
Group 07: Final Presentation

P.A.L (*Peace and Love*): A personal security mobile application

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Content

Part A:

1. Our Prototype
 - a. Features
 - b. System Architecture & Design
2. Testing
 - a. Planning
 - b. Conducting the tests
 - c. Outcomes
3. Team Performance
 - a. Distributing tasks & responsibilities
 - b. Execution of the work plan
4. Major Challenges
 - a. Completing the project
 - b. Features to be implemented
 - c. Unexpected challenges
 - d. Remote Collaboration
5. Demo

Part B (4PM, 7th of May 2020):

1. Q&A Session on Microsoft Teams

Our Prototype

Features

Our Prototype

Features

Ensuring accessibility and ease-of-use

Log-in & Sign-up

Application Settings

Privacy Policy

“Report a problem”

Help screen

My Account screen

Minimising the chance of an attack

Suggested Routes

Route Deviation

Crime Data Heatmap

User Advice

Trusted Contacts

Mitigating the impact of an attack

Accelerometer

Dead Man's Switch

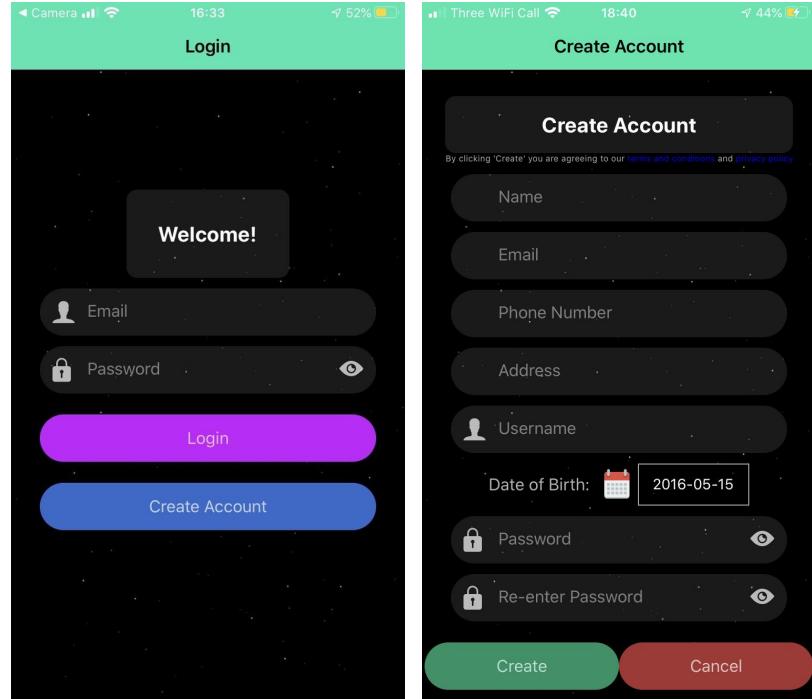
Countdown screen

Accessibility Features



Login and create account

- Email and password required for login
- When creating account, user must also provide:
 - Name
 - Username
 - Date of birth
 - Address
 - Phone number
 - Five digit passcode
 - Trusted contact



Accessibility Features

How this works...

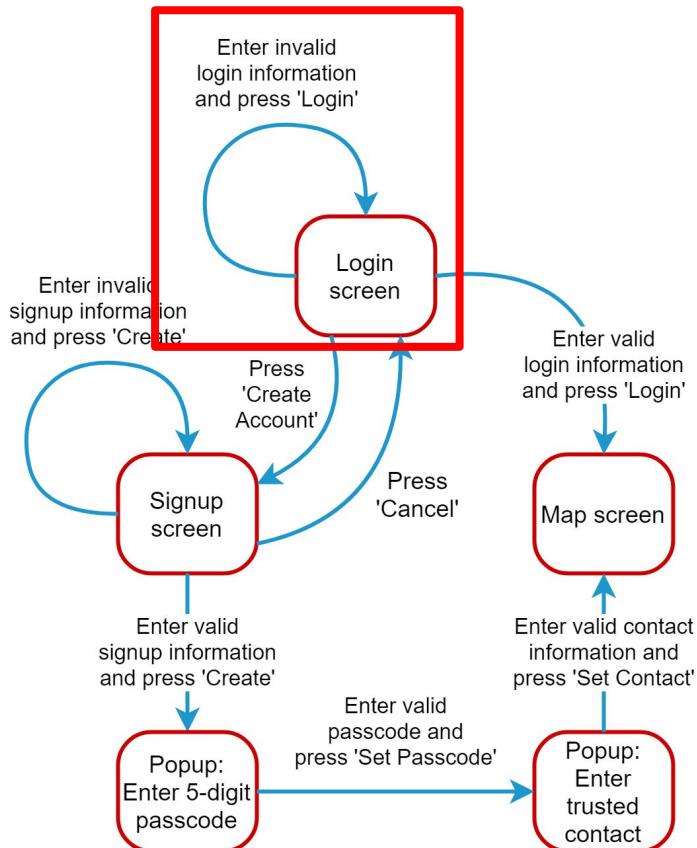


- Uses Firebase (Google's user management system)
- Easily integrated with React Native via pre-existing node packages
- Different methods of authentication available
- Integrates easily with Firebase Realtime Database

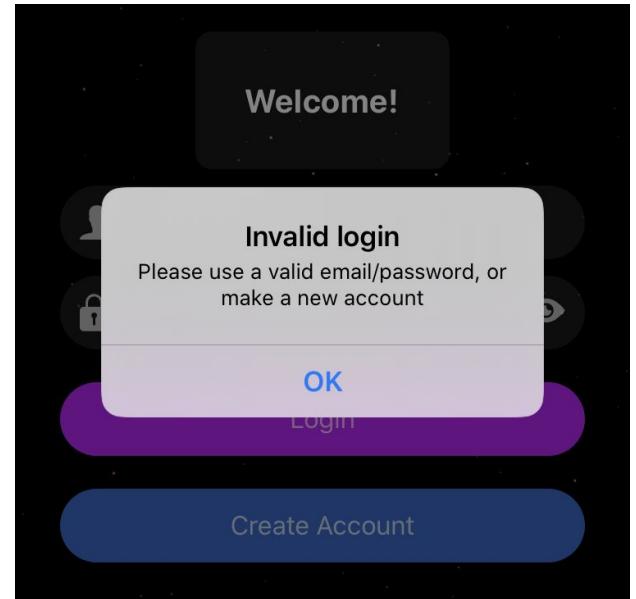
User Management				
Identifier	Providers	Created	Signed In	User UID ↑
marleytest2@test.com	✉️	3 May 2020	3 May 2020	63Bq6OaBcqYOAxATvE4MKsbqtIA2
marleysudbury@gmail.com	✉️	7 Apr 2020	7 Apr 2020	AHtov7CbnYTD4qoHThHSGlo3Dxi2

User Data
9OE9sVMekwNGg9T8MHTA6oFLWdo2
Address: "23 Greg St"
Name: "Greg"
PhoneNo: "07772331199"
Username: "TheGreg"
CSay5zeuqZOXJebv0Z8QglRY6Y2
Address: "Jejekd"
Name: "Bansskajzj"
PhoneNo: "84646464411"
Username: "Jsjdjkd"

