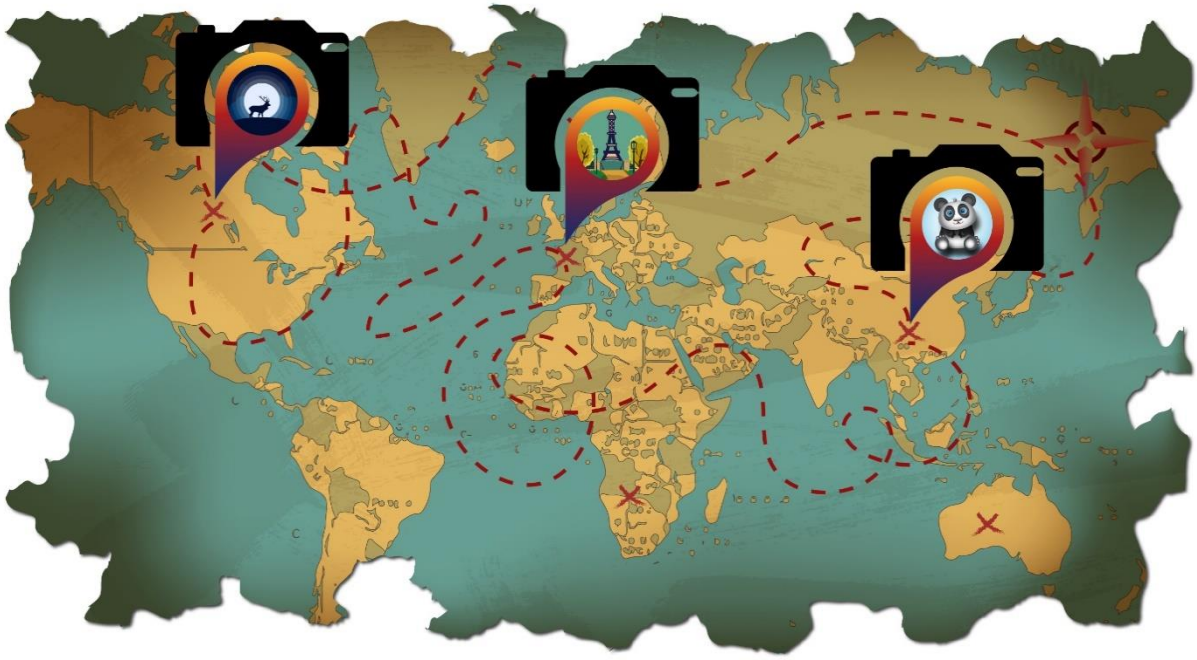

PixPlace
Social Hub

Stage 3 (Final Product) Report

[Company website](https://aaronmolesbury.github.io/PixPlace-Company-Website/website/home.html)
https://aaronmolesbury.github.io/PixPlace-Company-Website/website/home.html

Group 3 | PixPlace Software Development

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Project Coordinator: Ron Petrick | **Group Manager:** Jessica Chen-Burger

Application Design

1. Introduction

1.1. Purpose

This document describes the design process for PixPlace, a social image sharing application created by PixPlace Software Development. The current state of the application will be demonstrated and discussed in this document as the delivery deadline is reached. The customers initial requirements, as well as the development teams requirements stated in the Stage 1 document will be compared against the final product.

This document provides an overview for the product in its final stage and should be used as reference for any future development.

The readers of this document will be the client and PixPlace Software Development. It is intended for reading by:

1. The client and their company to examine and evaluate the end product.
2. PixPlace Software Development as the outline for development of the platform.

1.2. Scope

This report will cover what has been implemented into the final product, and the design decisions behind each function. Any deviations from the original requirements will be highlighted, and a brief description of the changes made will be discussed.

Screenshots of the final product will be displayed at the end of this report.

2.0. Overview

2.1 Objectives

This section will give a rundown of the system design, architecture, and reasoning behind each part of the final system. An overview of the system UI as well as insights into design choices will be presented at the end of this section also.

2.2 System overview

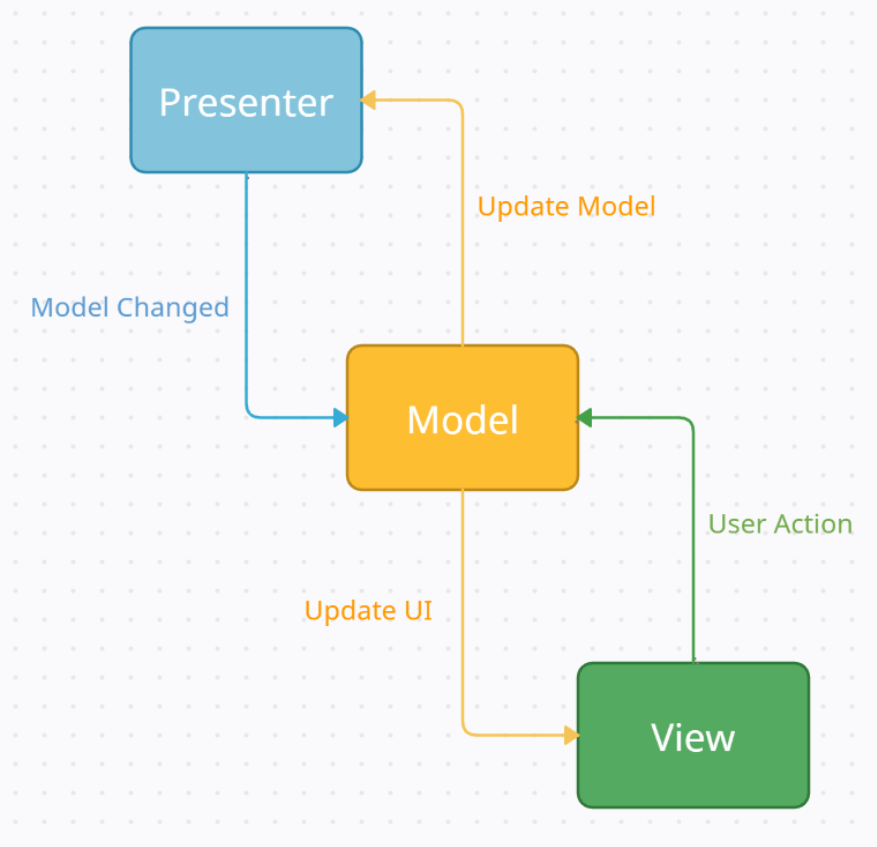
The application is created using Flutter, a framework purpose built for cross-platform support. The Flutter framework is written in Dart, a programming language created by Google. The application makes use of many freely available packages for Flutter, created by other users to streamline production of apps. Along with this, Firebase was used as the backend for the application, and it provides many different services making it a highly effective tool for a fully functional deployable app. Since the team is using a free Firebase account, the size of databases and storage available are limited, thought this can be increased in the future if the demand is needed, by paying for a Firebase upgrade subscription. The following technologies are present in the final system.

- Flutter 1.22.6

- Dart SDK 2.7
- Firebase
    - Firebase Authentication
    - Firebase Firestore
    - Firebase Storage
    - Firebase ML Vision

Model Presenter Controller

The original MVC model was scrapped in favour of the MVP model, which is the standard model used by Flutter. This model provides a better framework for working with asynchronous code. As all the Firebase calls, whether it be authorisation or database querying, create call backs, this model makes it easier to design a threaded system.



3.0 Systems Design

3.1 Outline

During development, the team followed common software engineering principles to make sure collaboration was done successfully, and that our vision of the app could be achieved in the most streamlined manner.

In order to do so, we used design layouts created during the planning phases as guidance for the architecture of the system. UML diagrams were used to show user interactions, and database diagrams to show the relationships between different entities. Following these diagrams as a guide, the team was able to work concurrently on different features before bringing them together.

Date	Author(s)	Changes
09/02/21	Jose Fernandes	Document created; all structure set up.
20/02/2021	Ghazi Yusaf	Started introduction, finished scope sub part

Usability Testing

Introduction

Purpose

This usability evaluation study has the purpose of giving proof to the client that the final application meets the requirements and the expectations of the end-users. Therefore, this study will be crucial to demonstrate the client, using the scientific methodologies, that the application is fit for the purpose and ultimately will bring value to the company.

Aims and Objectives

The aim of this study is to measure how effectively is the application/system used in a controlled environment, which attempts to recreate all the uses cases proposed by the client. The final objective is to understand how easy, effective, and valuable the application/system is perceived by the end-user.

Scope

The scope of this study covers the all the front-end interface functionalities as well as the back-end system which manages the content being manipulated by the user. This study will be prepared to cover every use case included in the final planning specification and all high and medium priority requirements. The low priority requirements will be covered, as well, but any of them can be rolled back if the study circumstances were to suddenly change.

Overview

The usability study success will rely on a number of fundamental steps that include:

- Create and design a usability testing plan.
- Prepare consent and ethics forms to anonymise subject's personal data.
- Creating a testing protocol.
- Collect initial and post questionnaires.
- Analysing the results and propose modifications.

- Reflect and conclude on general findings.

