter, which uses the programming language Dart. Flutter was used to develop the front end and the back end of the application. Dart has a surplus of tools that allowed us to format the app how we wanted to, down to the specific margins of a button. One of the difficulties we faced when making the front end of the application was designing the plan page, as it was difficult to manage all the different data required for the workouts. However, we found the ExpansionPanelList, which is a useful class that allowed us to format the Plan page in an efficient manner with a drop down menu, as shown in Figure 3.

```
onPressed: () {
  FirebaseAuth.instance
      .createUserWithEmailAndPassword(
          email: emailController.text,
          password: passwordController.text)
      .then((value) {
    FirebaseFirestore.instance
        .collection('userInformation')
        .doc(emailController.text)
        .set({
      'email': emailController.text,
      'firstName': firstNameController.text,
      'lastName': lastNameController.text,
      'password': passwordController.text,
```

Figure 4. Backend #1 - Application Code

The backend of this application consists of the code itself and the Firebase. The code behind different pages or features were separated into different Flutter documents. The code takes the information input by the user and transfers it directly to the database for later use. It can also go through the database, and if given a DocID, can take information from the database for different uses as well. Figure 4 shows the code behind the sign up system of the code.

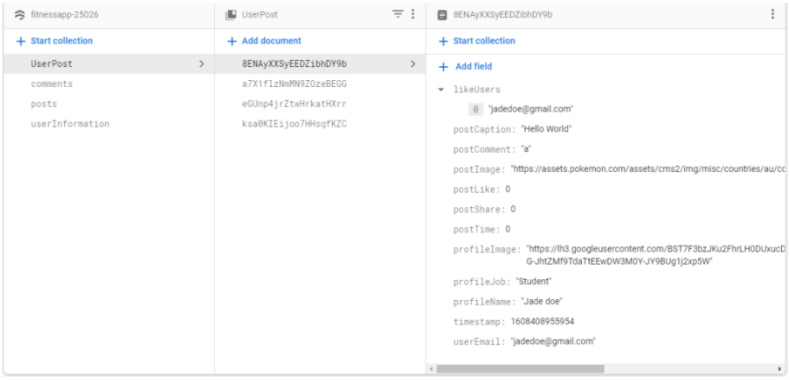

Figure 5. Backend #2- Firebase Organization

The Firebase is separated into 3 parts: Collections, Documents, Fields/New Collection. This particular database is organized into 4 different classes: UserPost, comments, posts, and userInformation. These four classes have different sub categories with various data, all organized meaningfully to provide for efficient access. For instance, the class shown, userInformation, contains all the emails of the users. Each email has a collection containing their workout plan and cumulative workout sessions, while the other field contains all of their information such as their friends, age, name, password, and more.

4. EXPERIMENT

In the following experiments, we will aim to discover if the implementation of a social media feature into a Fitness app will increase a user's activity and exercise levels based on their various interactions upon using the application. Data will be gathered from the user information in the Firebase for various purposes. For instance, the total number of workouts can be used to see if other factors have increased the exercise time of the users. Additionally, the interactions with the social media system such as the number of posts, number of friends, and the time of a post can be used to determine certain results.

4.1. Experiment 1

In the following two experiments, a total of ten people were used to determine certain results about the effectiveness of the app. The first experiment conducted was to find how long it took for any given user to create a new account and interact with another user or make a friend. Upon first opening the app, each user was timed by the same person to provide minimal variations and human error. The intention of this test is to see if people are encouraged to interact with users on the app to gain advice or make new friends.

Over twelve trials, the average time it took for a friend to be added was approximately 2:12 minutes, which was much lower than expected. While some participants were much more precarious in selecting which friends to add, others were more accepting and were more eager to connect with others immediately. These results are positive as they show that the social media system of the app is a vital part of the application and allows users to connect with others easily.

4.2. Experiment 2

After the ten subjects created their account and added friends, they were allowed to use the app for two weeks. At the end of the two weeks, each person would give a feedback score on the app on a scale of 1-10 on the app's effectiveness and were surveyed on their overall experience. The group was also separated into three groups, divided relatively evenly (one group having an extra person): those who did not exercise, those who sometimes exercised, and those who consistently exercised.

