TREECARE

A Persuasive Game to Prevent Sedentarism

Project Report

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Introduction

Exercise is one of the most important factors in a persons' life. Physical activity or the lack of it affects the life of a person directly. Exercise makes a person physically fit and contributes towards an improved lifestyle. The positive health results, the improvement in attitude, even better academic or work performance are all factors which make not exercising inexcusable.

Merely not using a person's body is harmful. The absence of physical activity results in a person's muscles becoming weak and out of shape. It also reduces the effectiveness of heart and lungs, makes the joints of the person stiff and more injury prone. It also leads to sedentarism.

A sedentary lifestyle is defined as a type of lifestyle where an individual does not receive regular amounts of physical activity. A person living a sedentary lifestyle spends most of the day reading, watching television, sitting, working on the computer, playing video games and doing all kinds of works that require less physical activity. Such a lifestyle leads to obesity, weaker bones, poor metabolism and immune system and hormonal imbalance among others.

Problem

The main problem that this app address is '**How to prevent a sedentary lifestyle'**. As already described above, a sedentary lifestyle leads to lot of problems. There are a lot of fitness apps currently available in the market but they follow a traditional way of recording and presenting fitness data of a user, which is not enough to motivate a people living a sedentary lifestyle. It is clear from the previous description that the people living a sedentary lifestyle spend most of their time in front of screen. They also play a lot of video games.

The user interface and the user experience of the apps currently available in the market does not provide the users with a gamified environment which makes them feel that they are still playing a game while also keeping them physically active. So, the idea is to develop an app that gamifies the plane old process of keeping fitness records and present it to the user in a persuasive way.

Solution

In order to discourage sedentary lifestyle among people, which can have serious health consequences, we came up with an app called **'TreeCare'**. TreeCare is a **persuasive game to prevent sedentarism**. It is a game that encourages players to be physically active. By physically active, we mean walking (slowly or quickly) or running.

Walking is a great way to improve or maintain the overall health. It can increase cardiovascular fitness, strengthen bones, reduce excess body fat, and boost muscle power and endurance. It can also reduce your risk of developing conditions such as heart disease, type 2 diabetes, osteoporosis and some cancers. Unlike some other forms of exercise, walking is free and doesn't require any special equipment or training. All our smartphones are equipped with technologies capable of recording steps and thus, such an app is a natural choice.

TREECARE

TreeCare uses the metaphor of a flourishing tree with green leaves and fruits to represent someone who is physically active. In the context of this app, a person is physically active if he/she walks or runs daily. If a person does so regularly, he gets more leaves and fruits on the tree (Figure 1), while a tree with no leaf and fruit means zero activity (Figure 2). Figure 2 is the default tree.

Figure 1: Physically Active

Figure 2: Not physically active (zero activity)

Game Modes

To make the game engaging and fun, three modes are provided:

1. Starter mode
2. Challenger Mode
3. Tournament Mode

1. Starter Mode

This is a single player mode. Here are the rules of this mode:

1. A player's daily goal is initially set as 5,000 steps which can be increased by him.
2. For every 1,000 steps taken in a day, the player gains a green leaf.
3. When the player fails to meet his daily goal, he loses the number of leaves that corresponds to the remaining steps required to meet his goal. In other words, $number\ of\ leaves\ lost = ceil\left(\frac{daily\ goal - total\ steps}{1000}\right)$.
4. If the player meets his daily goal consistently for a week, he gains a fruit on his tree
5. But, if the player fails to fulfil his daily goals for a week, he loses a fruit (if any).

2. Challenger Mode

This is an individual-based competitive mode where a player competes with other player(s). Here are the rules of this mode:

1. The rules in the Starter Mode also apply to every player in this mode.
2. A player can see various active challenges (created by other players) and can choose to join any of them to compete. Alternatively, he can create his own challenge by inviting other players to compete with him.
3. To publicly recognize players' efforts, there is a leaderboard that ranks top 10 players in descending order of the number of leaves and fruits on their trees.
4. Every challenge has a timeline which is set by the organizer. Only the top 10 players are rewarded with a trophy corresponding to their position.
5. Every player starts a challenge with the default tree (Figure 2).

3. Tournament Mode

This is a team-based mode where a team of N players competes with another team of N players. Each team has a default tree to nurture (Figure 2). Here are the rules of the tournament mode:

1. The daily goal is initially set to 20,000 steps and the teams in a tournament can decide to increase this goal upon agreement.
2. For every 3,000 steps taken in a day, a team gains a green leaf on its tree.
3. When a team fails to meet its daily goal, it loses the number of leaves that corresponds to the remaining steps required to meet the goal. In other words, $number\ of\ leaves\ lost = ceil\left(\frac{daily\ goal - total\ steps}{3000}\right)$.
4. If a team meets its daily goal consistently for a week, a fruit appears on its tree.
5. But, if the team fails to fulfil its daily goals for a week, a fruit disappears (if any)

Note: This mode is still under development. In the current version, the game only contains starter mode and challenger mode.

User Interface

Almost all the smartphones today come with some means to record and observe the steps taken by the user. Keeping that in mind, TreeCare has been developed to be used on the smartphones, specifically, devices running on the Android operating system. The game leverages the various sensors available in the user's smartphone to detect the steps taken and then performs various calculations using that data to realise the modes mentioned above.