The first step is to design a clear strategy for the usability study by defining what will be the tested and how it will be tested by the potential users. In addition, a testing protocol is particularly important to determine if the usability study will be feasible and if it will produce valid results. The testing protocol needs to be piloted by the team before undertaking the experiment with the recruited subjects. Along with the data collected during the experiment, the initial and post questionnaires will gather summary data on the demographics and the overall reaction to the mock-ups and experiments.

The goal of this activity is to measure the system and application's user experience. This will be achieved when the data is analysed and the team identifies the strengths and weaknesses of the application/system. The outcome of this analysis will be an observations/recommendations list which infers conclusions from the measured and collected data.

Lastly, the final exercise is to reflect on the overall findings and do critical analysis of the final product for further client's appreciation.

Testing Plan

Objectives

The purpose of testing is to gain insight on the user experience from both those unfamiliar with the application and from members of the PixPlace team who know the application's full capabilities. The process will be undertaken to identify any issues that might not otherwise have been detected during development. In order to achieve this, the PixPlace team should carry out the following objectives:

- Follow a thorough and detailed checklist of the application's features
- Conduct the test protocol with members of the public

The functional testing for PixPlace was mostly conducted as it was being developed as any bugs or incompatibilities individual components had with the rest of the system were checked and fixed before being merged with the main branch of the application. Towards the end of the stage, once development was largely complete, a member of the PixPlace team should run through the application using a detailed checklist - much more detailed than what would normally be asked of our test participants - that tests every feature of the application to verify that they were working as expected. This detailed test will include verifying system behaviour with multiple combinations of valid/invalid registration and login details (checking that the appropriate error messages appeared), making sure the pages loaded correctly from each previous page and that the navigation bars worked consistently for each page.

For general usability and design testing, members of the public will be asked to take part in the usability study using the testing protocol (given below). This study will be conducted using online voice calls and screen sharing to comply with COVID-19 health and safety regulations.

Results of Detailed Testing

The results of this thorough testing were successful as every feature performed as predicted with all pages achieving accurate functionality and quick load times, the only irregularity being the post times. It was noted that typically the first image to be uploaded and posted in one login session took longer than the uploads that followed. During this testing, it took approximately 6.55 seconds for the first image to be uploaded and posted, and then every subsequent image under 3 seconds. The recorded times of four posts in one login session gave an approximate average of 3.79 seconds, however without the unusually longer first time, that brings the average down to 2.86 seconds.

Upload	Time (milliseconds)	Time (seconds)
1	6550	06.55
2	2880	02.88
3	2950	02.95
4	2760	02.76
		03.79

sign that outlines the
nd reassurance that any personal data will be held in compliance with the GDPR (General Data Protection Regulation) and in accordance with the Data Protection Act 2018. The consent form also informs the participant that participation in the study will not affect their status with the university in any way and that they are free to withdraw at any time.

Next, the participant will be asked to fill out another form asking for their personal details (such as name, age, and gender) as well as what course they study at university and how they typically use the internet. This information is collected to give the PixPlace team a look into the demographics of the usability study participants in order to provide context and help in the analysis of the results of the study.

After these initial questionnaires have been completed, the testing protocol shall begin. This protocol will utilise online voice calls and screen-sharing applications to engage with the participants as face-to-face contact is not possible due to the ongoing COVID-19 situation. The PixPlace development team member conducting the testing will first read through the introduction which once again outlines the purpose of the study and what the gathered information will be used for, and that any personal data collected will be erased upon completion of the project. They will then share their screen, showing the application running on an Android Virtual Device (AVD), and proceed to ask the participant questions which will test the functionality of the app from the perspective of a first-time user as well as what they think of the overall design of the app. While this testing methodology cannot produce results as accurate as real-life testing of the application would allow (due to the lack of personal interactivity), the participants would still be able to get a feel for the responsiveness and ease of use of the app as they would be the ones deciding which actions to take to complete the tasks given in the testing protocol.

Finally, to finish the study the participants will be asked to complete a final questionnaire which records how they personally feel about the system. They are given a series of statements - both positive and negative - and asked to rate their agreement with the accuracy of those statements on a scale 1 to 5, where 1 means “Strongly Disagree”, and 5 means “Strongly Agree”. This is a Likert scale, the most widely used rating scale. (McLeod, 2019)

Participants

The participants recruitment will be challenging for this experiment, due to the current social distancing restrictions. For that reason, the sample size might be smaller than in a normal social environment. Despite that the recruitment will try to reach the participants digitally.

The team has established, inferring from the requirements, that the target user will be young people that are technology enthusiasts, photographers, academics, and gamers. The sample recruited must match this profile to get the most accurate and relevant data to inform our development. Those recruited will also likely be friends or family of the PixPlace team due to the aforementioned restrictions.

Test Scenarios

Table showing the various testing scenarios in the testing protocol, outlining which requirements are being tested in each scenario.

Scenario	Requirements	Interactions
1. Registration	F-UR1-1.1 F-UR1.1.2 F-UR1-2 NF-UR4-2	Register user account Create username Verify email Password guideline
2. Login	F-UR1-3	Login and logout
3. Homepage	F-UR2-3 F-UR2-4 F-UR3-1 F-UR4-1 F-UR4-3 F-UR4-4 F-UR4-6	Post visibility Post location Homepage Comments Sharing Saving Reporting
4. Profile	F-UR3-3 F-UR3-4 F-UR5-2 F-UR5-3	Profile Bottom anchored navigation bar Experience Level system
5. Camera	F-UR2-1.1 F-UR2-1.2 F-UR2-3 F-UR2-4 F-UR3-4	Post images In app camera Post visibility Post location Bottom anchored navigation bar

	F-UR4-5	Tagging
6. Challenges	F-UR3-4 F-UR5-1 F-UR5-2	Bottom anchored navigation bar Challenges Experience
7. Leaderboard	F-UR3-4 F-UR5-2 F-UR5-5	Bottom anchored navigation bar Experience Leader boards

Metrics

The following metrics were measured and analysed as part of the usability study:

- Success rate - not completed, required assistance, completed.
- User satisfaction - using Likert scales in post-questionnaire

The testing protocol also recorded general feedback from users regarding their opinions on the design and/or functionality of the application.

Testing protocol

PixPlace Usability Evaluation Study

Tester's Name:

This testing protocol should be followed by the one conducting the test as they show the app to the participant, going through each stage and taking note of the participant's responses. When the participant says what they would do (e.g., "I would then click on that button"), the tester should perform that action (click on that button) to act as if the participant was interacting with the system themself.

It is recommended that the tester look through the document before conducting the test and please use a blank document for each participant.

Please read aloud the following introduction to the participant and ensure the participant understands the aim and purpose of this test.

Introduction: *PixPlace* is an app that allows users to create an account and post images to participant in challenges and earn experience points ('XP' for short). For this test, I will ask you to create an account with the application using your name, email address and password of your choice. This account will be deleted following the end of the project (01/04/2021) and no personal data will be kept by the project team. I will share my screen with you so you can see the application and ask you to complete some tasks as well as ask questions about your opinion on the overall design and functionality of the system. I will also be taking notes to record your responses and feedback, however they will be completely anonymous. After this, I will then ask you to complete a questionnaire that will gather your comments and feedback on the system. Your personal data will

not be used in our final report, only the answers you give, so that we may reflect on our design and make improvements.

You may request that we stop at any time.

We will now begin.

Questions

1. Registration

The tester should open the app, displaying the first screen.

a) Can you identify what this is? E.g., its purpose.
Success: not completed, required assistance, completed
Comments, if any:

b) How would you describe this screen?
Answer:

If they ask for clarification:
Is it aesthetically pleasing?
Is there anything about it that confuses you?
etc...

c) Please talk through how you would create an account.
Success: not completed, required assistance, completed
Comments, if any:

Note down what they required assistance on, if any. If the participant enters invalid data (e.g., a password without a number) let them try to figure it out on their own at first based on the error message:

2. Login

Upon successful registration, the screen should now be back to the original seen upon opening the app.

a) Please tell me how you would now login to the app.
Success: not completed, required assistance, completed
Comments, if any:

b) What did you think about the logging in process?
Answer:

If they ask for clarification:
Was anything about it particularly difficult?
Was the process clear?
etc...

Note down what they required assistance on, if any:

3. Homepage

Upon successfully logging in, the screen should now display the PixPlace homepage.

a) What do you think the purpose of this page is?
Answer:

b) How would you describe this screen?
Answer:

c) Please talk through how you would:
1. Leave a like on a post
2. View the current comments
3. Comment on a post
4. Share the post
5. Save the post

Success: not completed, required assistance, completed
Comments, if any:

c) Look at the post at the top of the screen. Can you identify the user that posted it?
Success: not completed, required assistance, completed
Comments, if any:

d) Look at the same post. Can you tell me if the user also tagged their location? If so, what is the location?
Success: not completed, required assistance, completed
Comments, if any:

e) Can you talk me through how you would report a picture?
Success: not completed, required assistance, completed
Comments, if any:

Note down what they required assistance on, if any:

4. Profile
App should still be showing the Homepage.

a) Could you tell me how you would navigate to Profile?
Success: not completed, required assistance, completed
Comments, if any:

b) What do you think the purpose of this page is?
Answer:

c) How would you describe this screen?
Answer:

d) Can you identify some of the key features on this page?
Answer:

If the participant is struggling, perhaps nudge them in the right direction e.g.
What about the icons below the username?
Do you know what the circle around the picture indicates?
etc….