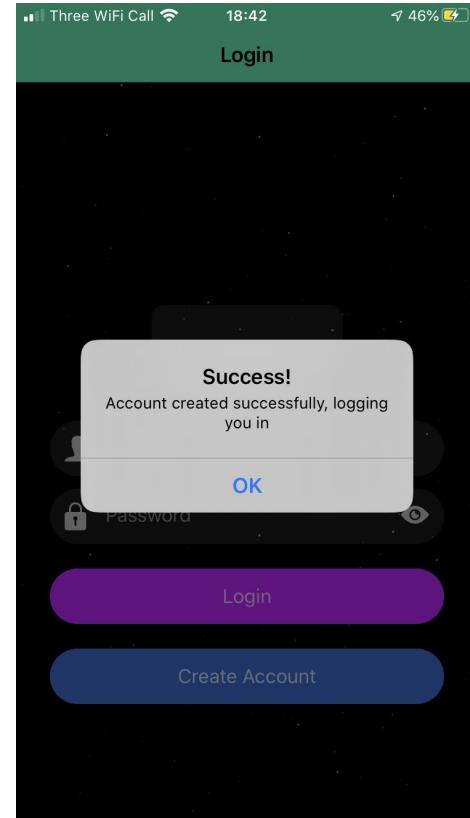
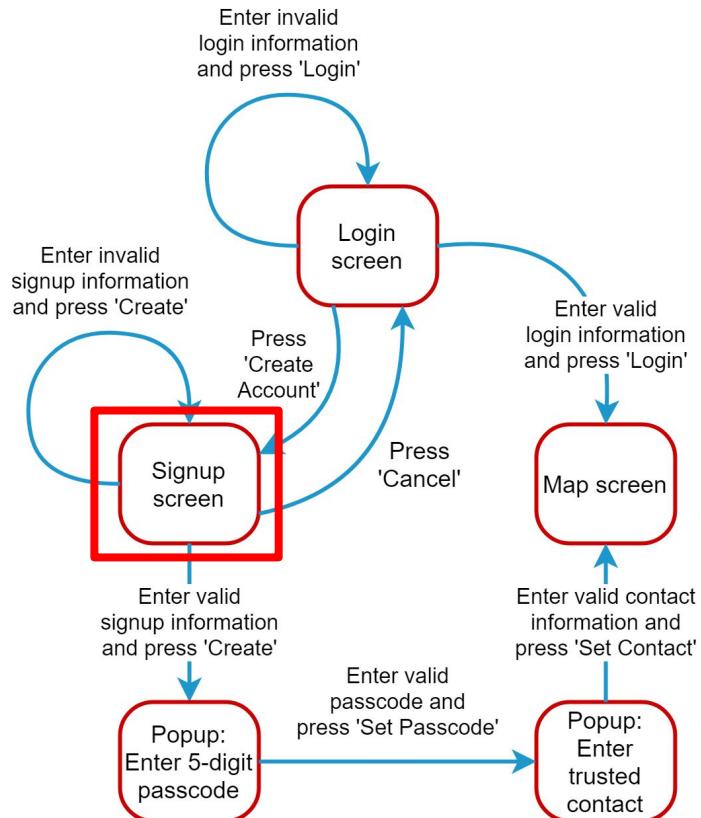
Accessibility Features



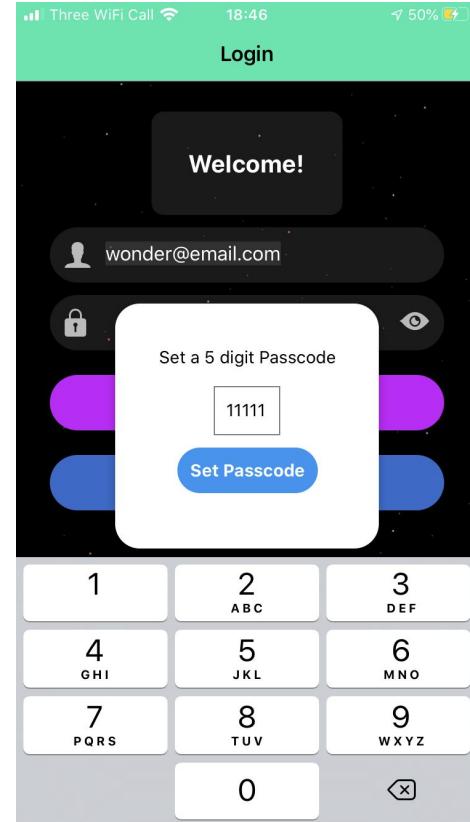
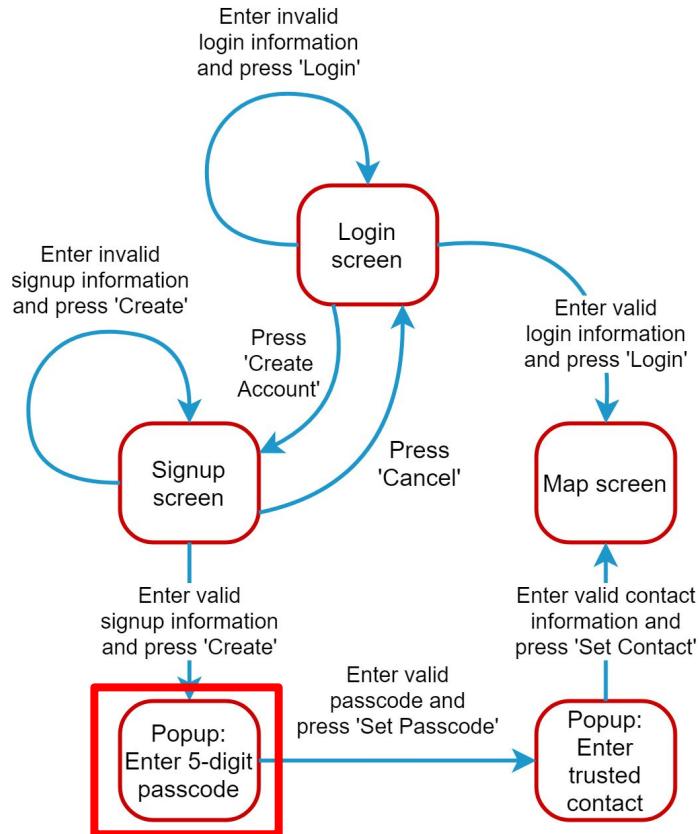
```
Database Initialized
Starting login
n0PStES
auth/invalid-email The email address is badly formatted.
```



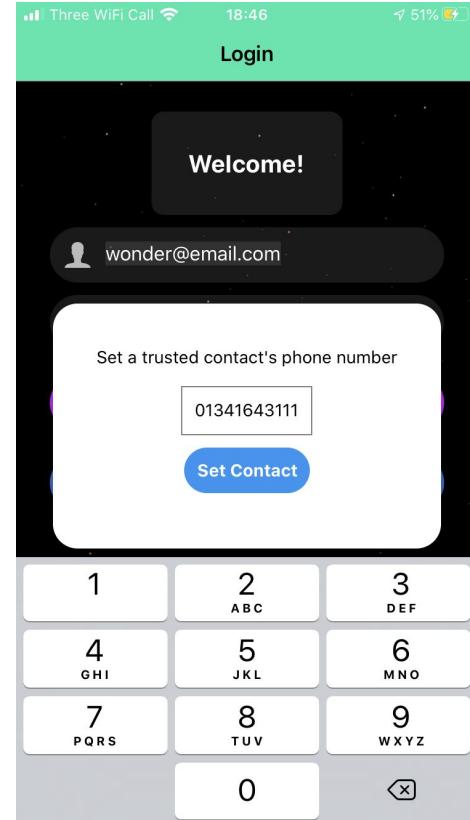
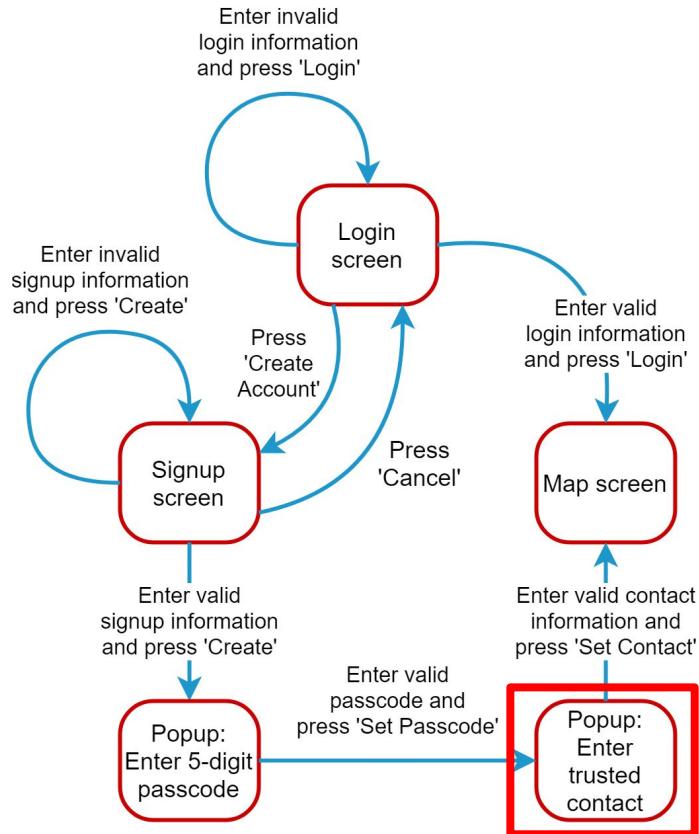
Accessibility Features



