Software Design Document

Mobile Navigation Control for Planetary Web Portals (MNCPWP)

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1. INTRODUCTION

1.1. Purpose

This purpose of this document is to outline in detail the software architecture and system design of Mobile Navigation Control for Planetary Web Portals (MNCPWP). This document will provide the data flow diagram of MNCPWP to give a better understanding of how information will be processed with regards to the application. In addition, images will be provided that show a comparison of each view of the iOS and web application to give a better idea of the system's user interface design.

1.2. Scope

This document provides the architecture and design of MNCPWP. It will show how the application's functionalities work by explaining each of the system's components.

1.3. Overview

This document will cover the basic functionality of the application, its context and its design. It will cover how data flows within and out of the system. The system architecture will cover each of the components of the application and its relation to system functionality.

2. SYSTEM OVERVIEW

This project developed a mobile remote controller for JPL's Mars Trek and Vesta Trek. Implemented as both an iOS native app and a Web app, users of all devices have the ability to take control. Core features include various control modes, guest queuing, and full integration with Mars Trek. For control modes, users can choose to navigate using joysticks, the accelerometer, or swipes and pinches. Guest queueing is available for situations when users need to take turns such as at a museum or special event. Lastly, the controller is fully integrated with Mars Trek to allow users full exploration of the planet.

3. DESIGN CONSIDERATIONS

3.1. Goals

- Ease of usability is top priority for the development process.
- The application will have buttons with labels that explain the functionality of that button
- The application will have a side navigation menu with functions to go to a specific page.

3.2. Development Methods

This project was initially conducted using the waterfall model method. As time progressed we switched to agile development due to requirements being changed on a weekly basis.

4. ARCHITECTURAL STRATEGIES

4.1. Use of Certain Products

MNCPWP is being developed on the iOS platform for mobile devices using Xcode . MNCPWP is also being developed as a Web application for mobile devices using the Eclipse IDE.

4.2. Reuse of Existing Software Components

MNCPWP uses a prototype of JPL's Mars Trek to instantiate a Mars object on a webpage.

4.3. Future Plans for Extending/Enhancing Software

Future plans for MNCPWP are including but not limited to:

- Improving the cosmetic look of MNCPWP for a more pleasurable viewing experience.
- Implementing a queueing system for users that want to control a hyperwall.
- Allowing the user to capture a screenshot of what is shown on the browser.

- Creating an Android application that has the same functionality and look as the iOS and Web Application.

4.4. Error Detection and Recovery

HTTP is used as a communication protocol which has built in packet error handling.

On the server side, a database is used to keep track of all open sessions while providing recovery options.

4.5. External Databases

No external databases will be utilized.

4.6. Distributed Data or Control Over a Network

No use of distributed data is necessary.

4.7. Generalized Approaches to Control

Approaches to control shall be achieved when the user successfully inputs or snapshots a correct code during verification.

4.8. Concurrency and Synchronization

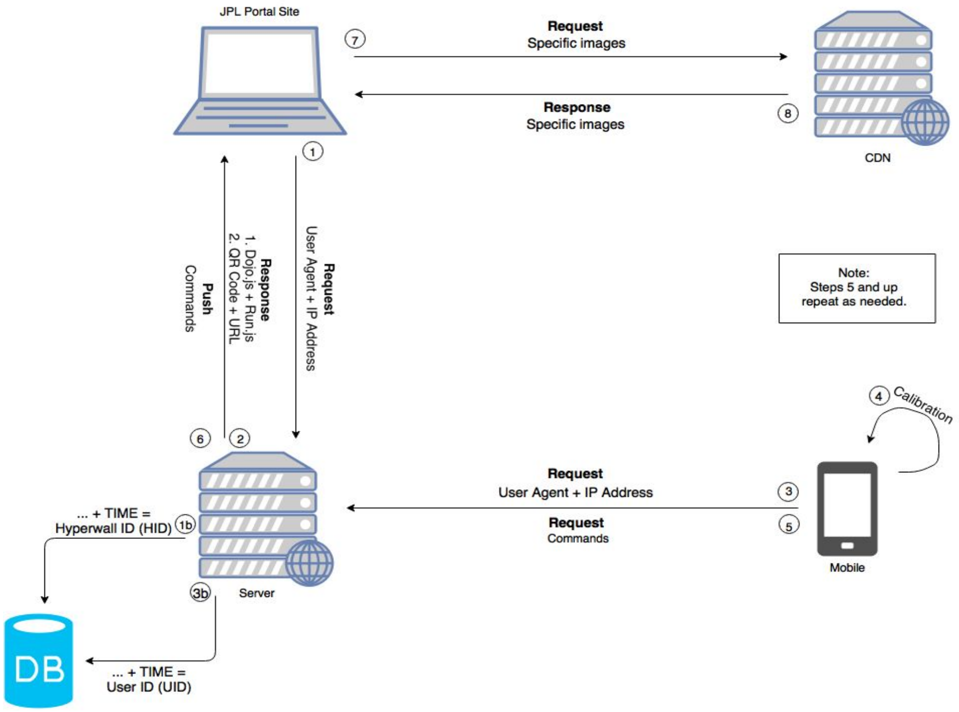
Concurrency and Synchronization is handled natively by Apache Tomcat.