Note down what they required assistance on, if any:

5. Camera
App should still be showing the Profile page.

a) Could you tell me how to navigate to the camera?
Success: not completed, required assistance, completed
Comments, if any:

b) What do you think the purpose of this page is?
Answer:

c) How would you describe this screen?
Answer:

d) Please talk through how you would take and post a picture.
Success: not completed, required assistance, completed
Comments, if any:

e) Can you identify what the purposes of “Description” and “Tag” may be?
Success: not completed, required assistance, completed
Comments, if any:

Note down what they required assistance on, if any:

6. Challenges
App should be showing the Homepage after submitting the picture.

a) Could you tell me how to navigate to Achievements?
Success: not completed, required assistance, completed
Comments, if any:

b) What do you think the purpose of this page is?
Answer:

c) How would you describe this screen?
Answer:

d) Can you tell me how to change to the different kinds of challenges?
Success: not completed, required assistance, completed
Comments, if any:

e) What do you think the different kinds of challenges mean?
Answer:

Note down what they required assistance on, if any:

7. Leaderboard

App should still be showing Achievements.

a) Could you tell me how to navigate to Leaderboard?
Success: not completed, required assistance, completed
Comments, if any:

b) What do you think the purpose of this page is?
Answer:

c) How would you describe this screen?
Answer:

d) Can you tell me how to change to the other Leaderboard?
Success: not completed, required assistance, completed
Comments, if any:

Note down what they required assistance on, if any:

Pre-Questionnaire

Questionnaire

Post-Questionnaire

Test results

Participants

Due to the lack of engagement of the group, only 2 members of the group have successfully completed the usability evaluation with subjects meaning we are working with limited feedback data. We are aware this sample size could lead to the interpretations and results deduced from the questionnaires to be inaccurate to a certain degree due to extrapolation which we will further discuss in the coming section.

Qualitative Findings

For the usability study in stage 3, we have opted to use qualitative style of questions because we feel they will provide us with the best way to allow subjects to communicate true feelings and opinions of the application. It also allows for suggestions of improvements to be discussed.

Section 1. Registration

From the questions in section 1, we can see that the general consensus amongst subjects is that they found the registration page easy to use whilst finding it clear and concise. Subjects tended to like the animation and aesthetic of the page and thought it helped add to the engagement of the app.

Section 2. Login

Subjects found the login page to be just like most other systems which is what they would expect. This means that we can be confident we have created a login system that utilises the generic concepts that users will find familiar and hence trivial.

Section 3. Homepage

Subjects understood the purpose of the homepage (a feed that shows other users posted images). All subjects thought the aesthetic of the page was nearly there but there were some noticeable and off-putting errors such as the padding of the likes being offset, and the comment box not being confined in the post properly. These are useful errors that we also noticed and will try to work on fixing.

Section 4. Profile Page

Subjects found the profile page to be a little confusing. Some had no idea what the three middle buttons did which means we need to either label them or rework the icons. Some were also unsure as to what the white space at the bottom of the page was for. This implies that we need to add something there for when the user hasn't posted any images (i.e., "No Images Posted"). However, the top half of the profile page was generally found to be clear with some subjects complimenting the circle progress indicator XP bar.

Section 5. Camera

Subjects found the integrated camera to be easy to use but some thought it wasn't pleasing to look at. Whilst aesthetics is usually a major part to the application, we don't believe there is any feasible way to make the camera look any better.

Section 6. Challenges

Subjects found the challenges page to be easy to navigate with a clean finish. They liked the tab style swiping system, but some had complaints that there was a lot of whitespace on the page and believed it would have looked better if there was more on the screen. For example, we could add images to the page to fill it out a bit more seeing as though there isn't more information about the challenges we could add.

Section 7. Leaderboard

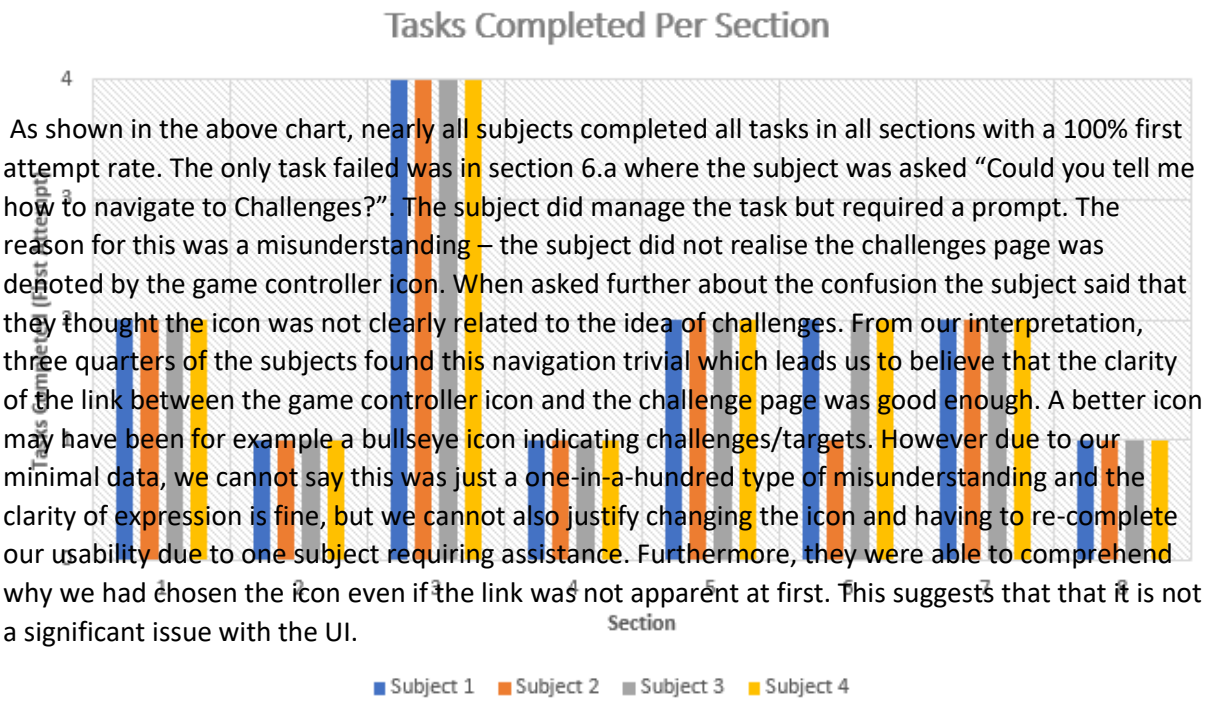
Subjects again found the clarity of the page to be good and they understood what they were looking at, but they found it to empty and not very engaging. Some suggestions were to add rewards/ medals to the podium users.

Sections 8, 9 and 10.

Subjects were not tested on the Settings (8), Help (9) or Search (10) pages as the features were not fully implemented in time for usability testing.

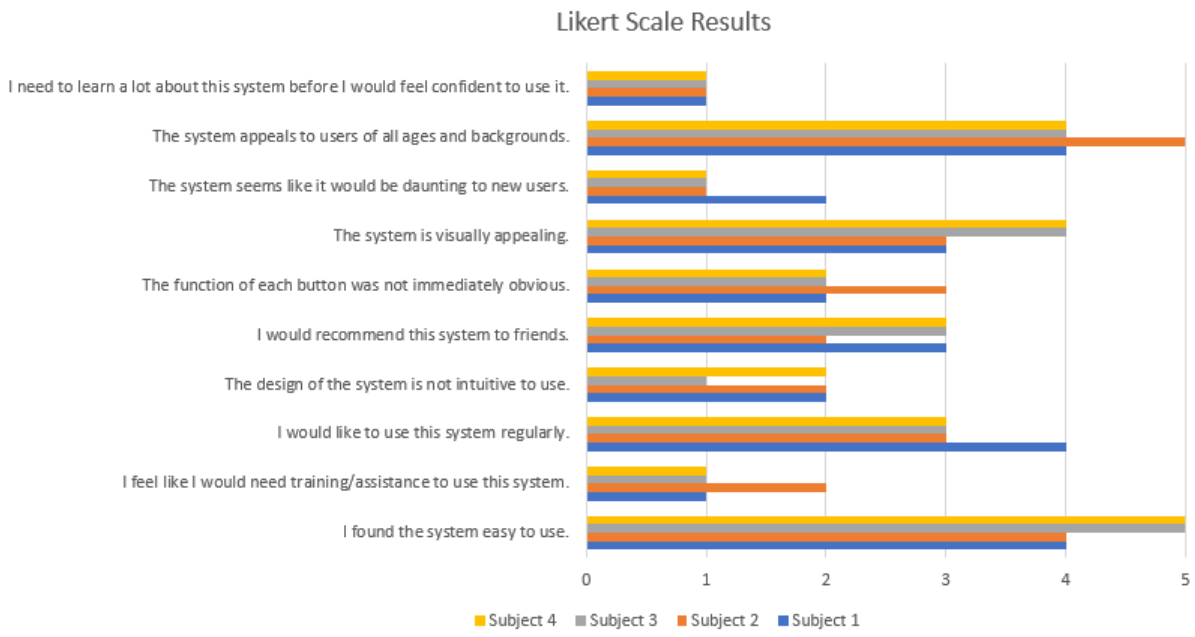
Quantitative Findings

Amongst all sections of the questionnaire, there were tasks that the subjects were asked to talk through as described earlier. Whilst the ability to complete the task could be considered qualitative data, we can quantify how many tasks each subject could complete from each section. The following bar chart shows the results per section.