Following is the description of how the user will use the app:

- **Login**

As the user clicks on the app icon in the device, it launches the app. The user is first greeted with a splash screen which then leads to the login screen based on the control flow showed in the following flowchart:

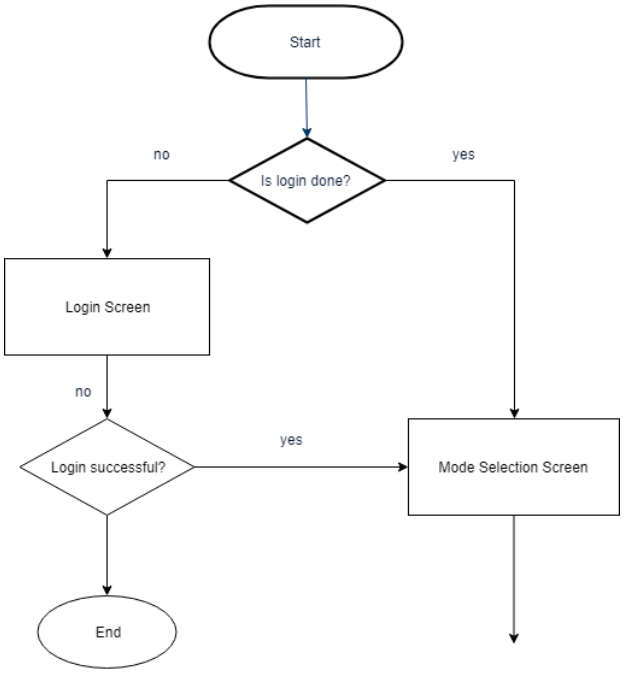
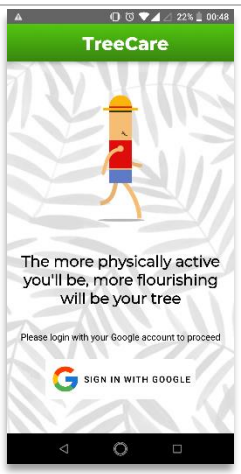


Figure 3: Login Flowchart

The exact steps involved along with the screenshots are shown below:

		
1. When the user clicks on the app icon, it opens the splash screen	2. If the user is not logged in, a login screen is opened. User clicks the Google Sign-In button. If sign-in is successful, mode selection screen is opened (3)	This is the mode selection screen. It opens if: a: Login was successful at login screen b: User was already logged in when starting the app

After the login is complete, in every subsequent run of the app, user is presented with the mode selection screen after the splash screen. We will describe the mode selection next.

- # Mode Selection

This screen is the main entry point to the various features of the app. Starting from the top, the mode selection screen provides the user with options to choose between **Starter Mode** and **Challenger Mode** and a button at the bottom-right corner to view the user profile.

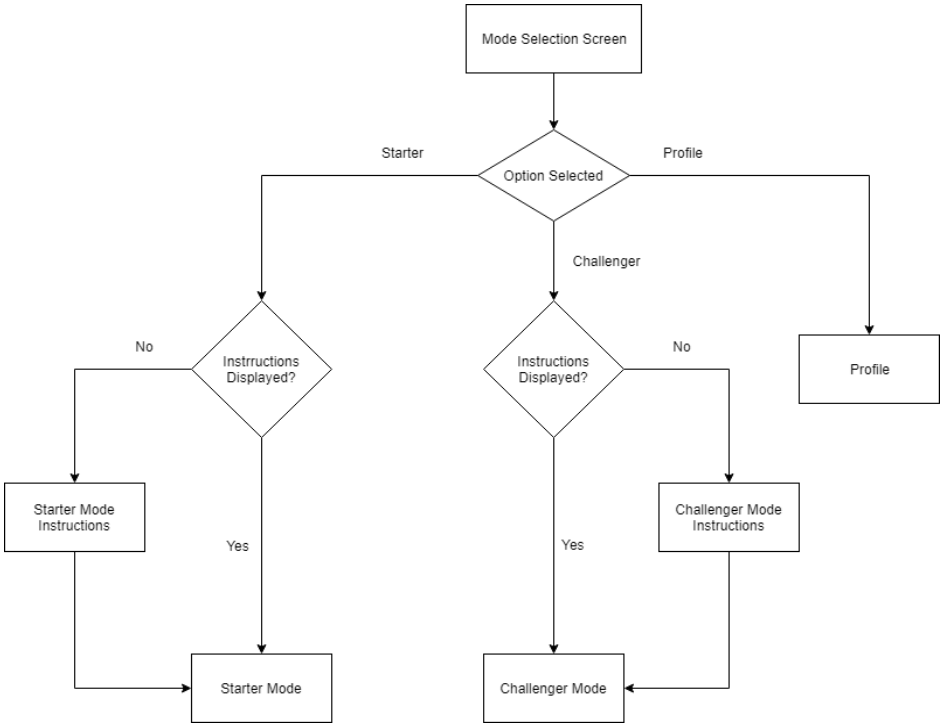
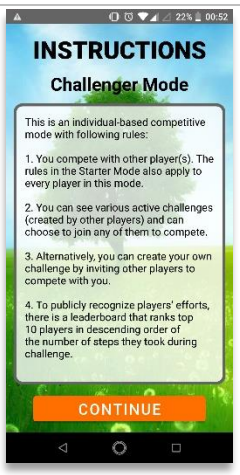
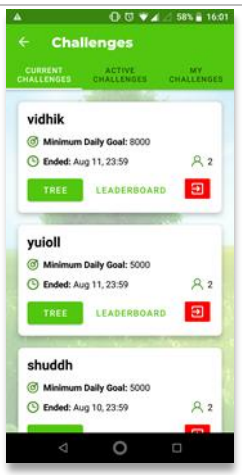


Figure 4: Mode Selection Flowchart

The exact steps involved along with the screenshots are shown below:

		
1: User reaches the mode selection screen after performing the steps in the last section.	**2.a.1:** User clicks on **Starter** button and comes to the screen showing instructions if it is the first time of the user opening starter mode.	**2.a.2:** User reaches the screen showing the state of the tree in **Starter mode** in two ways: a: After the instructions screen for the first time b: Directly from the Mode Selection screen every subsequent time.