4.9. Communication Mechanisms

Communications in MNCPWP will be done over a mobile network or a Wi-Fi connection.

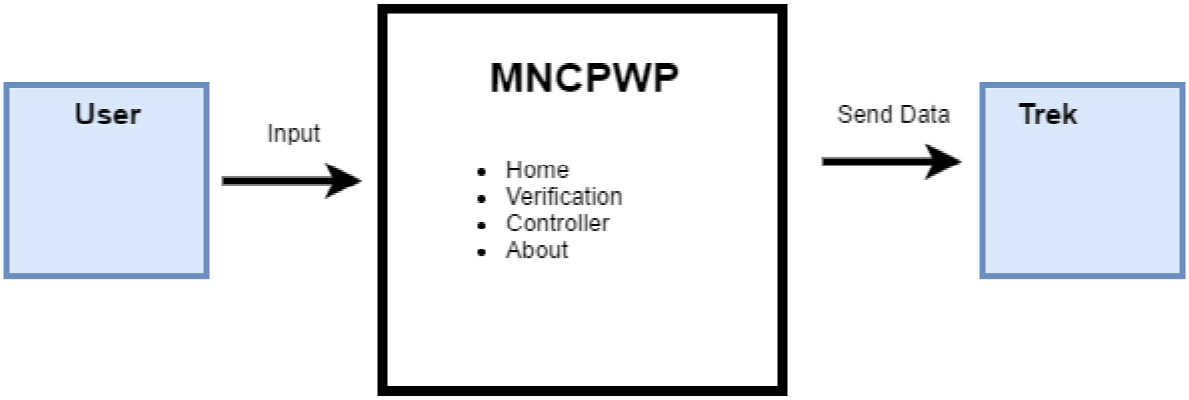
5. SYSTEM ARCHITECTURE

5.1. Architectural Design

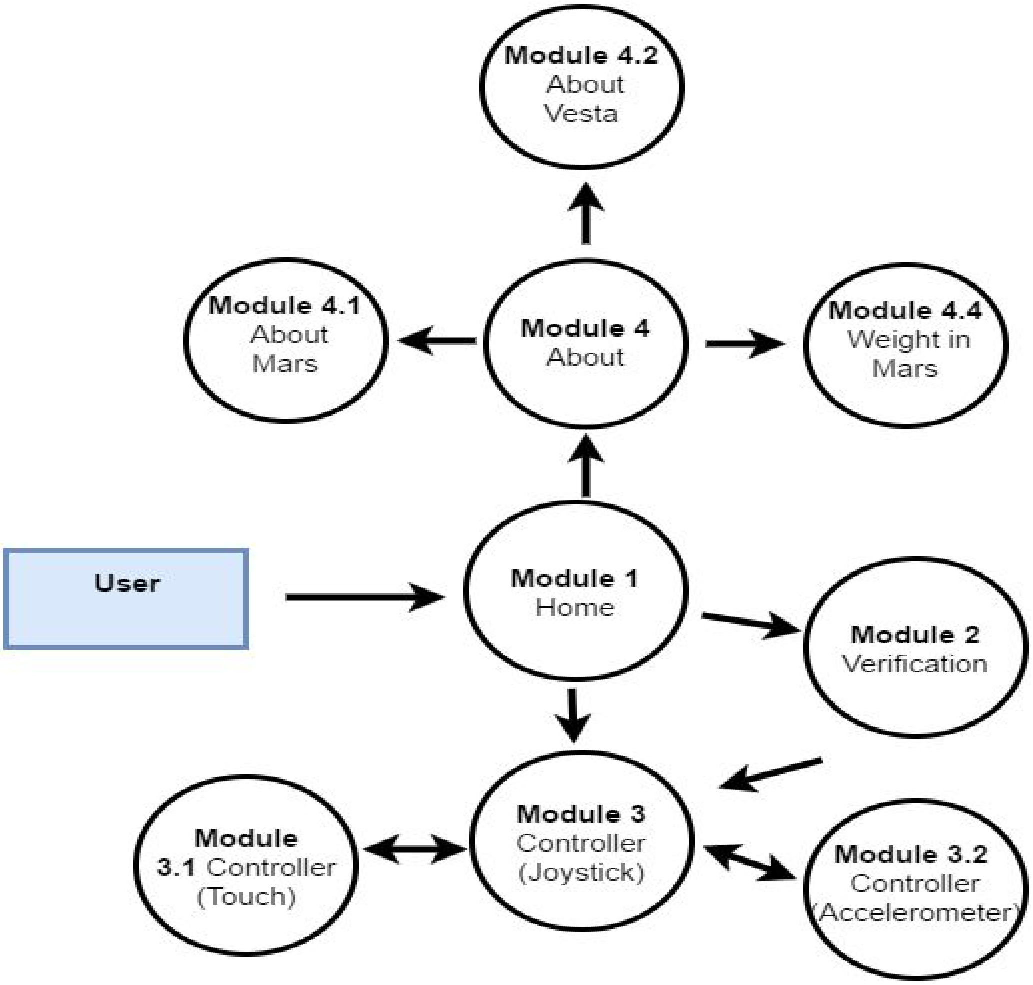


MNCPWP - System Diagram

5.2. Decomposition Description



Context Diagram (Level 0 DFD)



Context Diagram (Level 1 DFD)

6. DETAILED SYSTEM DESIGN

Module 1 — Home

Serves as the main page of the application.

Module 2 — Verification

Handles the passcode (Web App) or QR code (iOS App) inputted by the user. Redirects to controller module if verification is successful.

Module 3 — Controller Joystick (DEFAULT)

Displays two joysticks for Trek control. This control mode will only work with a landscape orientation.

Module 3.1 — Controller Touch

Handles touch inputs such as swipe, pinch, and tap.

Module 3.2 — Controller Accelerometer

Determines proper acceleration of the mobile device.

Module 4 — About

The basic page displaying other features of the application.

Module 4.1 — About Mars

Displays information about Mars.

Module 4.2 — About Vesta

Displays information about Vesta.

Module 4.3 — Weight in Mars

Handles converting user weight on Earth into weight on Mars. *Weight on earth (pounds) value will be converted to weight on Mars (pounds).*