As shown in the above chart, nearly all subjects completed all tasks in all sections with a 100% first attempt rate. The only task failed was in section 6.a where the subject was asked "Could you tell me how to navigate to Challenges?". The subject did manage the task but required a prompt. The reason for this was a misunderstanding – the subject did not realise the challenges page was denoted by the game controller icon. When asked further about the confusion the subject said that they thought the icon was not clearly related to the idea of challenges. From our interpretation, three quarters of the subjects found this navigation trivial which leads us to believe that the clarity of the link between the game controller icon and the challenge page was good enough. A better icon may have been for example a bullseye icon indicating challenges/targets. However due to our minimal data, we cannot say this was just a one-in-a-hundred type of misunderstanding and the clarity of expression is fine, but we cannot also justify changing the icon and having to re-complete our usability due to one subject requiring assistance. Furthermore, they were able to comprehend why we had chosen the icon even if the link was not apparent at first. This suggests that that it is not a significant issue with the UI.

We also had a Likert scale style questionnaire for the users to fill out in the final stage of the questionnaire.



As seen from the results, the general consensus for most questions seems to be that the subjects had similar views and opinions of the app. Most found the app to be easy to use and clear. However, the aesthetics of the app were generally not engaging enough for the subject's likings and are most likely the key point for us to look into in future development. Subjects also didn't seem massively enthusiastic about the idea of using the system regularly, further indicating engagement with the app needs improving.

Conclusions

Result analysis

From the results, it is clear to see that we have managed to make a system that is user friendly and intuitive to use. However, where we lack is the general aesthetics and engagement potential of the app. Subjects didn't find the app to be consistently visually pleasing whether it was some of the visual bugs on the feed or the large blank whitespaces in the challenges. With this in mind, we must remember that there were a number of team issues throughout the project and to be able to create an intuitive to use application is hard under these conditions on top of the COVID-19 scenario we are in. We also need to remember the results were not collected from an ideal sample size meaning some of the information may not have the backing that it needs making it harder to say what we can and cannot infer/take away from the data. We needed to test more subjects as planned.

Proposed modifications

For future development, we will try to finalise and clean the visuals of the UI up as well as add in some more filler features to better enhance engagement of the app.

References

McLeod, S. A. (2019, August 03). *Likert scale*. Simply Psychology. https://www.simplypsychology.org/likert-scale.html [Accessed 28 March 2021]

Changelogs

Revisions

Date	Author(s)	Changes
09/02/21	Jose Fernandes	Document created; all structure set up.
20/02/21	Jose Fernandes	Introduction fully finished; added participants section to testing plan; added form, aim and introduction to test protocol
15/03/21	Tania Henderson	Added testing scenarios table
27/03/21	Aaron Molesbury	Wrote out entire usability analysis, created necessary graphs
28/03/21	Tania Henderson	Added the Testing Protocol document; started writing under Testing Plan; added Usability Study Procedure; added References; general editing
30/03/2021	Tania Henderson	Created Metrics; added Revisions table under Changelogs; added to text under Testing Plan; created Results of Detailed Testing
30/03/2021	Magnus Mackay	Appended grammatical issues across report
31/03/2021	Tania Henderson	Completed Objectives; moved Objectives section to be under Testing Plan

System's Deployment

User Install

For the users want to use PixPlace, they need to use the phone with Android system. The PixPlace in the Android store will be available to download. The users need to give the permissions to allow the PixPlace uses the phone's camera, the local albums,

and the location information to do the function of upload when they use it at the first time. After the users give all the permissions for PixPlace, they can create their own account to get start their unforgettable memories with PixPlace! All the operations are done under the safe data environment.

Developer Setup and Maintenance

Developers need to have installed the things below to make sure the PixPlace can be programed.

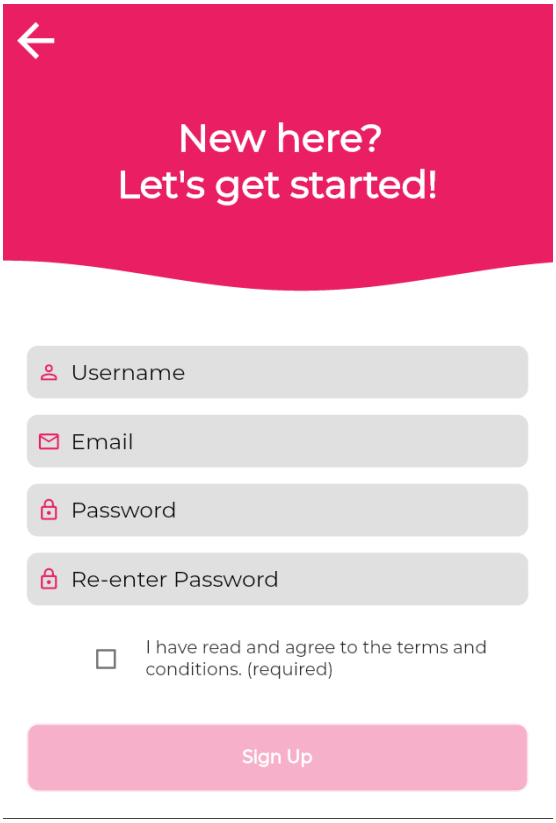
- Android Studio / Visual Studio Code (includes Emulator)
- Android SDK
- Flutter Plugin
- Dart Plugin
- Firebase (running on the webpage)

User guide

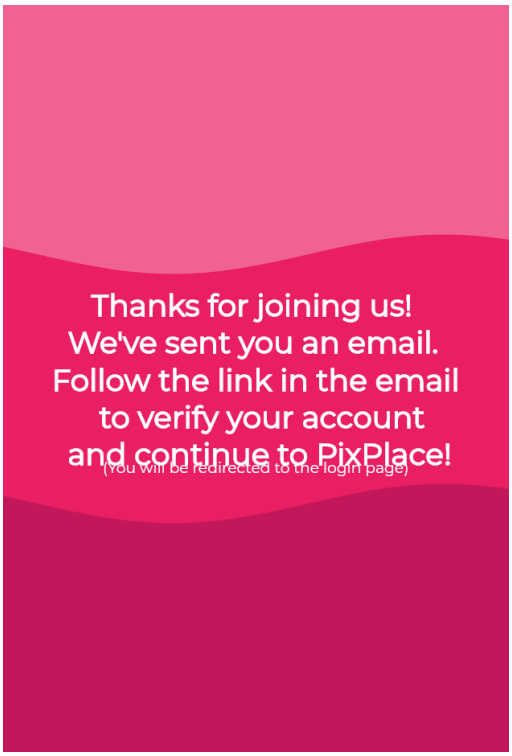
The PixPlace is a user-friendly application to all ages of users. It is clear and simple for users to learn how to use it. The texts below make an introduction for the users to use and enjoy the function of PixPlace perfectly.

- Sign up/ sign in

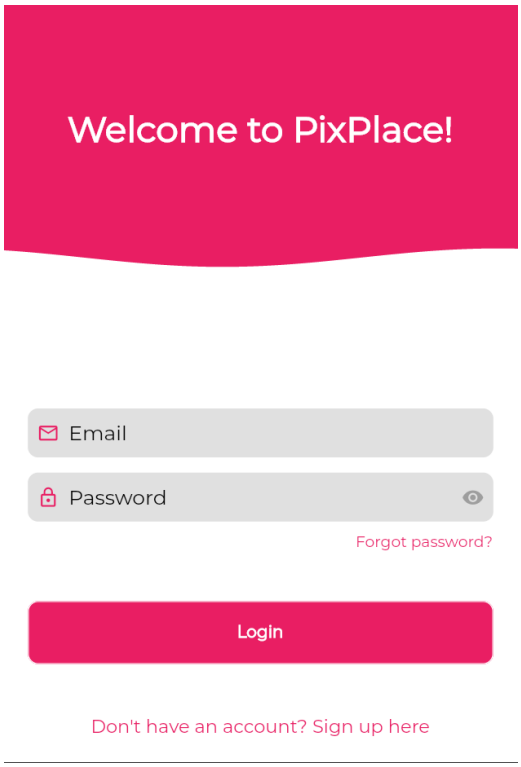
The users can create their account by the email in this page. The username should not with any spaces. For the users accounts security, the password should have at least an upper-case letter, a lower-case letter and one number.