		
2.b.1: User clicks on **Challenger** button and comes to the screen showing instructions if it is the first time of the user opening challenger mode.	**2.b.2:** User reaches the screen showing the state of the tree in **Challenger mode** in two ways: a: After the instructions screen for the first time b: Directly from the Mode Selection screen every subsequent time.	**2.c:** User clicks on the Profile image, which is the button to open the **Profile screen**. It opens the Profile section showing various data of the user related to the game.

Mode selection screens takes user to the different game modes and the profile section. The following sections describe the different modes and the profile section of the game.

1. Starter Mode

Starter mode is the most basic mode of the game. It is a single player mode with the rules described here. Below is a screenshot of the starter mode screen with an empty tree and a tree containing leaves and fruits:

Figure 4.a: Starter mode empty tree at start

Figure 4.b: Starter mode tree showing physical activity as leaves

The tree screen shows the state of the tree as the user continues to play the game.

1.1 Launch: Following is the flow chart to launch the Starter mode:

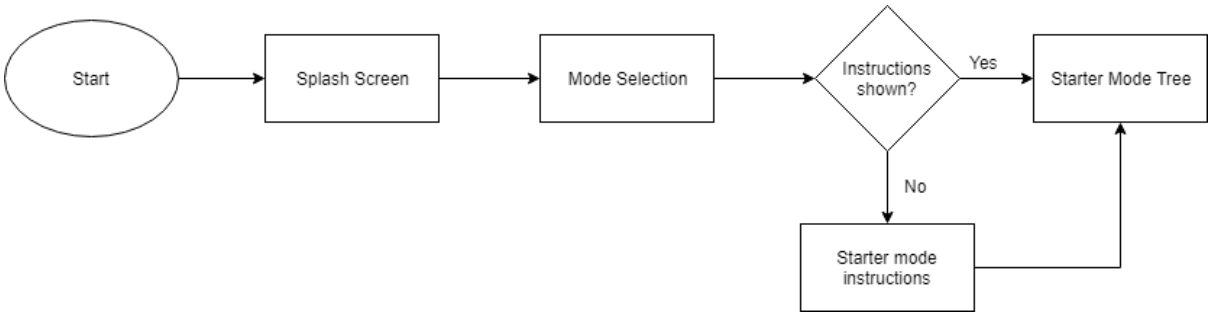


Figure 5: Starter mode launch flowchart

1.2 Options and actions

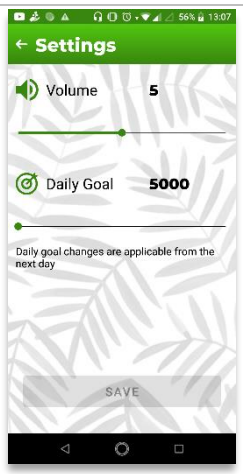
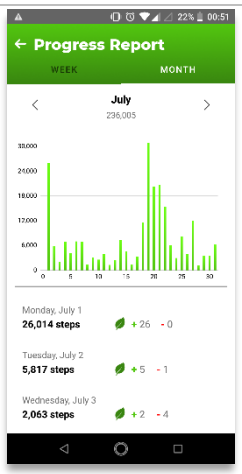
The meanings of various icons on the tree screen are shown below:

- **Leaf Count:** Shows the number of leaves the user currently has on the tree.
- **Fruit Count:** Shows the number of fruits the user currently has on the tree.
- **Settings:** Settings button opens settings to adjust volume of the music that plays in tree screen background and to adjust daily goal
- **Help:** Help button opens the instructions for the starter mode.
- **Progress Report:** Progress report button opens the progress report. It provides past weekly and monthly step count data plotted as bar graphs.
- **Back:** Back button takes the user back to the previous screen.

The tree screen also contains two large texts in the centre. They have the following meaning:

- **Larger Text:** Daily step count. It provides real-time step count as the user walks. The text color changes from red to yellow as the user reaches from 0 to mid-way till the daily goal. The color further changes from yellow to green as the user achieve the daily goal.
- **Smaller Text:** The daily goal set by the user. Initially set to 5,000.

The screenshots of the screens that can be reached from starter mode are shown below:

	
1.a: Settings opens after clicking on the settings icon.	**1.b:** Progress reports opens after clicking the progress report button.

2. Challenger Mode

This is an individual-based competitive mode where a player competes with other player(s). The rules of this mode are described here.