Accessibility Features



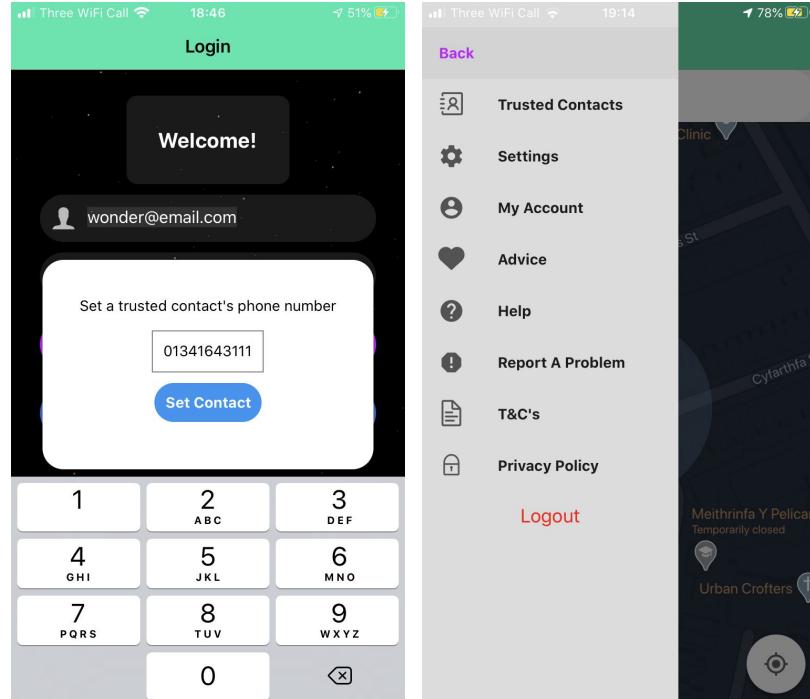
Accessibility Features



Accessibility Features

Trusted contact

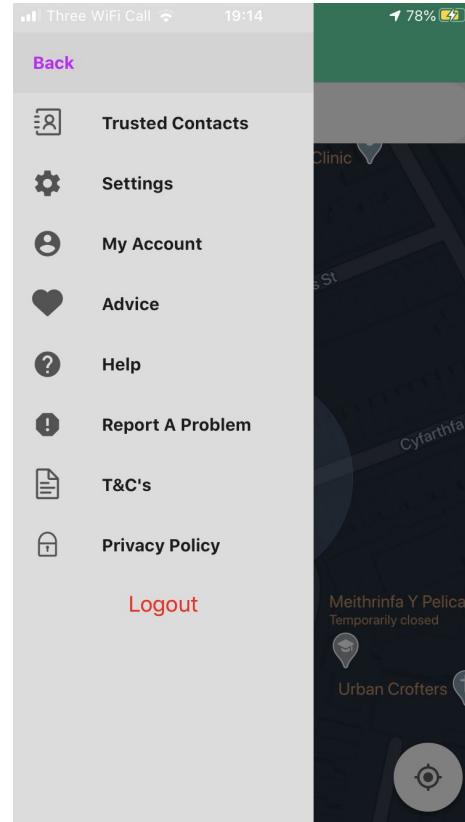
- Phone number that is prompted for calling after countdown ends
- Set after sign up
- Can be changed from the trusted contact page
- Stored locally on the phone



Accessibility Features

My account

- Edit the details provided during sign up
- The same validation
- Immediately synchronised with the database
- Email and password cannot currently be changed

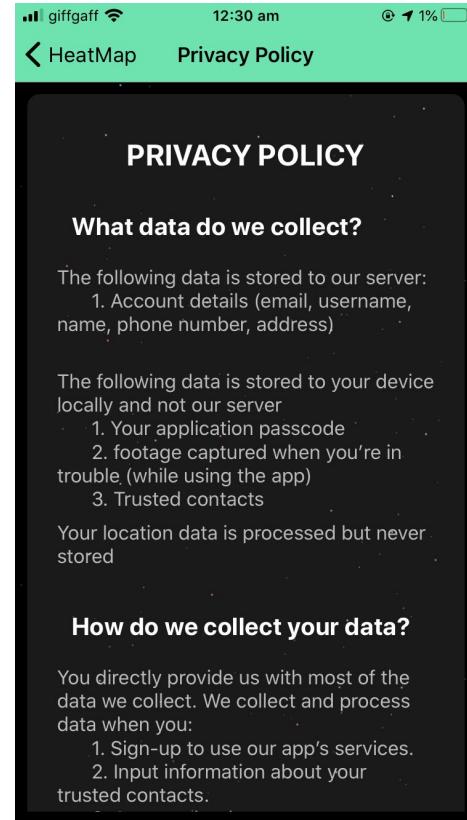


Accessibility Features

Accessible Privacy Policy

According to the GDPR, a privacy policy must be:

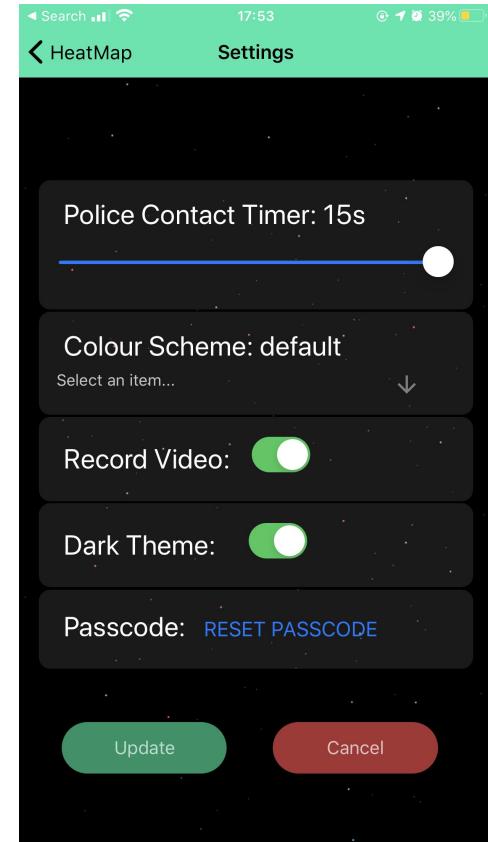
- In a concise, transparent, intelligible, and easily accessible form
- Written in clear and plain language, particularly for any information addressed specifically to a child
- Delivered in a timely manner
- Provided free of charge



Accessibility Features

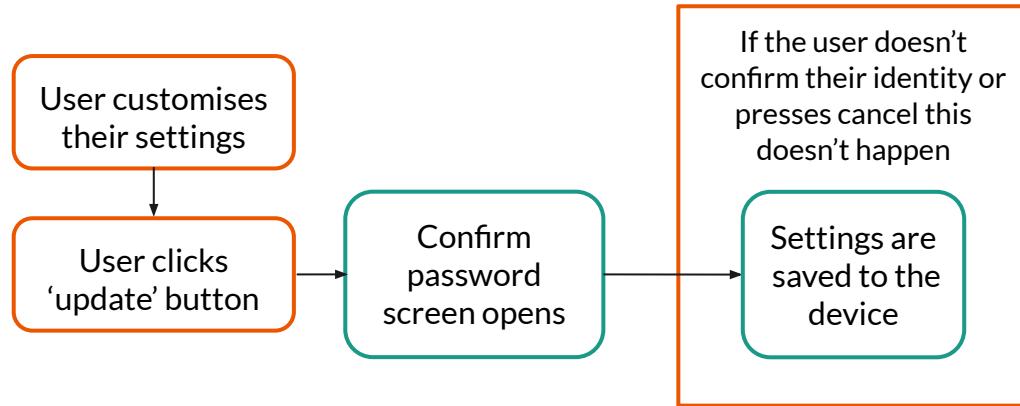
Application Settings

To improve the user's experience, we have included an array of different settings the user can customise to enhance their experience with the app.