The users will receive an email for verify after they click “Sign Up” button and they just need to click the link in the email. The screen of PixPlace will be shown as below after the users verify their email successfully.

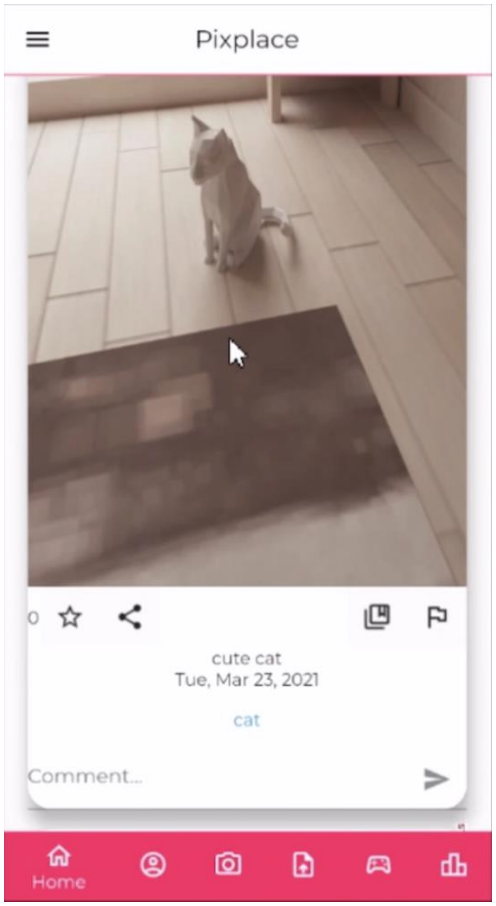


The users can sign in on this page by their email after they have signed up.



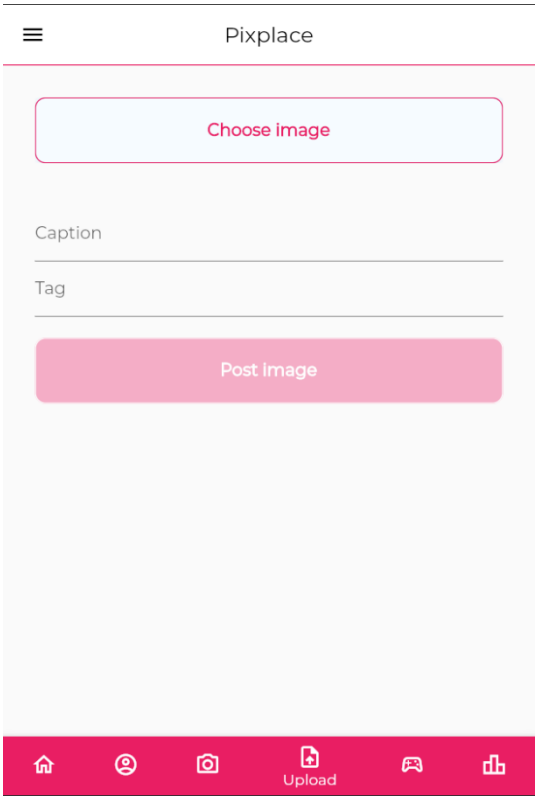
- View the posts.

The users will into the feed page firstly when they sign in successfully. They can view other's posts including the information about the photo's location, the caption, the time, and the tag for the picture. The users can "like" the posts by click the "star" and input their comments in the bar at the bottom of the posts. The tag under the image gives users a chance to go into the collection of a specific one and the PixPlace can also select correct tags.



- Upload the posts.

The users can upload the image from their phones' albums. They can describe their image in the "caption" bar and give it a "tag" for the different sorts. The users just need to click the "Post image" button to upload a new post.

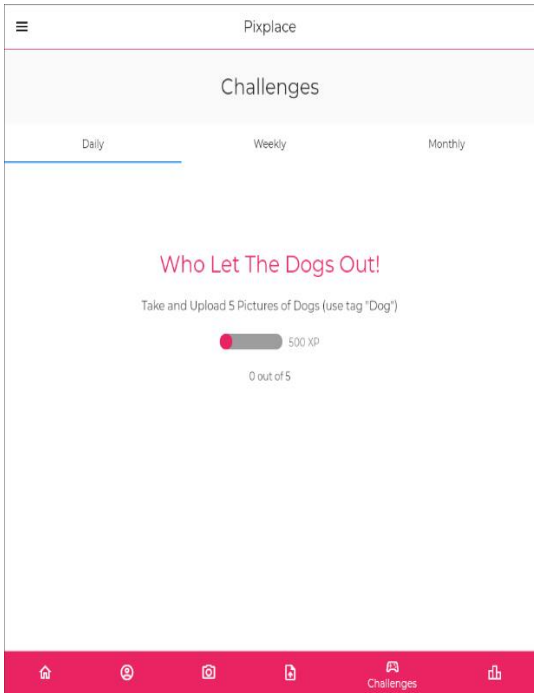


- Take pictures.

There has another way for users to upload the image is that they can take picture by run the camera in the PixPlace.

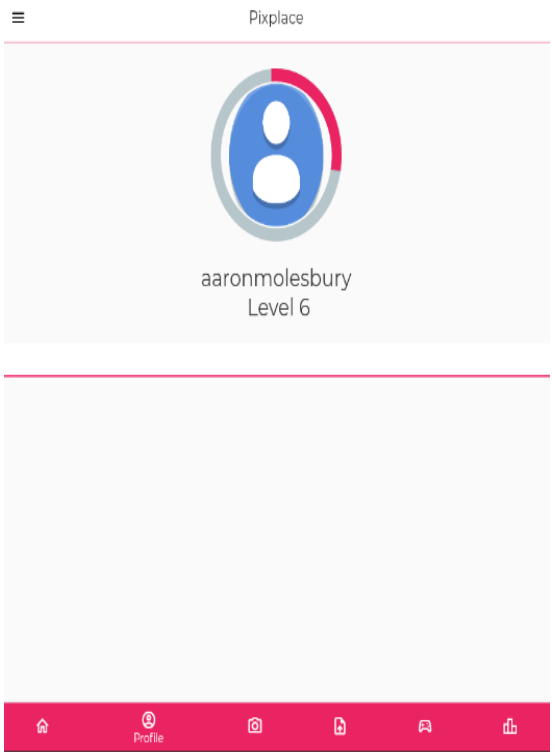
- Take part on the challenges.

The users can check the challenges which they prefer to take part on in this page, and the bar with a pink point followed by “500 XP” shows the progress of the challenges.



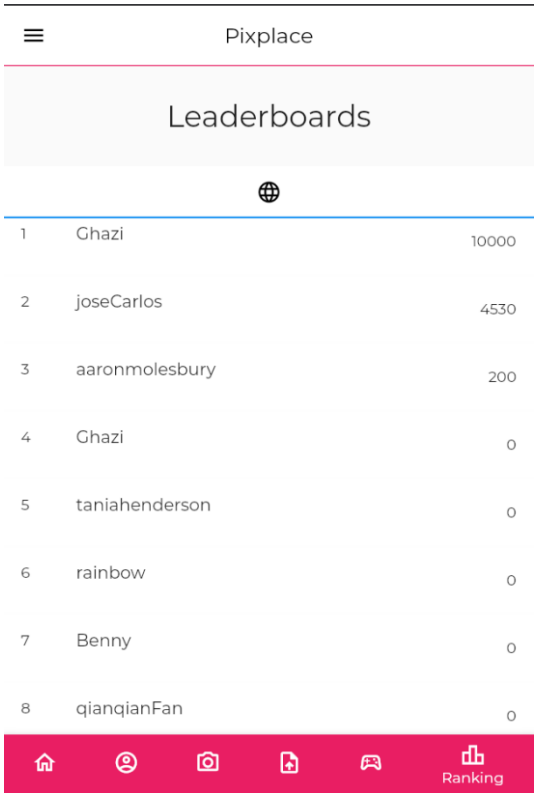
- Check the levels.

The users can check their own level and all the images they have posted in the profile page. The circle around the portrait with pink shows the progress of the levels.



- Check the ranking.