2.1 Launch: Following is the flowchart to launch the challenger mode:

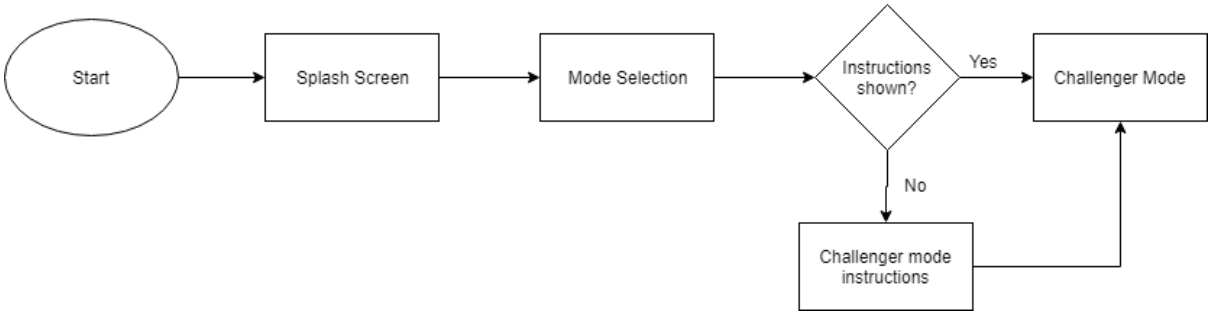


Figure 6: Challenger mode launch flowchart

2.2 Challenges:

As evident by its name, challenges are at the core of the Challenger mode. Challenges can be created by the users or by the admin of the app. A challenge consists of the following user visible information:

- **Name** : Every challenge has a name that needs to be unique.
- **Description** : A description of the challenge (optional).
- **Goal** : Minimum daily goal that the user needs to achieve.
- **End date** : The date on which the challenge ends and the results are decided.
- **Challengers** : The IDs of players who are currently a part of the challenge.
- **Creator ID** : It is only relevant to the user who created the challenge.

The calculation of leaves and fruits is done in the same way as done in the Starter mode.

The challenger mode screen contains three types of challenges:

- **Current Challenges** : Contains challenges of which the user is currently a part of.
- **Active Challenges** : Contains challenges that are available to be joined by the user.
- **My Challenges** : Contains challenges created by the user.

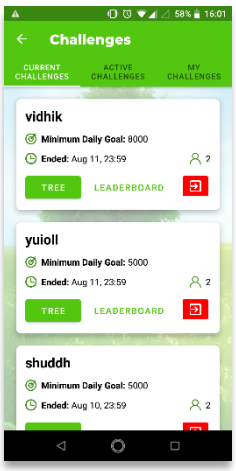


Figure 7.a: Current Challenges

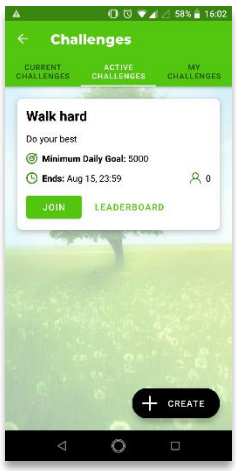


Figure 7.b: Active Challenges

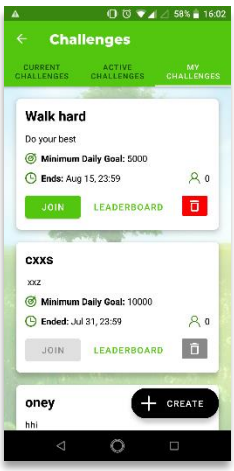


Figure 7.c: My Challenges

2.3 Navigation Flowchart

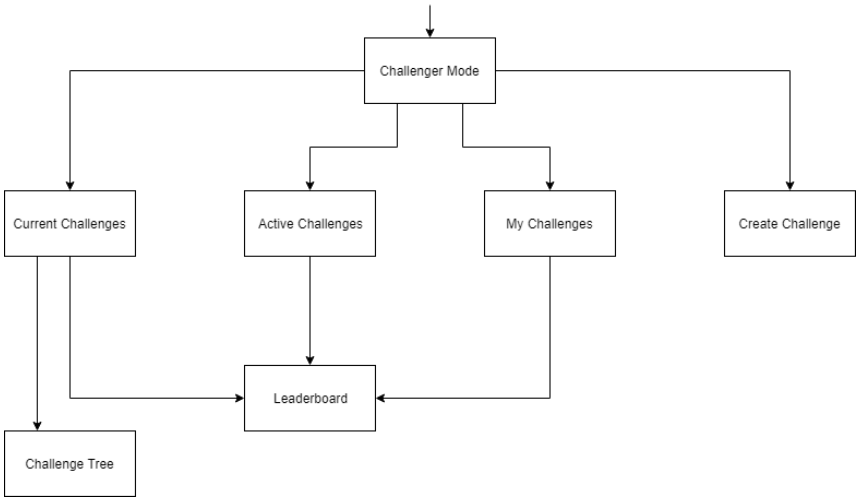
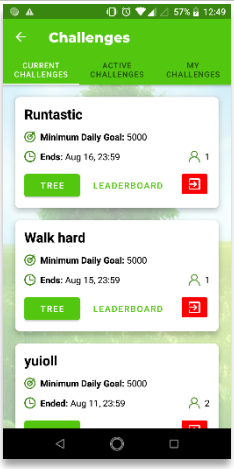
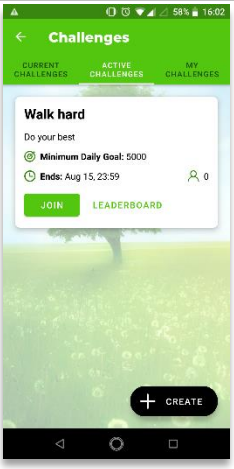
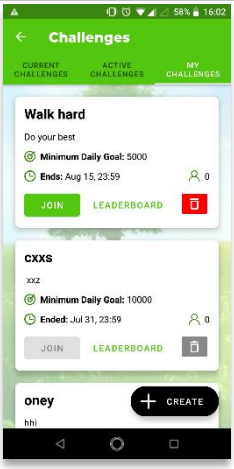
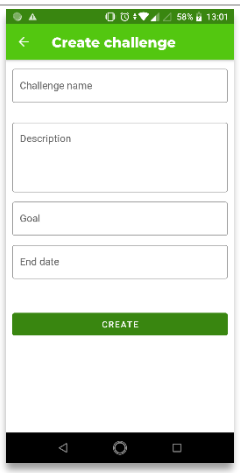
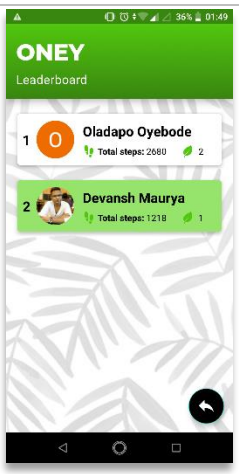