7. GRAPHICAL USER INTERFACE DESIGN

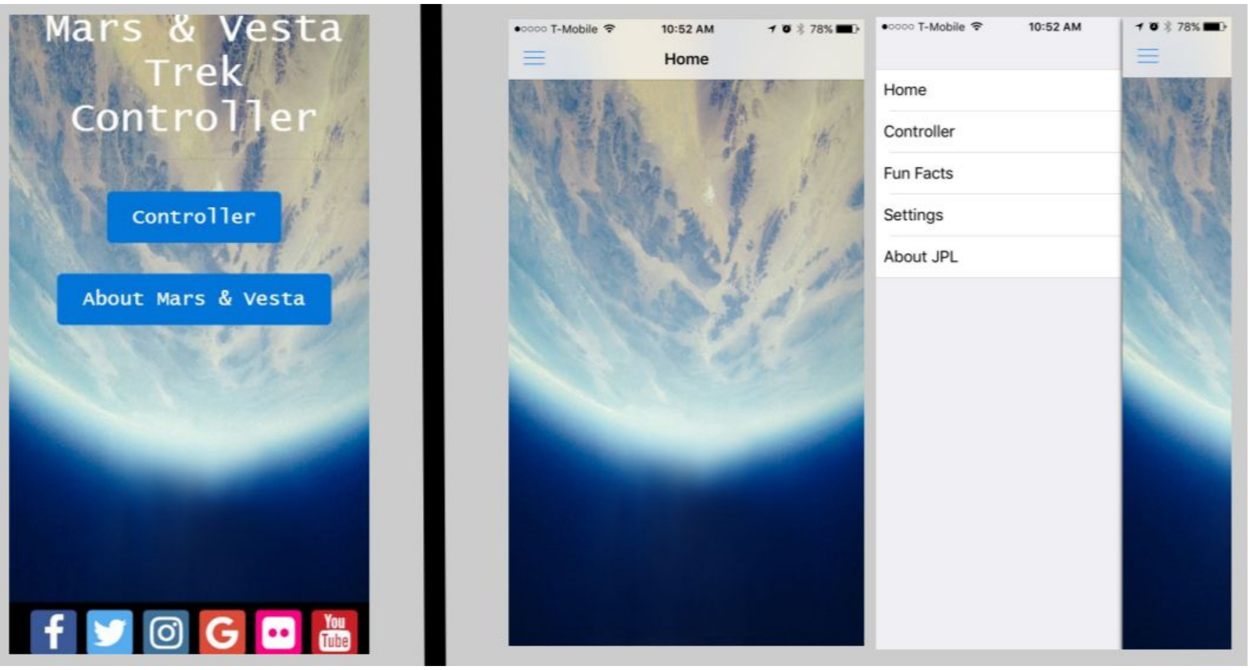
7.1. Overview of User Interface

The system will initially have a home screen with a menu to go to the controller or an about page. The about page will have three options: ‘About Mars’, ‘About Vesta’, and ‘Weight in Mars’. ‘About Mars’ and ‘About Vesta’ will have a page that will display information about each object. ‘Weight in Mars’ will contain a form in which the user can input their weight on Earth in pounds. A button then can be pressed to output their weight in Mars. In the controller option, the user will be