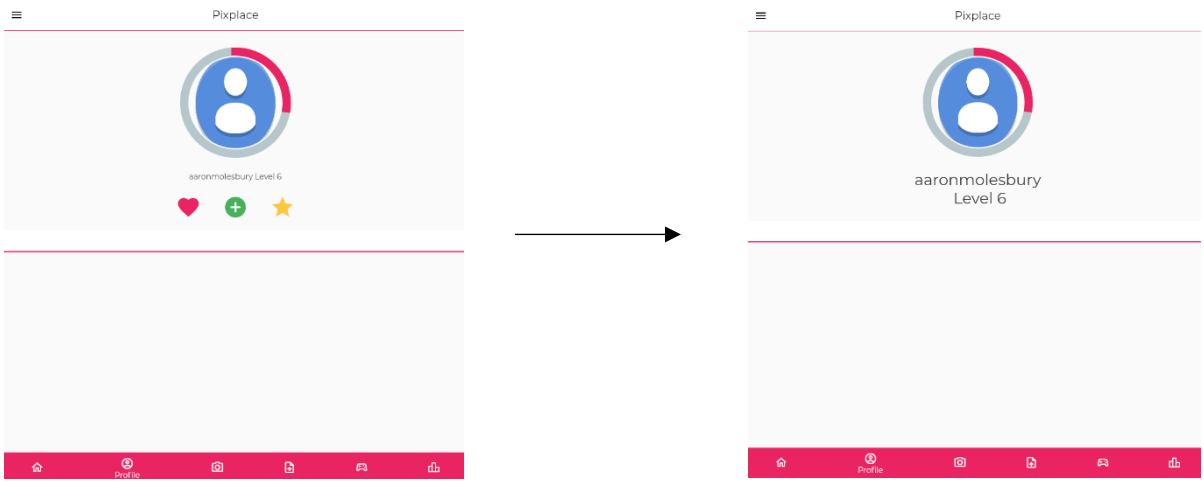
The users can check their own total scores and ranking in the leader boards page.



Changes of the Application For the Demo

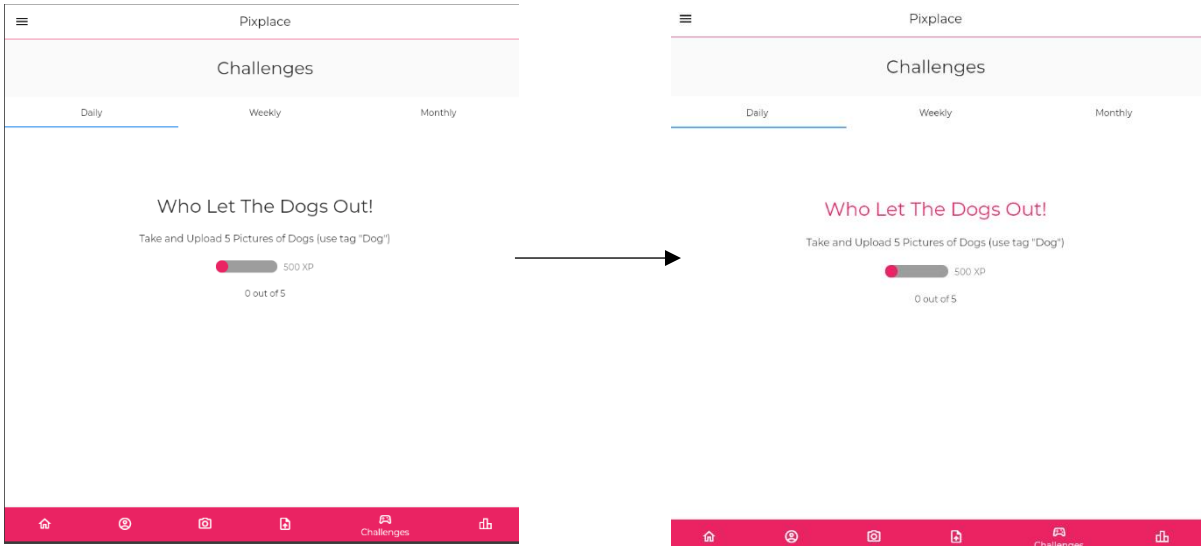
For the demo, some of the features that we had planned to be implemented hadn't been due to group issues. This meant that we had to remove some of the icons that we had put in the app as placeholders because they had no functionality. Listed below are some examples of features that we had to scale back:

Profile Page



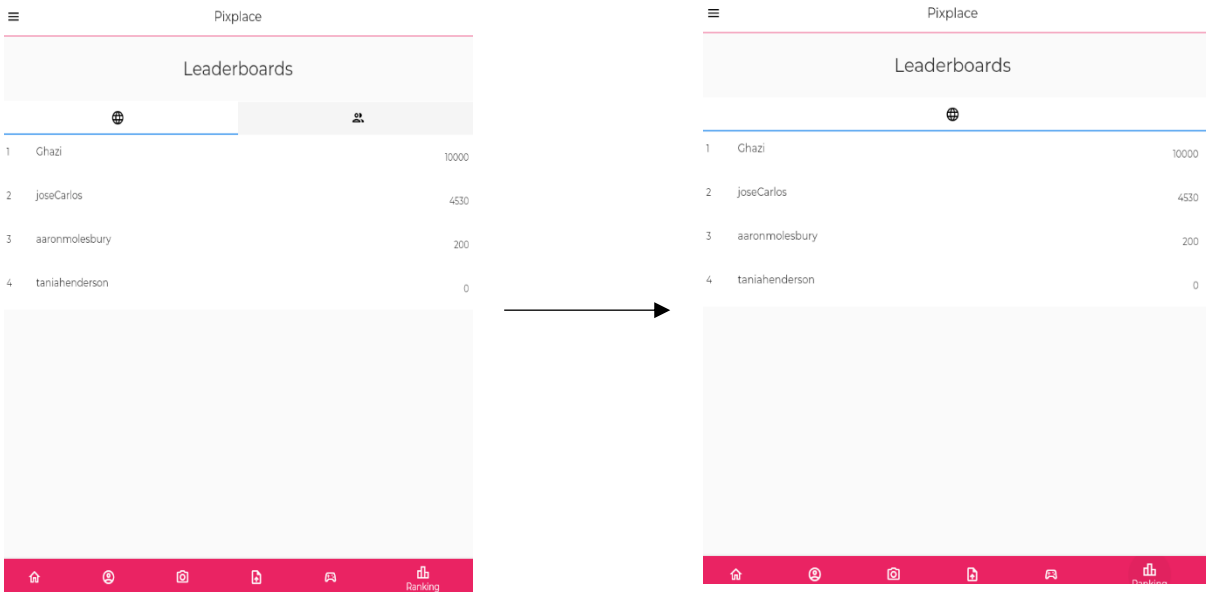
For the Profile page, we originally had planned to have 3 buttons in the middle of the page. The Heart icon would have taken the user to a page which displayed all the posts that the user had previously liked. The green Plus was meant for people to add a biography to their profile page and the yellow star was planned to show the users saved collections. We decided to remove the buttons because they did not do anything as they were just placeholders, so we felt they had no place in the demo of the app.

Challenges



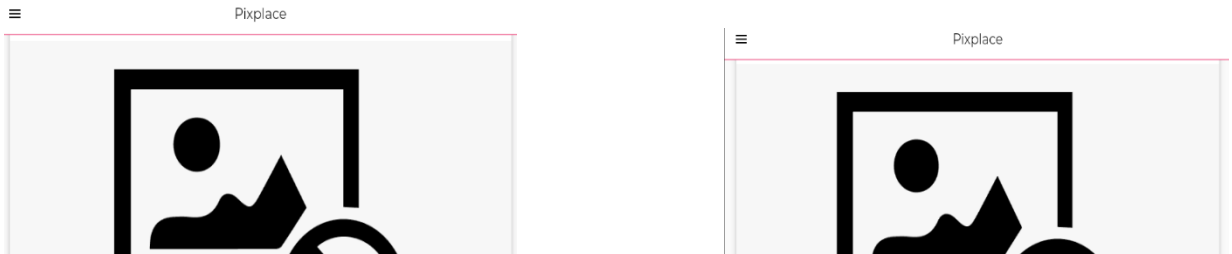
For the challenges, we decided to leave out the deadline field. This is because we did not have time to get a constantly updating timestamp working with the app so currently challenges do not have a set time frame like they are meant to. Challenges also must be manually created which we believe is then best way to implement them as it gives the admins of the app much more freedom in terms of what they can do.

Leaderboards



Originally for the leaderboards we were going to implement a global and friend only version of the leaderboards where the global leaderboard shows everyone in the world and the friend only leaderboard just shows your added friends. However, again due to team issues and time restraints, we never got the add friend functionality working so we decided to remove the friend leaderboard and just have 1 global board for the users for the demo to remove the duplicated boards.

Feed Page



We also removed some buttons from the post widget. We removed the button which would have allowed users to share the image to other applications and we also excluded the button which allowed users to save the post to their private save collection as mentioned earlier. We decided this function was not necessary if we did not have any way of displaying the save collection on the profile page, so we scaled it back. We also removed the likes from the comments because they value would not auto refresh and we could not find a fix for this, so we abandoned this function as it was not vital.

Finally, we removed the search functionality as it was not integrated with Firebase so did not function fully for demo purposes. It was remodeled to be demonstrated in a standalone capacity which allowed for a lesser, albeit still robust, solution. The new, remodeled solution handles web hosted JSON files in place of the full Firebase implementation. The user can search for other PixPlace users and is directed to the respective profile page. This was scaled back from originally being able to search for challenges and tags in addition to users – the downscaling of the functionality was largely down to the reduced implementation of challenges which meant that challenge searching was not able to be fully introduced into the feature. In addition to this, development issues arose when the entire feature was integrated into a widget mid-implementation which caused a number of issues which ultimately hindered the progress and overall finished solution. This setback also led to the exclusion of the feature in the usability testing. An attempt at connecting the search feature to Firebase has been made and although it is not in a runnable condition, the reference code for the attempt is being provided in supplement to the stage three report.