Figure 8: Challenger Mode navigation flowchart

The steps involved along with the screenshots are shown below:

		
1.a: Challenger mode starts with current challenges tab.	**1.b:** User can swipe right to go to active challenges tab.	**1.c:** User can swipe further to go to my challenges tab.

		
1.d: User can the click **Create** button to create a new challenge.	**2:** User can click on **Tree** button to view the state of the tree for that challenge. Joining a challenge also takes user to this screen.	**3:** User can click on **Leaderboard** button from any of the card to view that challenge's leaderboard.

2.4 Leaderboard

Every challenge has a leaderboard. For every challenger, leaderboard shows the following data:

- A profile picture
- Name
- Total aggregate steps taken by the challenger after joining the challenge
- Leaves gained by the challenger in the challenge
- Rank in the challenge

The following screenshot shows an entry for a player in the leaderboard:

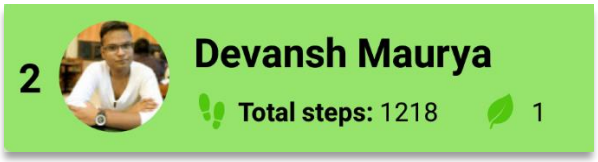


Figure 9: A leaderboard entry

- **Ranking:** The ranking of the challengers in the leaderboard is done in the following way:
    1. Players are ranked first based on the number of leaves gained by them in the challenge in descending order.
    2. If two or more players have equal leaf count, they are ranked based on their aggregate step count in descending order.

The leaderboard entry for the current user is highlighted in green while for all other challengers, it is with white background.

The following screenshot shows the leaderboard of a challenge:

*Figure 10: Leaderboard of a challenge named '**Oney**'*

At the end of the challenge, players are rewarded based on their positions. Trophies are awarded for first, second and third positions and a consolation trophy to rest top 7 players. Only the top 3 positions' trophies show up in the user profile section.

Figure 11.a: First position trophy

Figure 11.b: Second position trophy

Figure 11.c: Third position trophy

2.5 Challenger Mode Tree

The tree in challenger mode depicts the state of the user in the challenge. The screen contains all the elements present in the starter mode tree plus a view showing the position of the user in the leaderboard. Below is a screenshot of a tree in the challenger mode:

Figure 12: Tree screen of a challenge in Challenger mode

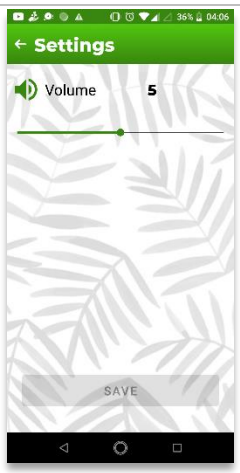
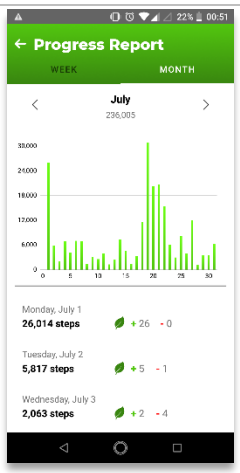
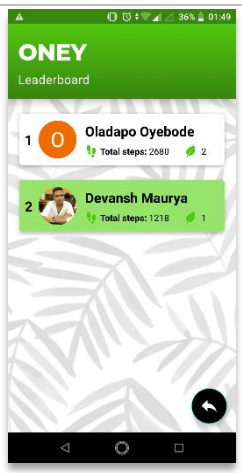
The meanings of various icons on the tree screen are shown below:

- **Leaf Count:** Shows the number of leaves the user currently has on the tree.
- **Fruit Count:** Shows the number of fruits the user currently has on the tree.
- **Leaderboard Position;** Shows the position of the user on the leaderboard. Clicking on this leads to the challenge's leaderboard.
- **Settings:** Settings button opens settings to adjust volume of the music that plays in tree screen background and to adjust daily goal
- **Help:** Help button opens the instructions for the starter mode.
- **Progress Report:** Progress report button opens the progress report. It provides past weekly and monthly step count data plotted as bar graphs.
- **Back:** Back button takes the user back to the previous screen.

The tree screen also contains two large texts in the centre. They have the following meaning:

- **Larger Text:** This depend on the condition if the challenge is active or completed:
  - **If challenge is active,** it displays daily step count. It provides real-time step count as the user walks. The text color changes from red to yellow as the user reaches from 0 to mid-way till the daily goal. The color further changes from yellow to green as the user achieve the daily goal.
  - **If challenge has finished,** it displays total step count for the challenge.
- **Smaller Text:** The minimum daily goal for the challenge.