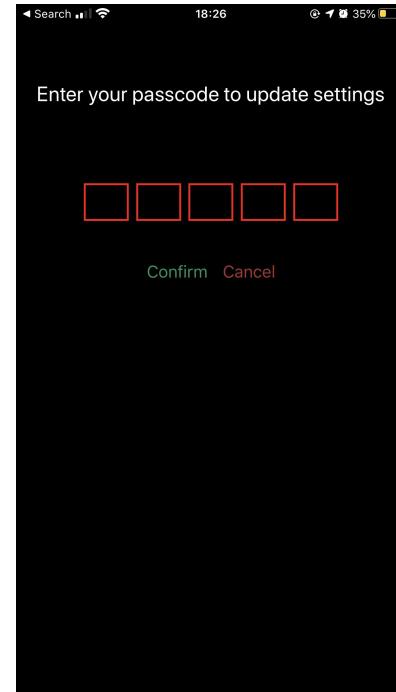
Accessibility Features

How this works...



= User Action

= Automated Action



Minimising the chance of an attack

User Advice



Inform someone prior to leaving



Carry a personal safety alarm



Check in with someone frequently



Carry pepper spray



Avoid walking alone



Trust your instincts

The screenshot shows a mobile application interface. At the top, there is a navigation bar with icons for signal strength, network provider 'giffgaff', battery level at 5%, and the time '12:11 am'. Below the navigation bar, the title 'Advice' is displayed above a back arrow and the word 'HeatMap'. The main content area is titled 'Advice' and contains the following text:

Our app uses local crime data in order to recommend the routes we believe are the safest for our users to take to reach their destination. As well as this, we have several features in place such as the "Deadman's Switch" in order to help reinforce that our users are safe. However, as much as we would like to ensure your safety - we cannot guarantee that you will be. We have decided it is appropriate to provide you with further information and resources to increase your safety:

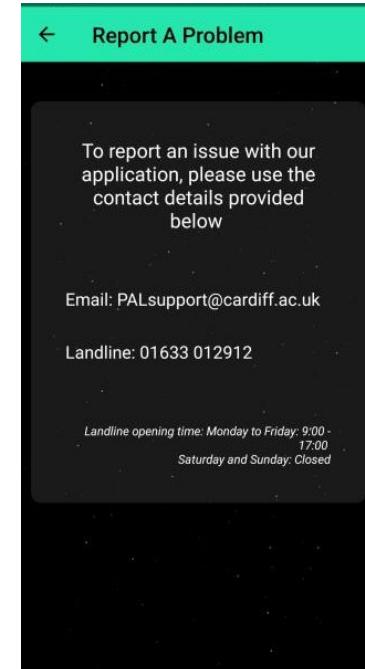
1. Inform someone of your whereabouts prior to leaving.

- Ensure that a couple of trusted friends or family members are aware of your plans for the night before you leave. Try to give them specifics, like clubs/restaurants you plan to visit, and the name(s) of the person(s) you're going with.

Accessibility Features

Report a problem Screen

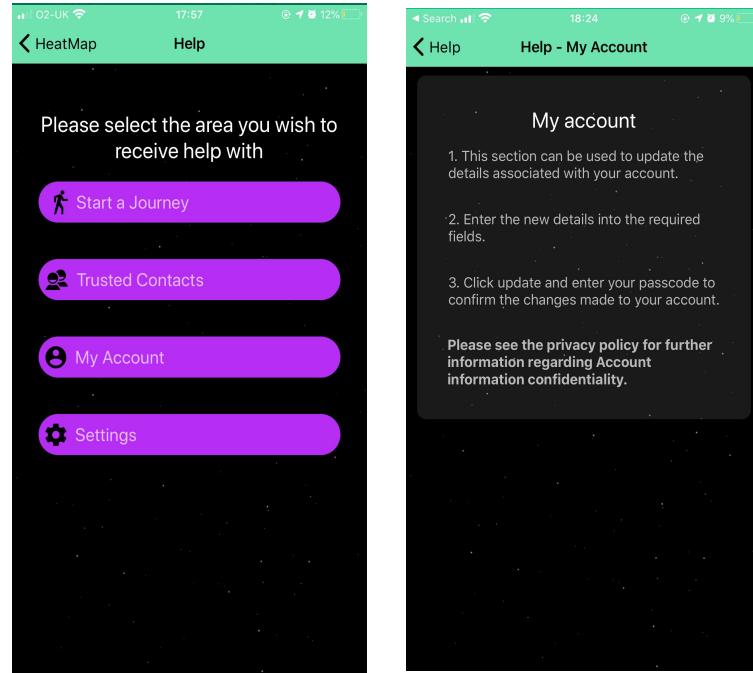
To improve the app, we have created the report a problem. This will allow us to react quickly to any problems that arise as well as offer users a way to give feedback



Accessibility Features

Help Page

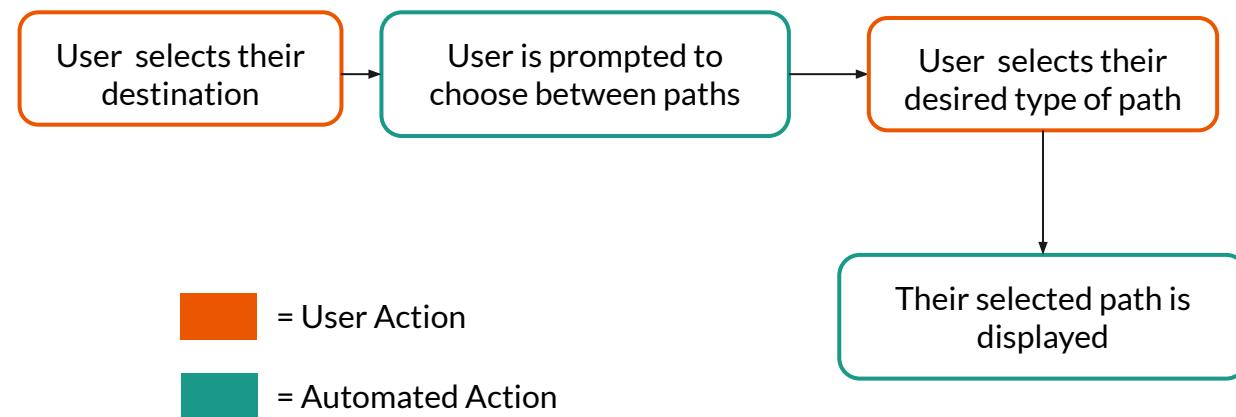
This menu has step by step tutorials, to read them the user selects them from the screen and is take to a screen relating to it.



Minimising the chance of an attack

Suggested Routes

We suggest 3 routes for the user to reach their destination (safest, shortest and combined)



Minimising the chance of an attack

Suggested Routes

How this works...