Changelogs

Revisions

Date	Author(s)	Changes
20/02/2021	Ghazi Yusaf	Started introduction, finished scope sub part

27/03/2021	Aaron Molesbury	Wrote Changes of the Application for the Demo section
30/03/2021	Tania Henderson	Added Revisions table under Changelogs
31/03/2021	Qianqian Fan	Wrote the System's deployment
31/03/2021	Magnus Mackay	Added to changes of the application for the demo section and appended issues within section.

Project Evaluation

Organisation

Our group was composed of 8 members, of which one from Information Systems and the remaining from Computer Science. Unfortunately, two of the members dropped out during the first stage, including the Information Systems student which means that the group is exempt from producing the Marketing Analysis and Strategy doccument.

The group unanimously decided to assign the project roles in early meetings. Ghazi Yusaf was elected as the organisational manager, Jose Fernandes as technical manager, Tania Henderson as reporter and Aaron Molesbury as the liaison.

The documentation, organisation and writing were the responsibility of Ghazi, Jose, Aaron, and Tania. The usability evaluation studies were planned and designed out by Ghazi and Jose, Aaron did all its analysis and most of the group executed the usability test with their experiment subjects.

The development of the application was mostly done by Aaron, Ghazi and Jose. The development team was supposed to be organised into front- and back-end units, but these plans had to be reverted since there was little to no development done by a substantial number of members. Tania was responsible for the image labelling and application's testing. Magnus worked on the search bar feature and carried out documentation work throughout the 3-stage documentation. Qianqian worked on producing a demo video, a demo presentation as well as taking over the 3-stage documentation's System's Deployment section.

Collaboration

The collaboration during this project was not easy due to the communication difficulties, lack of engagement and commitment from some members of the group. The workload in every activity was unevenly distributed and, despite the best efforts of the most active member to motivate others, it stayed like that.

The meetings were held 3 times a week because the organisational and technical managers insisted that it was important to have frequent meetings to be consistent with the agile development methodologies. The meetings were attended by everybody most of the times, but it was not productive due to the lack of communication skills and lack of work being done by some individuals.

As a result of these issues, Ghazi quit his role as organisational manager and the group manager kindly offered to participate in some meetings to motivate and moderate some of the meetings. As a result of the first meeting, the roles were reorganised into the following:

- Tania Henderson – Organisational Manager/ Testing Lead
- Aaron Molesbury – Communication Officer
- Magnus Mackay – Report Lead
- Ghazi Yusaf - Demo Lead

- Qianqian Fan - Web Browser and I/O Lead
- Jose Fernandes - System Development Lead

Group

The group was not successful, due to some members dropping out and to the lack of engagement and communication of some of the members. The meetings were generally not productive, and it was challenging to communicate and plan next steps. It was usual for some members to not commit to meetings, either by missing several consecutive of them or just be completely silent and not contribute in any way. Another quite common behavior, by some members, was insisting in just working on a single task throughout the stage, always avoiding giving out any update or even show their progress.

These events led to the constant rolling back of features that have direct correlation with the requirements. Despite this negative affect, there was little change and the conducts only got worse as the time went by. The changes dramatically affected the development the active set of members had to continuously improvise new ways to deliver the final product.

Online tools

Git and GitHub

Git was the main tool used by the team to manage the project's code base. It was very useful because it allowed the concurrent development of many unique features. The main functionality responsible for that was git branching. Branching was heavily used by the developing team to work on unstable features independently from other branches, before merging into the stable main branch. This strategy made the development collaboration more straightforward and saved time by avoiding manual code merging and management.

GitHub was the online platform that the git version control system was running on. This platform, apart from freely hosting the code, also provided web GUI tools that were particularly useful for resolving and debugging merging conflicts.

Microsoft Teams

Teams was heavily used for formal meetings with the Project Manager and for the demonstrations. It was a particularly useful communication channel because it allows for asynchronous communication between the team and Project Manager. The group also decided to start to conduct meetings through Teams, which proved to be more efficient and allowed for recording (agreed upon the meetings change from Discord to Microsoft Teams).

OneDrive

The OneDrive cloud proved to be a great way to collectively document and report during the project. The team enjoyed having a simple and intuitive platform that could keep other every document needed and track their progress.

Discord

It was the main platform used by the team to exchange direct messages, do some meetings and post announcements. The team used this platform heavily because it has cross-device applications and was the most convenient for everyone since most are frequent users.

Implementation

Schedule

The project schedule was deeply disrupted by the intermittent or even low engagement of some group members. It was particularly challenging to plan a schedule because the priorities would constantly change, and it was difficult to even plan the next development cycles. Unfortunately, these circumstances led the group to have a very generic informal schedule and it changed so constantly that it was not tracked as the development process progressed.

Implementation approach

Although the application has many important and critical features that were planned, for instance the security requirements, the implementation was not completely successful because there were many critical requirements that were not achieved. The main reason might be that group had to roll back the project's scope and the requirements prioritisation was not the most effective. The clearest examples are the requirements relating to the administrative tools which were mostly not implemented.

Languages, tools, and techniques

Live group programming sessions

These sessions were very productive because it the best way to develop something collectively since everyone was unfamiliar with Flutter. These were the most productive activities ever done in this project because developers were sharing insights and ideas while working concurrently on several aspects of the application. The sharing of knowledge eased up the learning process of the framework, programming language and even how the project worked and was organised. The members taking part in these sessions believed that it was the best way to get everyone involved in the development process. Although many invites were made from members participating in these sessions during the meetings, the remaining group members never tried to join a single session.

Flutter

This framework proved to be a decent way of developing a mobile application as it is accessible for everyone capable of programming. Its architecture is based on an API which the team felt was easy

to learn but was still a bit limited for more complex interfaces. For this reason, the team relied instead on community-maintained packages which were mostly useful but had some significant caveats such as having different layers of compatibility across platforms. For instance, some packages only worked on mobile devices, totally ignoring the web or even the desktop, whereas others only worked on Android devices exclusively.

This was clear when attempting to get the image with faces blurred back from the server, as a stream, and there was no package that could decode the byte stream into a normal file consistently on every platform or device. According to official documentation the alternative to this is using a native library that provides a C language compiling for every platform, but it defeats the purpose of a higher-level framework that has the goal of abstract these lower levels of programming.

The debugging is also a drawback in the framework due to the low-quality error messages which did not clearly identify where the bug was or what was causing it. This made development frustrating at times when the team was trying to do more complex interfaces.

The Flutter initial setup was very weird and difficult to set up because it had many different caveats and limitations depending on the IDE or operating system. This makes the development less accessible to a team using diverse personal setups.

In all this framework was decent implementing and suitable for the project but the team feels that it promised more than it could deliver.

Dart Language

This language is similar to JavaScript, which is convenient to newcomers, especially ones that are already familiar with JavaScript. The language was very flexible and extendible because it is an interpreted language which can infer types at runtime. The downside of it is that it uses many ES6 features but it rewrites some others, such as replacing the Promise asynchronous abstraction by the Future abstraction, which do not bring any significant improvements to a language that has the intention of persuading JavaScript developers to adopt it instead.

The type checking is not better than Typescript, which does not rewrite any JavaScript feature and infers types as Dart does.

Judging by the times for the app and its dependencies to build, the compiling time of Dart programs are not faster than JavaScript.

Android Studio

Android Studio was a decent IDE to develop the application, but its setup was challenging because it involved installing together with the Android SDK (Software Development Kit), the Android emulator, and the Flutter and Dart plugins. There was enough online documentation to overcome any issue, but the team noticed that it was difficult for less experienced developers to get started with it.

The development experience was good, but its UI feels very cluttered and difficult to configure it to the personal taste of each developer.

VS Code

This IDE was slowly adopted by most of members because it is more straightforward to set up for Flutter development, its easy integration with the Android emulator and for the easy customisability of its interface. All in all, it had useful plugins ecosystem that made the experience of developing a Flutter application more enjoyable.

Android Phone and Web emulators

The emulator was an especially valuable tool because it allowed for rapid development cycles because the app could be run at each change instead of just continuously downloading and installing it at every code change. It would be inconceivable to do this project without any kind of emulator. The Android phone emulator is a bit unstable because it had some issues running and booting up and eventually stopped working for some machines.

Firebase

The project's scope had to be dramatically rolled back and that meant that the original back-end solution was dropped in favor of a more accessible solution. The team negotiated and decided to use the Firebase platform because it offered in-app authentication, NoSQL database and image storing. This solution was a good alternative to our use case because of its Flutter official package that offers all these functionalities out of the box. The downside of using the NoSQL database is that any change causes bugs everywhere in the application and the way to fix it is to manually change the database or the MVC data entities, which can be very slow and frustrating.