directed to a verification page which will prompt the user to input a passcode (Web App) or scan a QR Code (iOS App). After verification, the user will see two joystick controllers. For the web application, if the user’s phone is not on landscape it will prompt the user to turn to landscape. The user can change to two other modes: accelerometer and touch. In accelerometer mode, the user can tilt the device in any motion to control the Trek. In touch mode, the user can swipe and pinch to control the Trek.

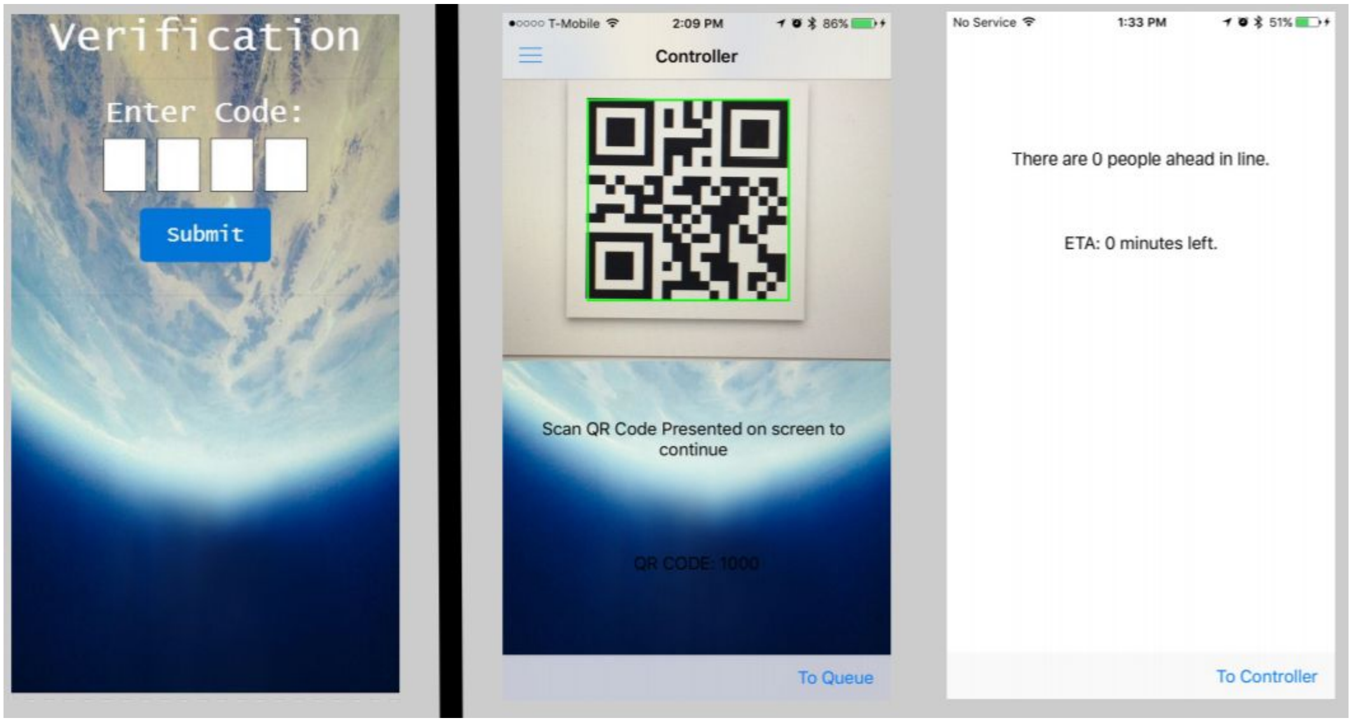
7.2. Screen Images

Images: Web (Left), iOS (Right)