Data: A graph G with edge weight $\ell()$ and $r()$

Result: The set S of three non-dominated bi-objective paths

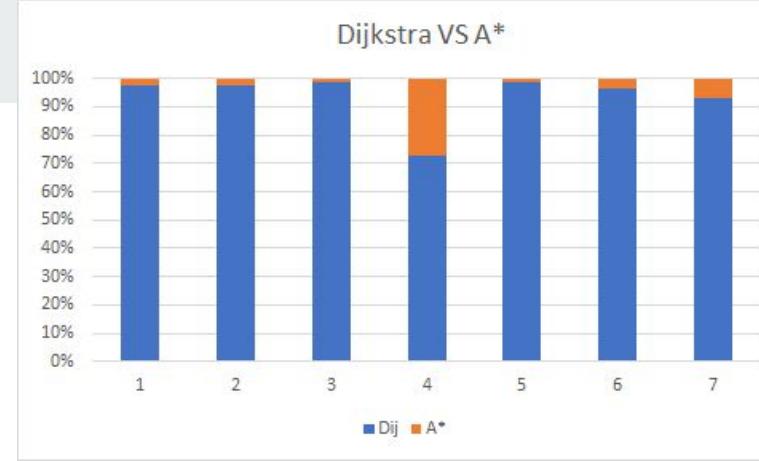
```
 $P_\ell^* \leftarrow \text{Dijkstra}(G, \ell());$  Shortest Route  
 $P_r^* \leftarrow \text{Dijkstra}(G, r());$  Safest Route  
 $\mathcal{H} \leftarrow \{P_\ell^*, P_r^*\};$   
sum-rec( $P_\ell^*, P_r^*, \mathcal{H}$ );  
return  $\mathcal{H}$ ;
```

routine sum-rec(P_u, P_l, \mathcal{H}):

```
 $\lambda \leftarrow (r(P_u) - r(P_l)) / (\ell(P_u) - \ell(P_l));$   
 $\forall e \in E : f(e) = r(e) - \lambda \ell(e);$   
 $P_i \leftarrow \text{Dijkstra}(G, f());$  Combined Route  
if  $P_i \neq P_u$  and  $P_i \neq P_l$  then  
  |  $\mathcal{H} \leftarrow \mathcal{H} \cup \{P_i\};$   
end  
end
```

Algorithm Improvement

- From Dijkstra to A*
- Performance improvement in terms of the number of nodes traversed
- Evaluating the loss of using non-admissible heuristic function for trade-off path
- Memory consumption tuning



Minimising the chance of an attack

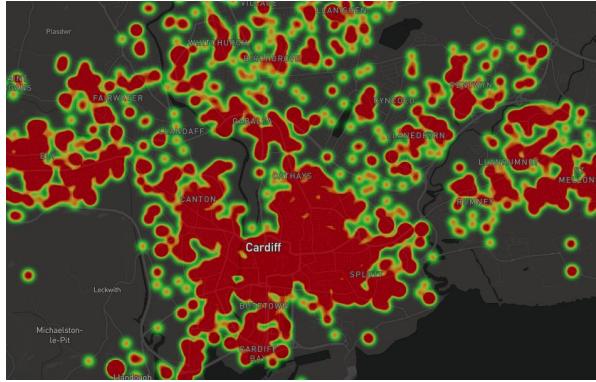
Route Deviation

- Detect deviation based on the current device's location
- Raise countdown if the distance between current location and the path > threshold

Minimising the chance of an attack

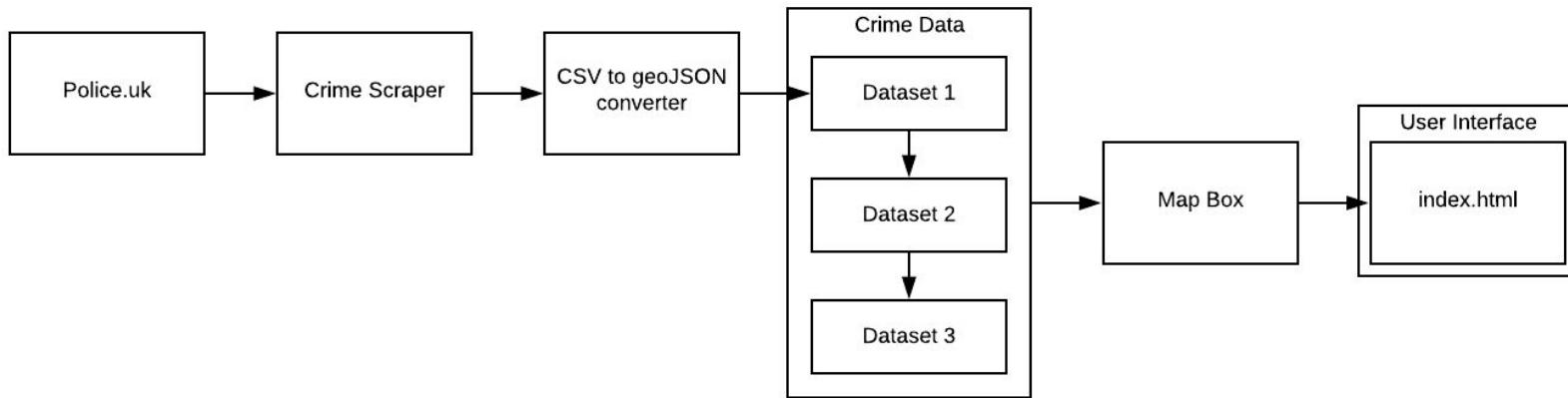
Crime Data Heatmap

- Improving user safety goes beyond implementing purely navigational features.
- We've made a conscious decision to include features which focus on helping users make informed decisions - such as a heatmap



Minimising the chance of an attack

How this works...



Mitigating the impact of an attack

Jeopardy Detection

Accelerometer

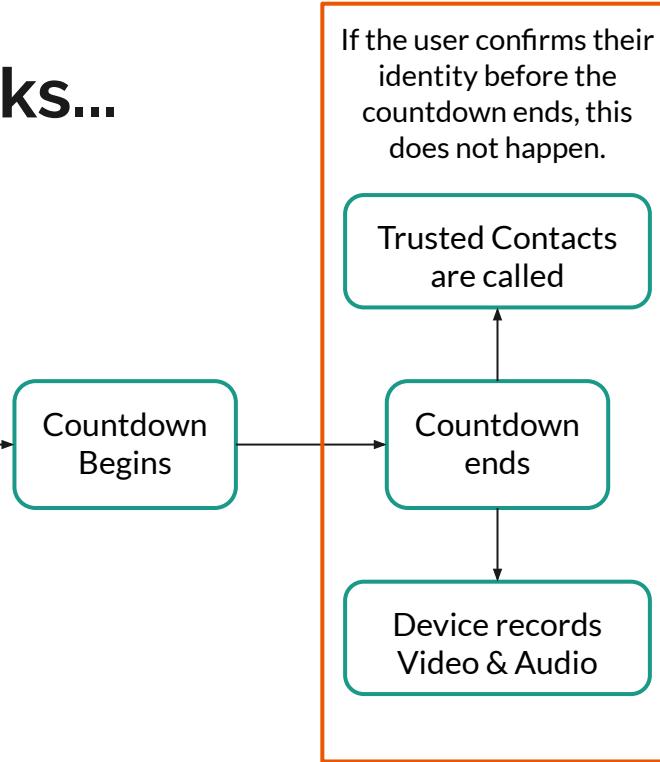
Whilst on a journey, we constantly monitor the device's accelerometer sensors for any changes that could be a potential attack.

Mitigating the impact of an attack

Accelerometer

How this works...

```
if changeInAcceleration then  
    calculateMagnitude();  
    if magnitude > threshold then  
        | respond();  
    end  
end
```