Product

Requirements

Functional

F-R1	Registration	Was it achieved?
F-UR1-1.1	🔴 **Register user account**	Yes
F-UR1-1.2	🔴 **Create username**	Yes
F-UR1-1.3	🟡 **Create user biography**	No
F-UR1-1.4	🟢 **Create user avatar**	Partially
F-UR1-2	🟢 **Verify email**	Yes
F-UR1-3	🔴 **Login and logout**	Yes
F-UR1-4	🔴 **Age restriction**	No
F-UR1-5	🔴 **One account per email**	No
F-UR1-6	🔴 **Delete account**	No

F-R2	Platform use	Was it achieved?
F-UR2-1.1	🔴 **Post images**	Yes

F-UR2-1.2	**In app camera**	Yes
F-UR2-2	**Channels**	Yes
F-UR2-3	**Post visibility**	No
F-UR2-4	**Post location**	Yes

F-R3	Navigation	Was it achieved?
F-UR3-1	**Homepage**	Yes
F-UR3-2	**Search**	Partially
F-UR3-3	**Friends**	No
F-UR3-3	**Profile**	Yes
F-UR3-4	**Bottom anchored navigation bar**	Yes
F-UR3-5	**Top anchored navigation bar**	No

F-R4	Interactions	Was it achieved?
F-UR4-1	**Comments**	Yes
F-UR4-2	**Point-based rewards**	Yes
F-UR4-3	**Sharing**	No
F-UR4-4	**Saving**	No
F-UR4-5	**Tagging**	Yes
F-UR4-6	**Reporting**	Yes

F-R5	Game	Was it achieved?
F-UR5-1	**Challenges**	Yes
F-UR5-2	**Experience**	Yes
F-UR5-3	**Level system**	Yes
F-UR5-4	**Rewards**	Yes
F-UR5-5	**Leader boards** ▪ **Global** ▪ **Local** ▪ **Friends**	Partially

F-R6	Safety	Was it achieved?
F-UR6-1	**Photo detection**	Yes
F-UR6-2	**Blacklisted words and phrases**	No
F-UR6-3	**Anti-cheat**	Partially

F-R7	Administration Tools	Was it achieved?
F-UR7-1	**Channel admin**	No
F-UR7-2.1	**Moderator privileges**	Partially
F-UR7-2.2	**Edit channel posts**	No
F-UR7-2.3	**Delete channel posts**	Partially
F-UR7-3	**Interactions with other moderators**	No

F-R8	Analytics Data	Was it achieved?
F-SR8-1	**Usage data**	No
F-SR8-2	**Report actions**	Yes

Non-Functional

NF-R1	Hardware	Was it achieved?
NF-UR1-1	**Cross-platform support**	Partially
NF-SR1-2	**Standard hardware specifications**	Yes
NF-SR1-3	**Storage**	Yes

NF-R2	Software	Was it achieved?
NF-UR2-1	**Software support**	Yes
NF-SR2-2	**Firmware support**	Yes
NF-SR2-3	**Model-View-Controller**	Yes

NF-R3	Data	Was it achieved?
NF-SR3-1	**Data storage**	Yes
NF-SR3-2	**Backup of data**	Partially
NF-SR3-3	**User details**	Yes

NF-R4	Security	Was it achieved?
NF-SR4-1	**Secure platform**	Yes
NF-SR4-2	**Secure login**	Yes
NF-UR4-2	**User visibility**	Partially
NF-UR4-2	**Password guideline** ▪ **Length** ▪ **Numbers** ▪ **Special characters** ▪ **Case**	Yes

NF-R5	Usability	Was it achieved?
NF-UR5-1.1	**Supported users** ▪ **Photographers** ▪ **Collectors**	Partially
NF-UR5-1.2	**More supported users** ▪ **Academics and hobbyists** ▪ **Game players**	Partially

NF-UR5-2	**User privacy protection**	Partially
NF-UR5-3	**Disability support**	No
NF-UR5-4	**Support diversity**	Yes
NF-UR5-5	**Safe environment**	Yes
NF-UR5-6	**User manual**	Partially

NF-R6	Time	Was it achieved?
NF-SR6-1	**Release date**	Yes

NF-R7	Legislation	Was it achieved?
NF-SR7-1	**Data protection**	Yes
NF-SR7-2	**Legal disclaimers**	No
NF-SR7-3	**Privacy policy**	No

NF-R8	Performance	Was it achieved?
NF-SR8-1	**Responsiveness**	Yes
NF-SR8-2	**Capacity**	Yes

Extra functionalities

This project is different from others because it focused on the main user case required by the client, taking a picture. The camera is the main extra functionality which the development team focused on. It allows the user to take a picture and post it on the platform.

There is also, in addition, an image labelling feature which uses Firebase machine learning to identify objects or animals right after the picture is taken and create labels from them, which are then entered into a dropdown menu below the image. The user can then open this menu and select a label to use as the image's tag. This feature is interesting because it suggests a list of automatically generated labels which can then be linked directly with the challenges using the tag.

Currently the image labelling cannot be integrated with the app's Upload page due to incompatibilities with the web and Firebase ML Vision, however a standalone version has been developed and a video showing it can be viewed on the PixPlace website.

These two functionalities set our application apart from others because it is closer to what the client has requested since the goal was to create some augmented reality.

Systems Robustness

The system is not robust enough for production because of constant rolling back from the original plan. The backend is completely distinct from the plan that included a Kubernetes container cluster, which would have many scalable and flexible set of containers.

The current solution is a JSON based database system that is managed by Firebase interface, in the front-end application, by a Flutter Firebase application. The current solution is limited and fragile because a minor change in the database or front-end entities cause many errors everywhere in application.

The front-end application is working decently but there are a few functionalities, which either included multiple asynchronous calls to the server or more complex interfaces, that are unstable and sometimes even fail if there is also an error in the database.

Usability Summary

The results of our usability study, although lacking in diversity and therefore not entirely conclusive, presented valuable feedback. While the majority believed the application was straightforward and easy to use, it was also clear that there were many aspects that could have used some improvement. Such aspects include (but are not limited to) the Profile page icons which were removed afterwards to prevent future confusion (due to lack of time needed to act upon the feedback), the large sections of whitespace present throughout the application, many small visual bugs that needed some adjustment and the lack of engaging features (which can be explained by many proposed features in the stage 1 mockups being scrapped in favour of working on the features that had already managed to be implemented, also due to the limited time).

Nonetheless, the participants also commented that despite the issues mentioned, some of the application's pages were visually appealing, such as the login/registration screen's animation and the appearance of the Homepage. This suggests that, for the application's future, the development team could implement more animations like it, as well as make the aesthetic of the application more consistent across all pages.

Finally, while many of the functional and non-functional requirements could not be achieved, the PixPlace development team managed to produce a functional application that implemented many of the required basic features, as well as a couple of extras that make the system particularly interesting. See above for the functional and non-functional requirements tables.

Appendices

Work Done

Name	Work Done (all stages)
Ghazi Yusaf	Organised most meetings, created tasks in ClickUp and managed Sprints, instructed all the other members through installing Flutter and Android Studio, managed the GitHub repo, merged other members work together from their branches, created entirety of the login and sign-up page including front and back end, connected login page with Firebase to allow for a fully functional user creation system. Created most the diagrams, added the requirements breakdown and

	wrote the deployment section in the Progress Report. Wrote the abbreviations and changed system to MVP.
Jose Fernandes	Stage 1: -Helped Ghazi with requirements -Done Project decision and plan section -Done introduction for usability, created graphics for usability Stage 2: -Front-end developer in stage 2 -Worked on backend, which had to rolled back -Did general Overview section, ghazi helped -Did front-end overview report section -did backend overview report section -Created ER diagram for report Stage 3: -Frint end developer -done project evaluation section on report, tania did usability summary -Did introductory section in Usability section
Aaron Molesbury	Front-end developer in stage 2, created challenges and feed. Helped develop other pages. created company website, helped to write the Progress Report.
Tania Henderson	Stage 1: - Risks + Risks Analysis document Project Costing document UML diagrams + specifications Helped with pre-questionnaire, post-questionnaire and testing protocol questions Stage 2: - Contributed towards Progress Report (see Changelogs) Assisted with website Tester for application Stage 3: - Contributed towards Final Document (see Changelogs) Image labelling Created Testing Protocol document Tester for application
Magnus Mackay	Stage 1: Created mockups Stage 2: Front-end development of search functionality Stage 3:

	Expanded functionality of search Contributed to report
Qianqian Fan	Minor changes to report. Made video for demo System's deployment section

Changelogs

Revisions

Date	Author(s)	Changes
09/02/2021	Jose Fernandes	(Project Evaluation) document created, all structure set up
04/03/2021	Jose Fernandes	(Project Evaluation) organisation and collaboration sections done
27/03/2021	Jose Fernandes	(Project Evaluation) done online tools, language tools added requirements table
31/03/2021	Jose Fernandes	(Project Evaluation) Extra functionalities, systems robustness, scheduling, implementation approach done
31/03/2021	Tania Henderson	(Project Evaluation) Extended information on image labelling feature; Usability Summary; created Work Done table