The screenshots of the screens that can be reached from the challenger mode are shown next. The extra option from starter mode is of leaderboard. Also, the settings screen only contains option to change the volume of the background music:

		
1.a: Settings opens after clicking on the settings icon.	**1.b:** Progress reports opens after clicking the progress report button.	**1.c:** Leaderboard opens after clicking on the leaderboard rank.

3. Tournament Mode (In Development)

Note: This mode is still in development and can not be used in present version of the game. The description here assumes that the Mode selection screen contains an option to start the tournament mode, which will be the case when the tournament mode will be included in the game.

This is a team-based mode where a team of N players competes with another team of N players. Each team has a default tree to nurture (Figure 2).

3.1 Launch: Following is the flowchart to launch the tournament mode:

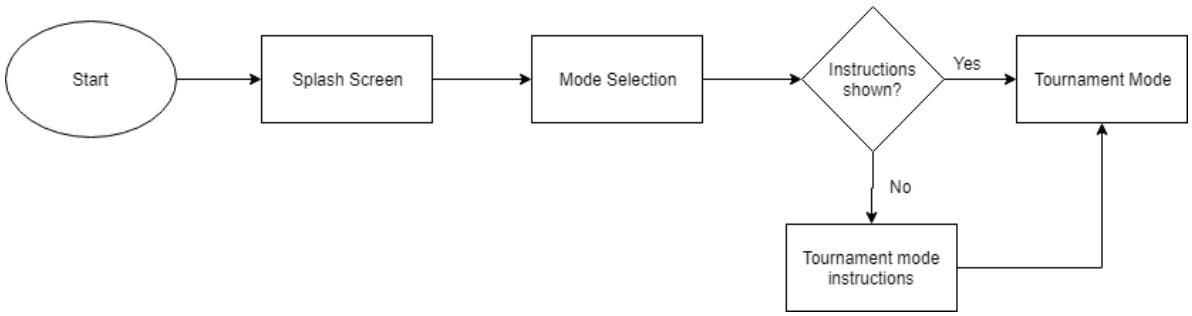


Figure 13: Tournament mode launch flowchart

2.2 Tournaments:

At the core of the Tournament mode are the tournaments. Tournaments are created by the by the admin of the game. A tournament consists of the following user visible information:

- **Name** : Every tournament has a name that needs to be unique.
- **Description** : A description of the tournament (optional).
- **Goal** : Minimum daily goal that the team needs to achieve.
- **End date** : The date on which the tournament ends and the results are decided.
- **Teams** : The IDs of teams who are currently a part of the tournament.

The rules of tournament mode are discussed here.

2.3 Teams

A team is another important entity in the Tournament mode. Users take part in the tournaments as a team. A team can be created by any of the user. A team contains following user visible information:

- **Name** **:** Every team need to have a unique name.
- **Description** **:** A description of the team (optional).
- **Captain name :** The name of the captain of the team. Initially, captain is the user who created the team. If the player wants, he can transfer the captaincy to some other member of the team. If that other player accepts the captaincy, he/she becomes the new captain.
- **Members** **:** All the users who are currently a member of the team.

A user can become part of a team in two ways:

- **By sending a join request.** If the requested is accepted by the captain of the team, the user will become a member of the team.
- **By accepting an invite by the captain.** If the player accepts the invite, he becomes a member of the team.

Teams take part in a tournament by the decision of the captain. A captain can take his team into a tournament at his/her own discretion or after discussing with the team members.

2.3 Navigation Flowchart

Following flowchart describes the navigation in the tournament mode:

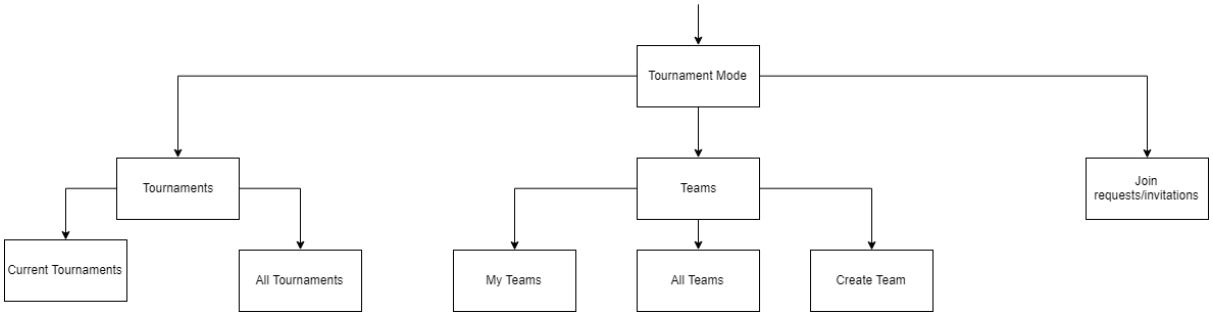


Figure 14: Tournament mode navigation flowchart

The different parts in tournament mode are explained below:

1. **Tournaments:** Lists the tournament in the game. It contains two categories:
    a. **Current Tournaments:** Tournaments of which user is currently a part of as a team member.
    b. **All Tournaments:** All the active tournaments.
2. **Teams:** Lists all the teams present in the game. It also contains a button to create team. The teams are divided into two categories:
    a. **My Teams:** The teams of which the user is currently a member of.
    b. **All Teams:** All the teams present in the game.
3. **Join Requests / Invitations:** Shows all the pending join requests and invitations for the teams.

This is the base on which the Tournament mode is being built. As the mode is still in development, more components and features will be added to it in future.

4. Player Profile

The game also contains a profile section which can be reached from the Mode selection screen. The profile screen contains various user information related to the game.