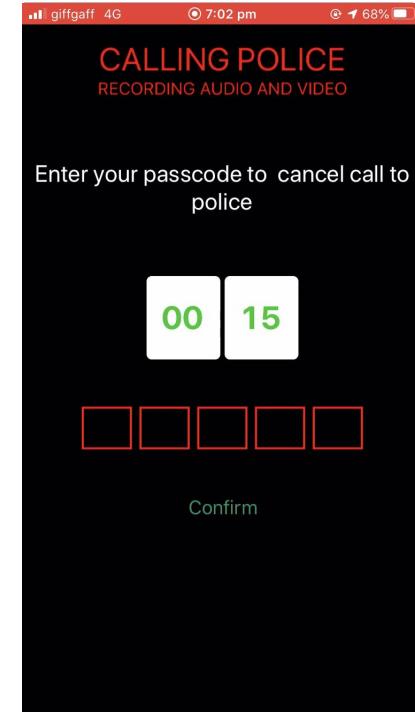
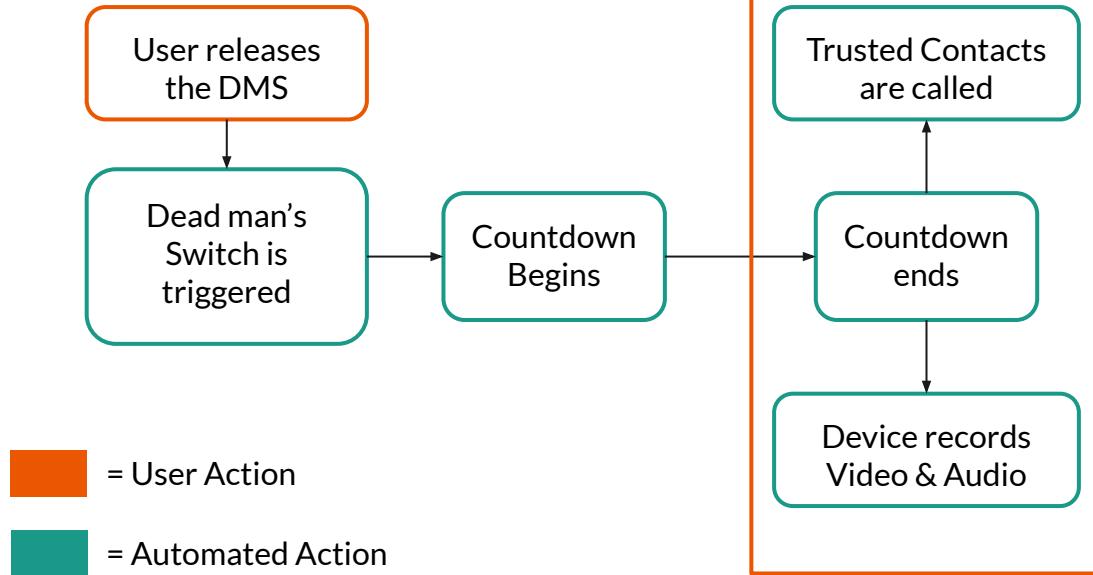
= User Action

= Automated Action

Mitigating the impact of an attack

Dead Man's Switch

How this works...



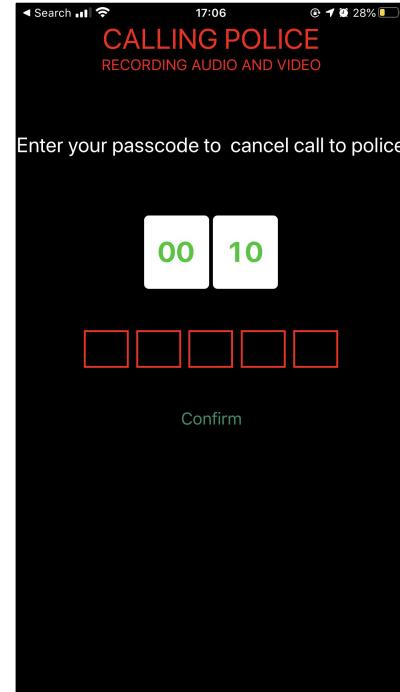
Mitigating the impact of an attack

Countdown Screen

If the user diverges from the path, an attack is detected via the accelerometer, or the user releases the dead man's switch we lock them into a countdown.

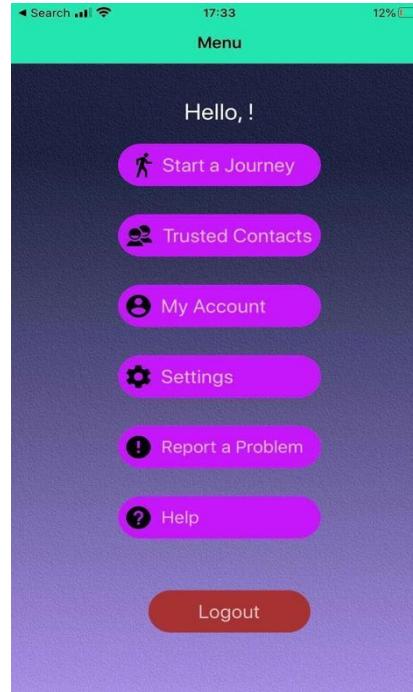
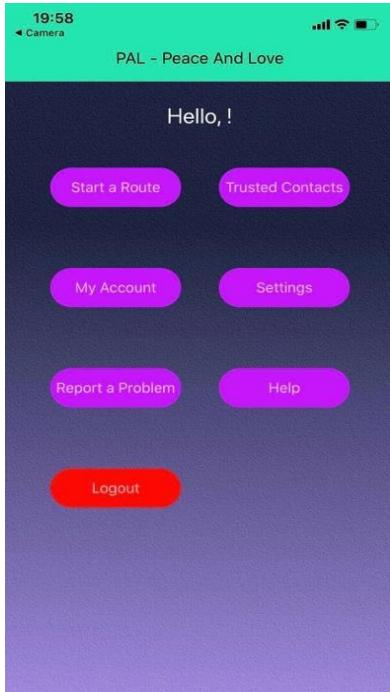
Features:

- Record audio & video in background
- Prompt user to call trusted contact at end of countdown
- Can only be exited once the passcode has been entered



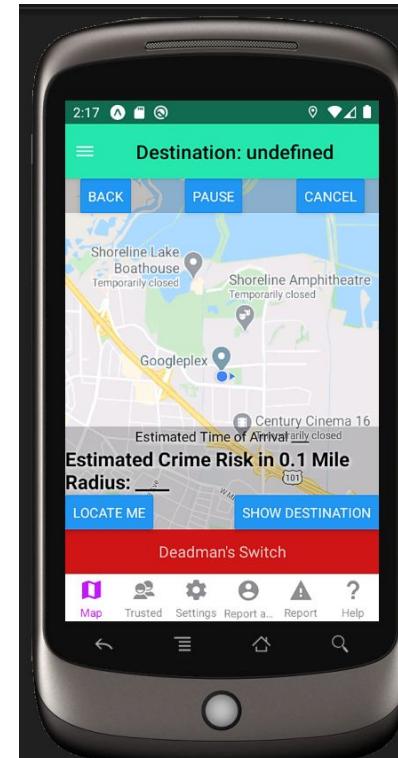
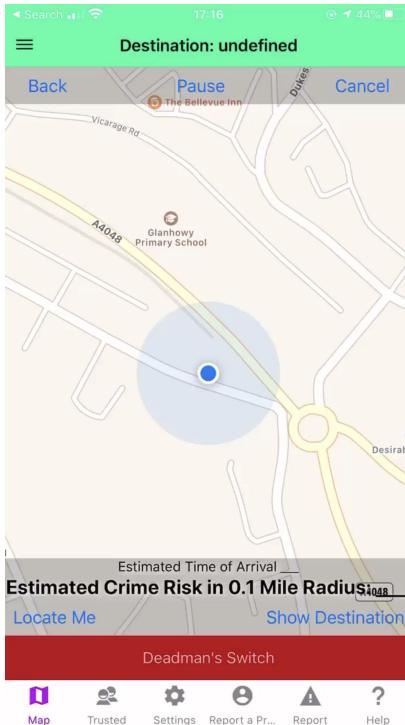
Response to Client Meeting

Changes to Menu Screen



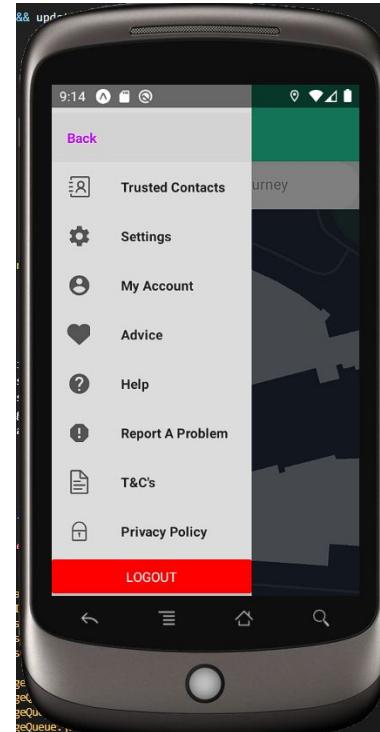
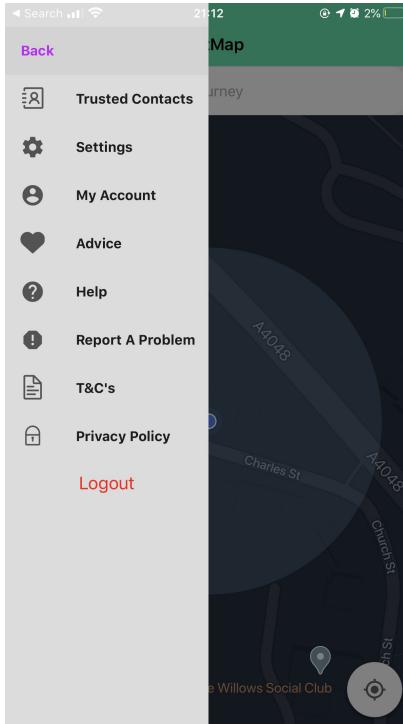
Response to Client Meeting