1. Home



2. Verification

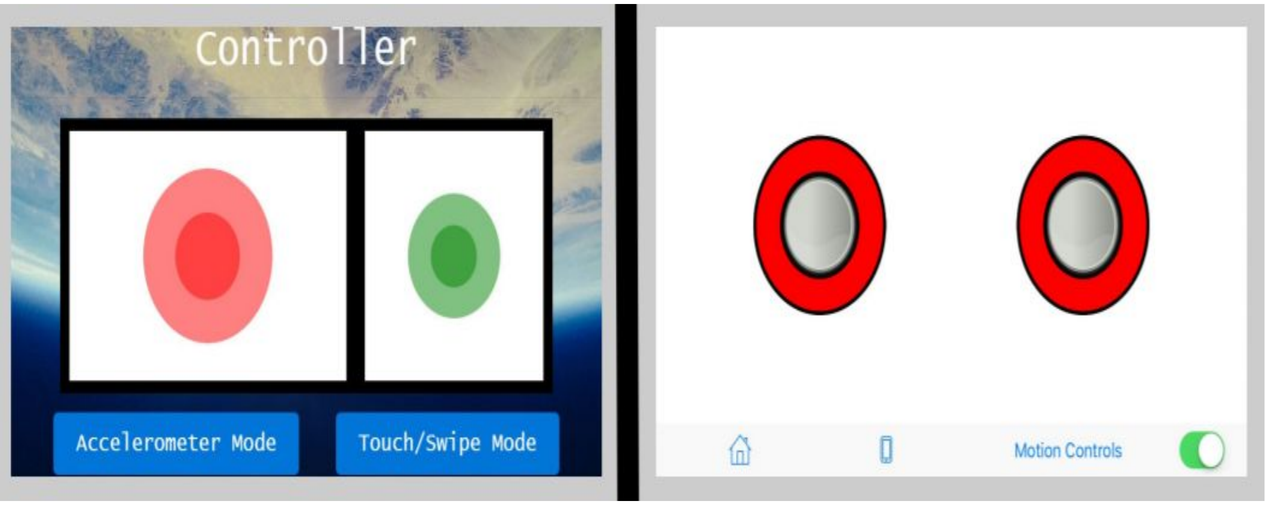


Scan QR Code Presented on screen to continue

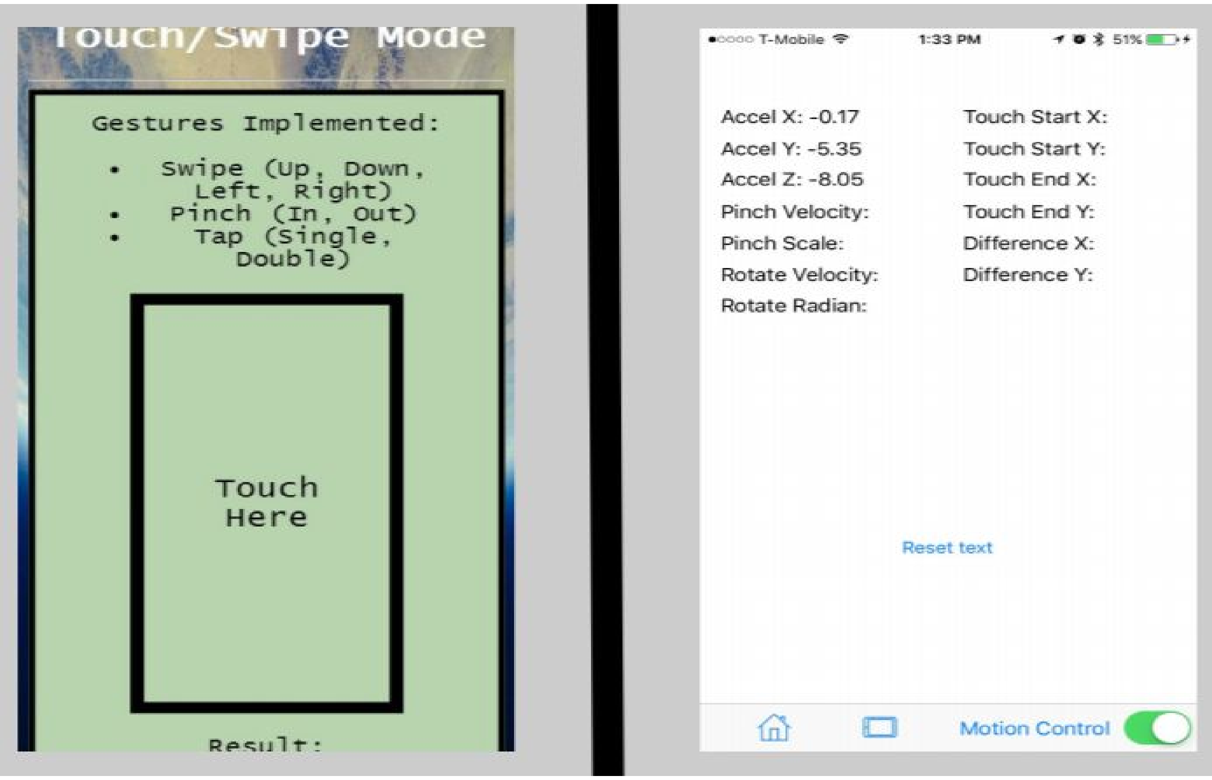
There are 0 people ahead in line.