4.1 Launch: Following is the flowchart to open the profile screen:

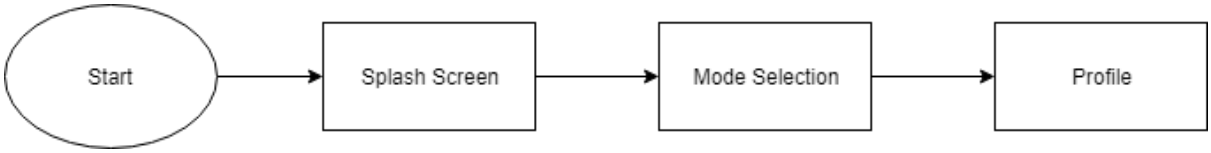


Figure 15: Profile mode launch flowchart

4.2 Options and Actions

Below is a screenshot of the profile screen:

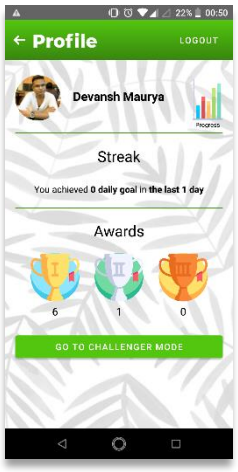


Figure 16: Profile screen

The different elements on the profile screen are:

- **Profile picture:** The profile picture of the user linked to the Google account.
- **Name:** The name of the user.
- **Progress Report Button:** A button shown as graphs icon to show the progress report.
- **Streak:** Shows the number of times user achieved his daily goal this week as gold coins. This week starts from the day user logs in the app.
- **Awards:** Awards won by the player in the challenger mode.
- **Challenger mode button:** A button to open challenger mode.

4.3 Navigation Flowchart

The navigation in profile section is simple. The user can go to two screens from here:

- **Progress Report**.
- **Challenger Mode**

Following is a flowchart of navigation in profile section:

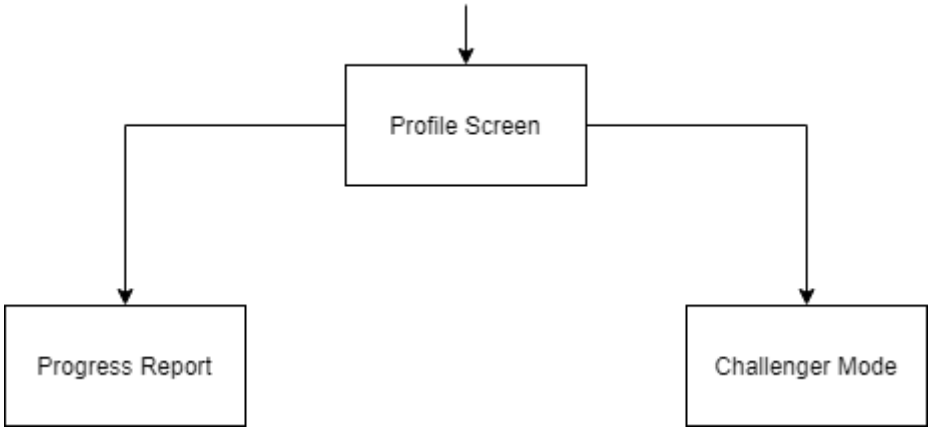
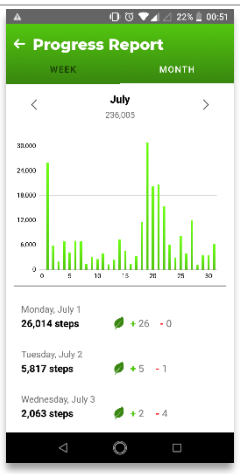
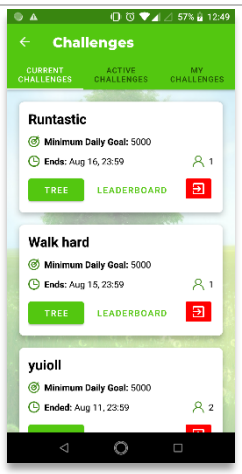


Figure 17: Profile navigation flowchart

The screenshots of the navigation destinations are shown below:

	
1.a: Progress report screen opens on clicking the graph icon. It gives the user historic data of the steps plotted in the form of graphs.	**1.b:** Clicking on the challenger mode button takes the user to the challenger mode.

4.4 Progress Report Section

Progress can be viewed from various screens:

- **Profile Screen:** User can use the progress report in profile section button described above to view progress report.
- **Tree Screen:** Progress report can also be viewed by using the progress report button on tree screen described in Starter and Challenger mode sections.

Progress report categorises the user's step count data in two major categories:

- **Weekly Progress Report:** Categorises the step count data in weeks since the user first started playing the game.
- **Monthly Progress Report:** Categorises the step count data in months since the user first started playing the game.