Changes to Menu Screen



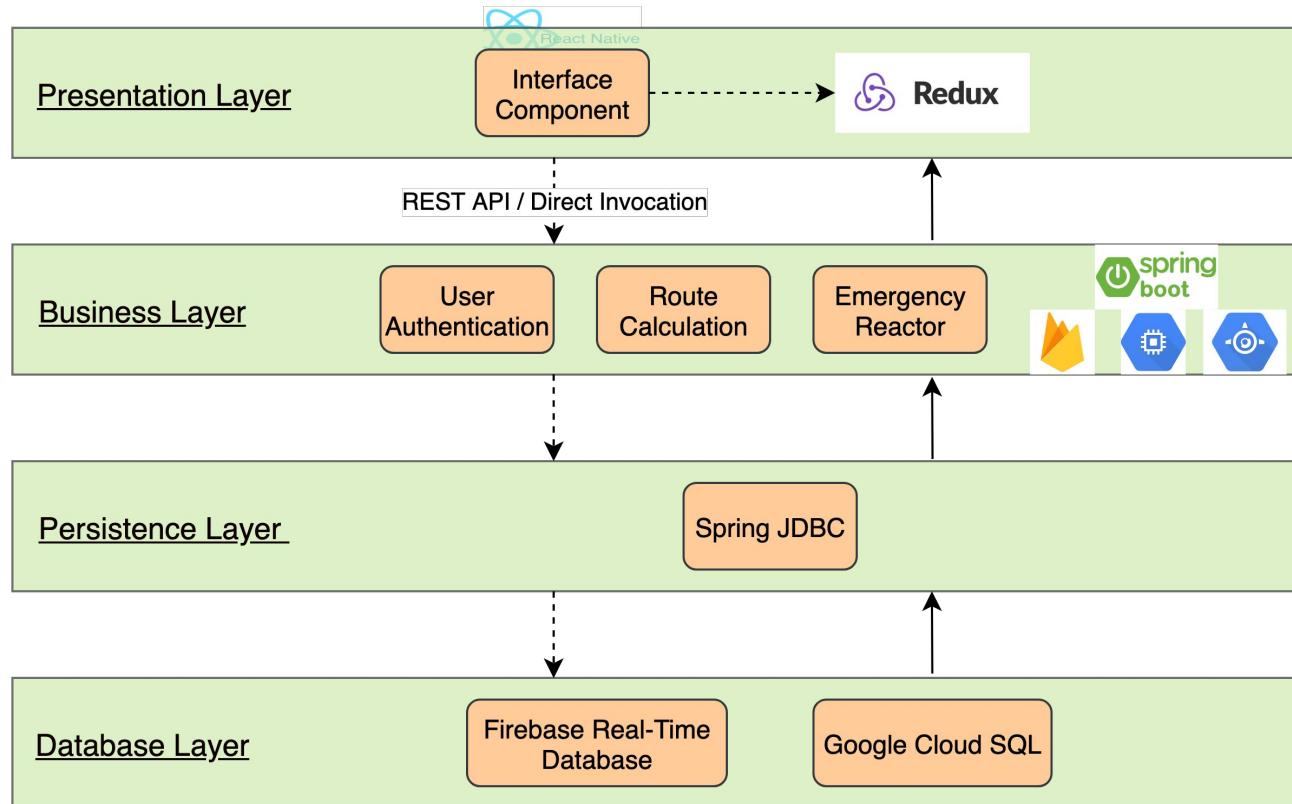
Response to Client Meeting

Changes to Menu Screen



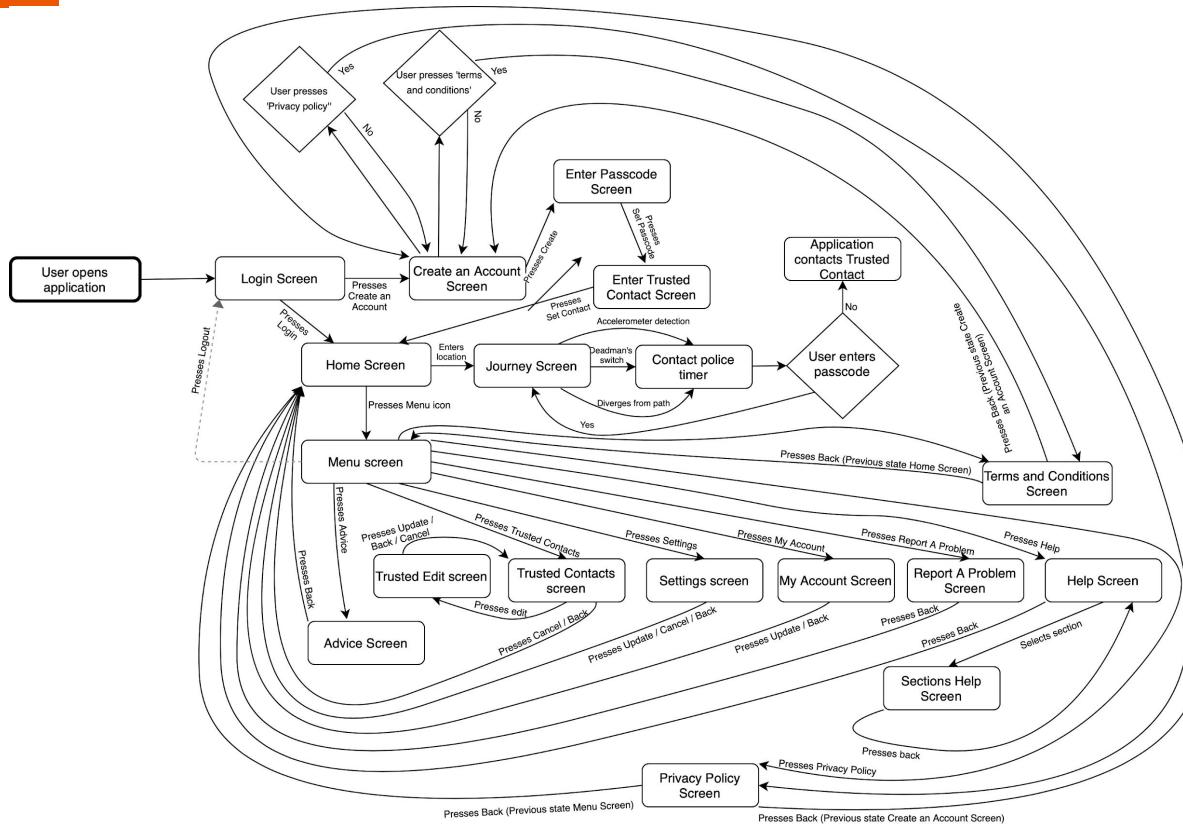
System Architecture & Design

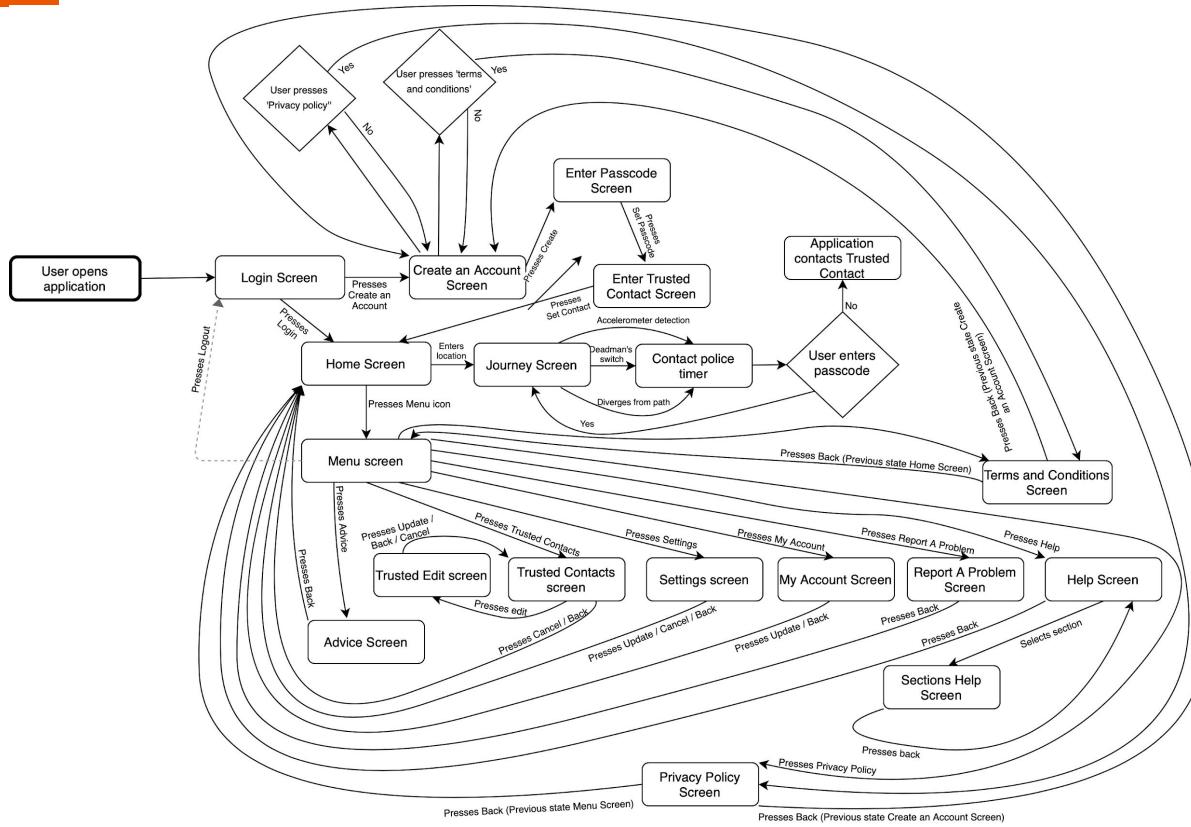
Overall Architecture



System Architecture and Design

App State Transition Network





Testing



Testing the server-side code

Automatic Testing

- Unit & Integration & System testing automation
- JUnit & Spring.MockMVC used
- Line coverage 95.2%
- Continuous testing
- Future CI/CD

Testing the application

Test Cases

1. Create Account (5/6 passed)
2. Login (?:/3 passed)
3. Start a journey (3/4 passed)
4. Finish journey (?:/1 passed)
5. Raise alarm by diverging from route (?:/3 passed)
6. Pause and resume journey (?:/3 passed)
7. Cancel journey (0/2 passed)

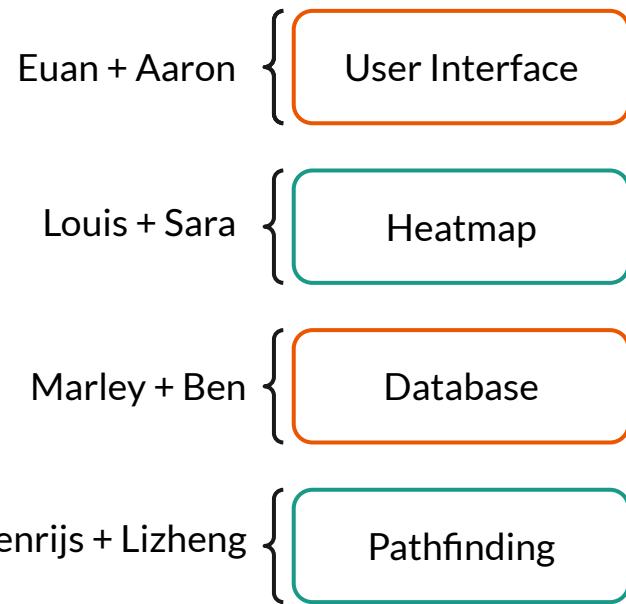
Other forms of testing

- Unit testing
 - Modular
 - Can be automated
- User testing
 - Very valuable feedback
 - Time intensive

Team Performance

Distributing Tasks & Responsibilities

Development Sub-teams

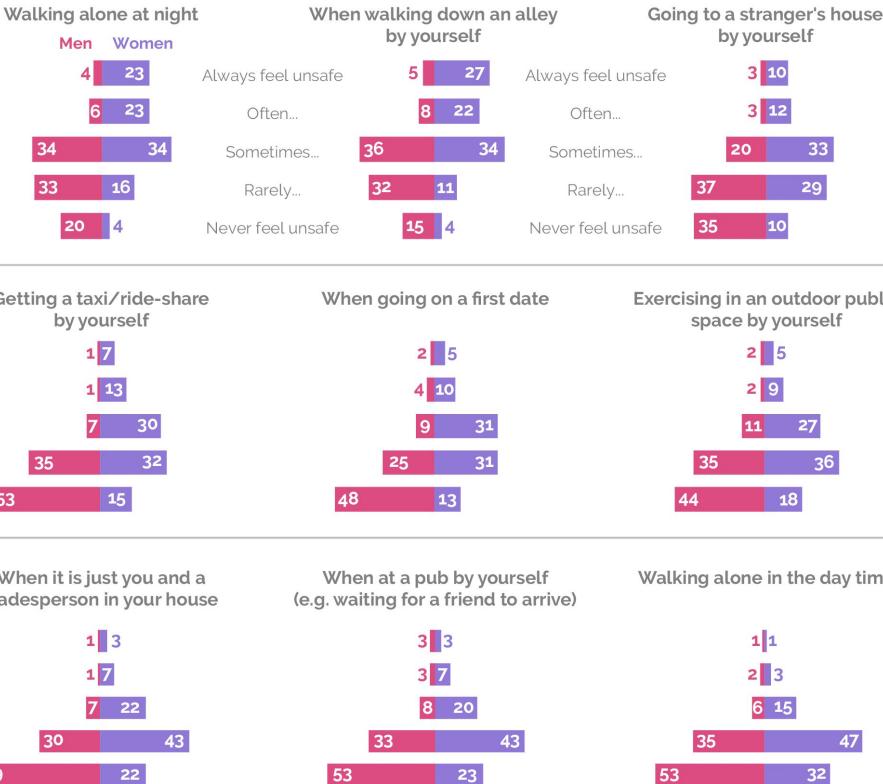


Major Challenges

Features to be implemented

Everyday Britain feels less safe to women

When you are in each of the following situations, how often, if at all, would you say you feel unsafe? % of those who have ever been in these situations, don't know/s not shown



Grouping Feature

Preface

Difficulties

Potential implementation

Full integration of crime data

- Not possible due to time constraints
- Automation systems were not a top priority for developing a prototype
- We wanted to focus on developing fully-working features rather than future-proofing systems
- If deployment were to happen, this would be completed as soon as possible
- It would significantly reduce the maintenance required for the application

Alternative Colour schemes

We aimed to include several colour schemes:

- Dark Theme
- Light Theme
- Multiple colour blind options
- High contrast mode



Further accommodating for disabilities

Crucial question: Can the app be expanded to show wheelchair-accessible routes?

1. Functionality does exist in Google Maps
2. As of March 2018, wheelchair-accessible option in six major cities
3. Ultimately, it infeasible to implement:
 - a. Impossible to vouch for accessibility of route at time of use
 - b. Could put user at risk, given the usecase of the app

Remote Collaboration

Demo