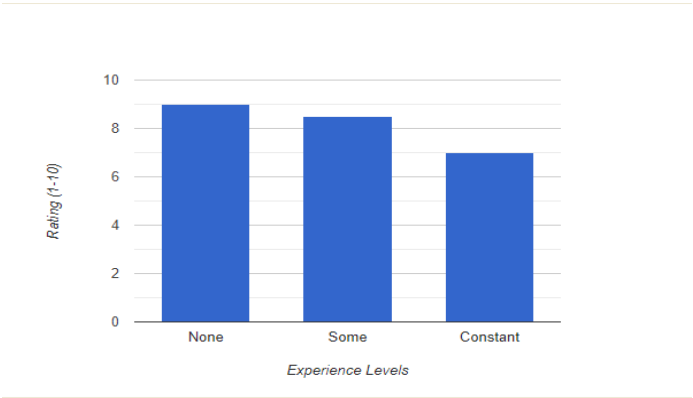

Figure 6. Experiment 1.2 Bar Graph Results

The graph shows that users who had some to no experience in fitness found great satisfaction in FitConnect ' s features, while those who had constant experience were not as satisfied. This chart shows an inversely proportional relationship between the fulfillment of users with their exercise levels and experience. The first two categories reported that the social media feature and workout plan creation served as great tools for building a foundation, as they were able to find a surplus of advice. Those who exercised more reported that various friends and posts sometimes provided small tips, they overall found little use for the social media feature. However, this group was still pleased with the plan creation system.

Overall, it was found that the application' s social media system was effective in encouraging users' exercise levels, although not as much as those who were already more experienced. The social media system allowed people to connect with friends and gain advice. This feature, in pair with an accessible workout plan creator, made the participants' involvement with fitness much

more beneficial. These results line up with our expectations, as we argued that having access to friends in fitness creates a positive environment that can boost motivation. The more experienced subject group already had their own workout plans and a basis in fitness, which gave them less incentive to connect with others seeking advice.

5. RELATED WORK

Wijnand IJsselsteijn utilized a virtual coach in pair with a stationary bike to encourage more exercise at home [11]. The results reveal that there was a positive correlation between immersion with the virtual coach and the motivation/activity levels of the users. The experiments featured a two-by-two design by gathering data with and without the coach as well as a high/low immersion. The two-by-two experiment design is similar to the one we used with either using the social media feature or not using it at all. A difference between Ijsselsteijn's method is by conducting the experiment in a laboratory simulated to be like a home environment, rather than the experiment taking place at the participant's actual home. Additionally, the virtual coach differs from this experiment as it is not an actual person one can interact with. This paper demonstrates the connection between an outside source of aid and the exercise levels of people.

Fletcher Lu et. al aimed to reduce obesity in adolescent populations by creating a mobile fitness application in the form of a game [12]. The application used software to track the workouts completed and also added features to allow users to compete and collaborate with other friends. The experiment classified people into underweight, normal, and overweight, using their BMI as means of measurement. Some similarities between this experiment and our experiment was that they tracked the workouts completed for their data and implemented a social feature. A major difference was that the mobile application was a game, which may have motivated the subjects. Additionally, while the game did include a feature to interact with others, it was relatively uniform and not as complex as the social media feature implemented into our application. The results showed that after six weeks, those who were overweight had a decrease in BMI, healthy subjects maintained their BMI levels, and all but one underweight case saw an increase in BMI. Overall, this paper proved that a mobile fitness application that was easy to access helped encourage exercise, but it did not delve specifically into how social interactions between others affected these results.

Sallis, James F. et al. explored how the exercise habits of others and their support could influence one's own exercise habits [13]. By surveying different people about their exercise habits compared to their family/friends, the results showed that exercise habits of friends are associated with the exercise habits of the individuals. Additionally, it showed that high levels of social support were also associated with the exercise levels of the person receiving the support. This experiment was very different from the other related works and our experiment, however, it shows that there is a positive correlation between the social support of others and the exercise habits of individual people.

6. CONCLUSIONS

Fitness is an important aspect of life and can improve someone's overall physical and mental health [14]. The global pandemic has made it difficult for people who enjoy fitness to workout again and has also inspired new people to start exercising at home. FitConnect provides a solution for those who want to remain safe while still having the option to interact with others. By giving more people motivation to workout, people can greatly benefit in many aspects in life. Not only will they be able to have a more healthy lifestyle, they will also find new friends and establish meaningful relationships along the way [15].

The application is still in its developing stages and has numerous limitations. One limitation is that there are not many intricate features within the social media system. Additionally, the data used for experiments was not on a large scale, so in future experiments, I would like to have more participants to further improve the application.

If given more time to work on this project, I would like to further develop the social media system and make it more complex. For instance, adding a chatting option between friends would significantly improve interactions between people on the app. Additionally, a machine learning system that would recommend friends based off of current ones would also bring people with common interests together.

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