The screenshots of both the categories are below:

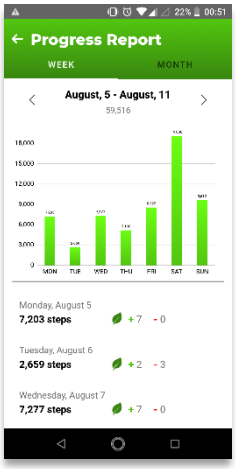


Figure 18.a: Weekly progress report

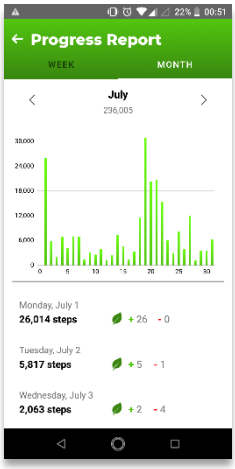


Figure 18.b: Monthly progress report

Below the step count graph, it shows the number of steps taken each day along with the effect it had on the overall leaf count, i.e., it indicates the number of leaves gained and lost that day. Following screenshot shows how it looks on the screen:

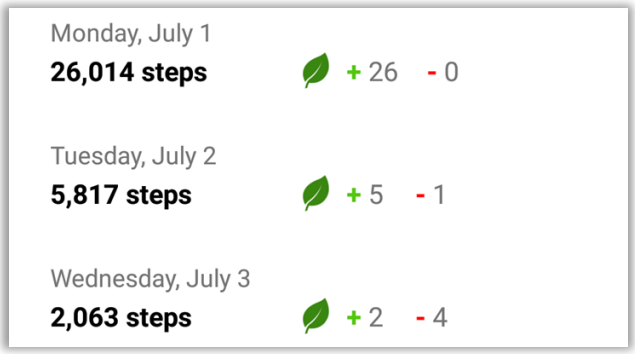


Figure 19: Progress report also shows how daily step count affects total leaf count

This completes the description of the user interface of **TreeCare.**

Continued…

Implementation

This section provides an implementation overview of **TreeCare.**

• Platform

TreeCare runs on the Android platform for all Android devices having version greater than or equal to **Lollipop (5.0)**. The user interface and backend logic of all but the tree screen has been developed using **Android Studio**, the IDE for making Android apps and the tree screen has been developed using **Unity**, the game development environment. Using Unity makes implementing the tree easier.

• Step Detection

At its core, the app uses Google Fit platform to record and get step count data. Google Fit allows recording of step count using its Recording API and fetch previously recorded step count using History API. The app also uses Google Fit's Sensors API to display real-time step count update on the tree screen.

• Database

The app uses Cloud Firestore included in Firebase as its database. It is a NO-SQL database storing data in the form of collections and documents. Firestore allows exporting the data into a Cloud Storage bucket but that requires the project to be on a paid plan. Currently, the project is on a free plan. More details regarding it can be found here.

• Repository

The project has been built using the Git version control system and is hosted on GitHub. The project is distributed across two separate repositories, one for the Android part and the other for the Unity part.

- **TreeCare-Android**
  This is the repository for the Android part. After cloning, this needs to be opened with Android Studio.
- **TreeCare-Unity**
  This is the repository for the Unity part. After cloning, this needs to be opened as a Unity project. It contains a folder called **Android Export**. This folder contains the Unity project exported as an Android Studio project. This is needed to add the Unity project as a module in Android Studio. After opening the exported project in Android Studio, it needs to be built as a module and then added to the main Android project.

Setup

This section contains instructions on how to setup the project for development on the local machine:

Requirements

- Android Studio
- Unity
- Visual Studio 2017

As the project is across two different repositories, the instructions will be in two parts, separately for Android and Unity.

Android Setup

The link for Android project repository is given on the last page. The final apk is always made using Android studio.

- Clone the repository on your local machine or use Android Studio's 'Checkout from version control option'.
- The project will ask for a **google-services.json** file after syncing. The project owner can download this file from the Firebase console for this project using the following instructions:
    - Sign in to Firebase, then open the project **TreeCare**.
    - Click the **Settings** icon, then select **Project settings**.
    - In the **Your apps** card, select the package name of the app for which you need a config file.
    - Click **google-services.json**, then add it to your app.

  Move your config file into the module (app-level) directory of the project.
- After this, sync the project again. If Android Studio asks for any additional downloads, agree to them.

Unity Setup

The link for the Unity project repository is given on the last page.

- Clone the repository into your local machine. Using **Unity Hub**, open the project. Unity will start with the project.
- After performing the desired work, the project needs to be exported as a module to the Android project mentioned above.
- For exporting, first click **File -> Build**.
- From the new screen, click **Export** at the bottom. Unity will export the current project as a project that can be opened in Android studio. The project will be in folder **Android Exports** by the name **TreeCarePrototype**.
- Open the exported project using Android Studio. Wait for the project to finish sync.

- Now open files **AndroidMainfest.xml** and **app level build.gradle** and undo all the changes. The AndroidManifest.xml contains an id tag, don't change it. If any problem occurs, try the following steps. These steps are just a manual way of doing what undoing should do:
    - In **AndroidManifest.xml**, remove **<intent-filter>** part and one more line below it which contains information about app-icon etc. Remove those parts. Usually, undoing the changes will work.
    - In **build.gradle**, remove **applicationId** from **defaultConfig{ }**. Change **apply plugin: 'com.android.application'** to **apply plugin: 'com.android.library'**. If the file contains some code under **bundle { }**, remove it.

  To do this step properly, undo must be performed before committing the files.

- After this, in Android Studio, click Build->Build module 'TreeCare'. After the build is done, look of the **AAR** file under **TreeCarePrototype\build\outputs\aar.**
- Copy this file and paste it under a folder by the name of **TreeCareUnityModule** inside the **TreeCare** Android project from the previous section. Rename the AAR file to **TreeCareUnityModule.aar**.
- Build the main **TreeCare** project. You can generate an apk or install it directly on a device.

This step needs to be performed anytime some changes are made to the Unity project and if the developer wants to see them inside the apk. Otherwise, the development can be continued on Unity and once all the changes have been done, the project can be exported as a module following the above steps.

For any clarification, please contact at the address mentioned below:

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Thank you