ETA: 0 minutes left.

3. Controller (Joystick)



3.1. Controller (Touch)



Gestures Implemented:

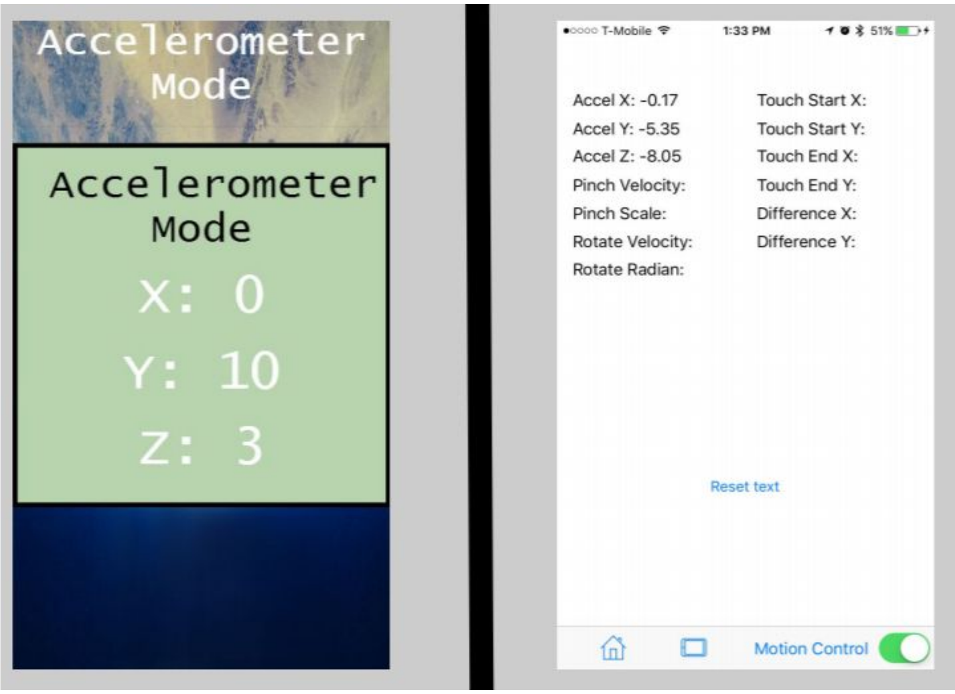
- Swipe (Up, Down, Left, Right)
- Pinch (In, Out)
- Tap (Single, Double)

Touch Here

Result:

Accel X: -0.17	Touch Start X:
Accel Y: -5.35	Touch Start Y:
Accel Z: -8.05	Touch End X:
Pinch Velocity:	Touch End Y:
Pinch Scale:	Difference X:
Rotate Velocity:	Difference Y:
Rotate Radian:	

3.2. Controller (Accelerometer)



Accelerometer Mode

Accelerometer Mode

X: 0

Y: 10

Z: 3

●○○○○ T-Mobile 1:33 PM 51%

Accel X: -0.17

Accel Y: -5.35

Accel Z: -8.05

Pinch Velocity:

Pinch Scale:

Rotate Velocity:

Rotate Radian:

Touch Start X:

Touch Start Y:

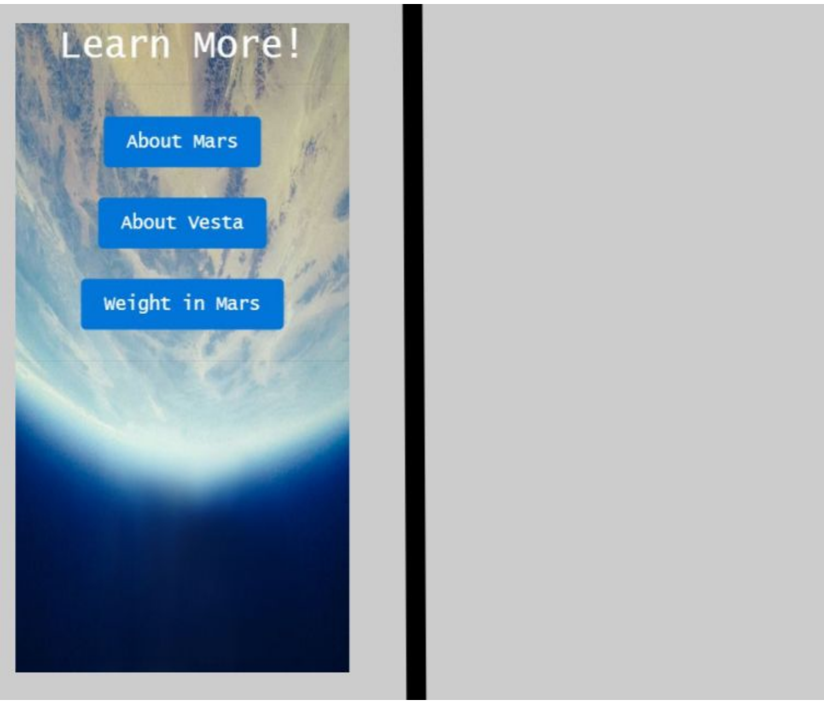
Touch End X:

Touch End Y:

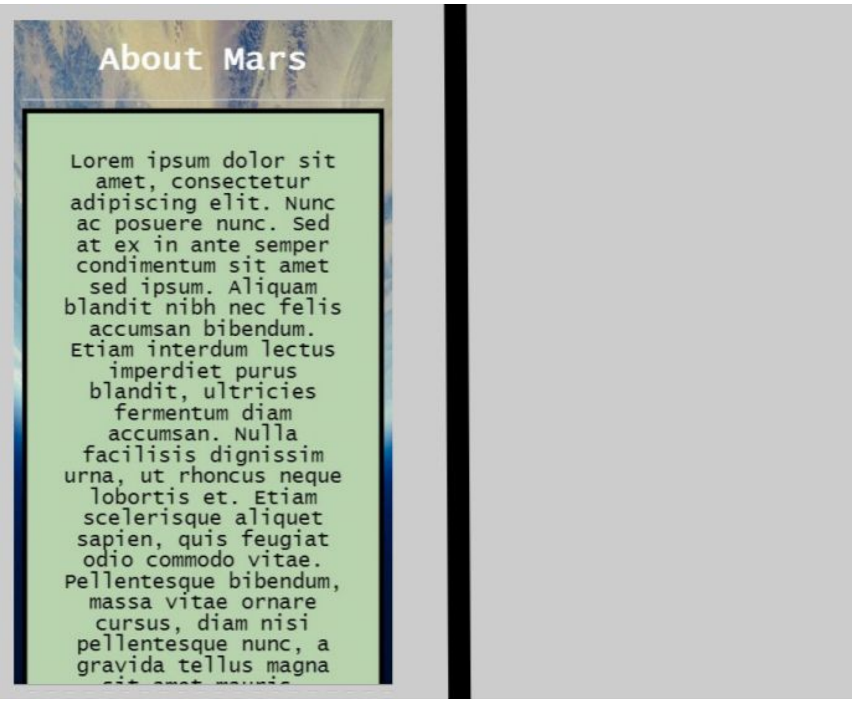
Difference X:

Difference Y:

4. About



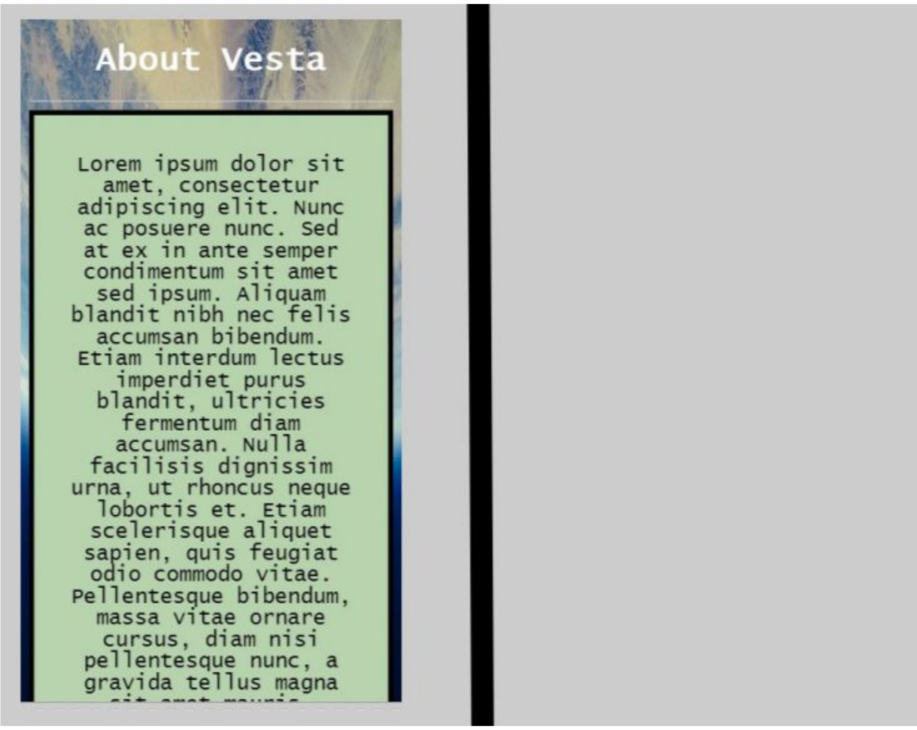
4.1. About Mars



About Mars

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Nunc ac posuere nunc. Sed at ex in ante semper condimentum sit amet sed ipsum. Aliquam blandit nibh nec felis accumsan bibendum. Etiam interdum lectus imperdiet purus blandit, ultricies fermentum diam accumsan. Nulla facilisis dignissim urna, ut rhoncus neque lobortis et. Etiam scelerisque aliquet sapien, quis feugiat odio commodo vitae. Pellentesque bibendum, massa vitae ornare cursus, diam nisi pellentesque nunc, a gravida tellus magna sit amet mauris

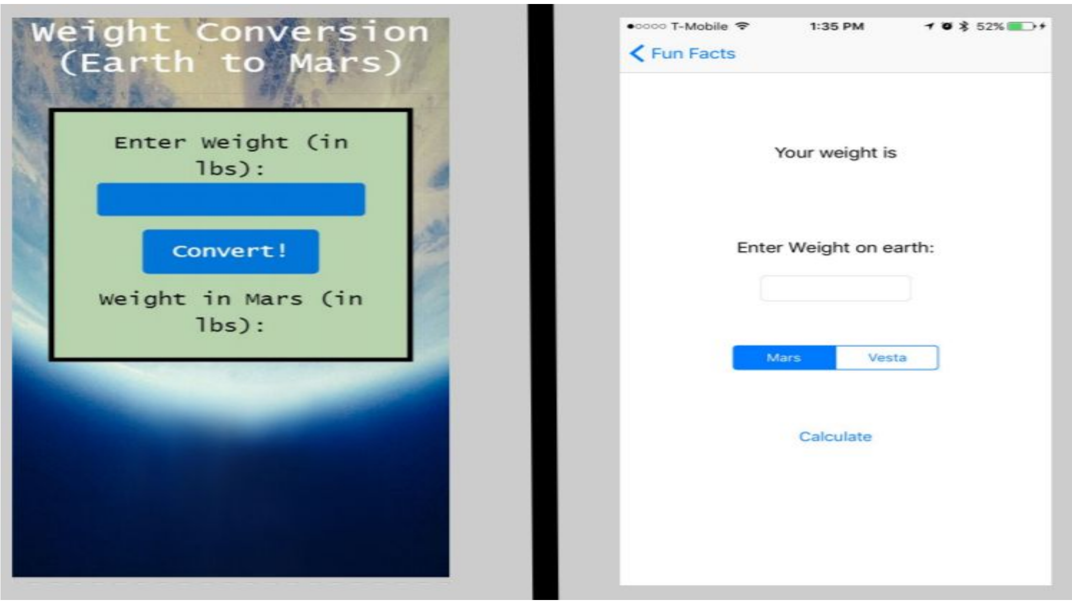
4.2. About Vesta



About Vesta

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Nunc ac posuere nunc. Sed at ex in ante semper condimentum sit amet sed ipsum. Aliquam blandit nibh nec felis accumsan bibendum. Etiam interdum lectus imperdiet purus blandit, ultricies fermentum diam accumsan. Nulla facilisis dignissim urna, ut rhoncus neque lobortis et. Etiam scelerisque aliquet sapien, quis feugiat odio commodo vitae. Pellentesque bibendum, massa vitae ornare cursus, diam nisi pellentesque nunc, a gravida tellus magna sit amet mauris

4.3. Weight in Mars



8. GLOSSARY

- MNCPWP — Mobile Navigation Control for Planetary Web Portals
- JPL — Jet Propulsion Laboratory
- IDE — Integrated Development Environment
- QR Code — Quick Response Code
- iOS — iPhone Operating System (Apple)
- Android — Mobile Operating System (Google)
- Integrated Development Environment — software application that provides tools for software development
- Eclipse — Eclipse is a popular IDE for creating Java applications
- Xcode — Xcode is an IDE for developing software for iOS