Creating your own solar system in Augmented reality

A Swift-base app

By Jenelle Bankas

Candidate Number: 8018 Centre Number: 22121

Table of Contents

[Analysis 2](#_Toc105093396)

[The Problem 2](#_Toc105093397)

[Supervisors 2](#_Toc105093398)

[Researched Products 2](#_Toc105093399)

[Relevant Research 2](#_Toc105093400)

[Surveys 2](#_Toc105093401)

[Prototypes 2](#_Toc105093402)

[Objectives 3](#_Toc105093403)

[Documented Design 4](#_Toc105093404)

[Technical Solution 5](#_Toc105093405)

[Testing 6](#_Toc105093406)

[Evaluation 7](#_Toc105093407)

# Analysis

## The Problem

*A User would be able to input different dimensions of a planet/edit the solar system including customising components like the colour and look potentially. Then the program would be able to*

*The challenges for this project would most likely be in the learning of a new language and also creating the 3D aspect of the project as well as it would require triple coordinates and a deeper understanding of programming with coordinates which can be tricky in some instances due to the nature of its data structure.*

*The outcome would be an app or website where a user could input their dimensions of a planet and/or manipulate the solar system and it would show them how the orbit would be altered in response, theoretically.*

*I would also need to learn how to integrate the users' modifications: would they be able to click each planet and drag and then have a button to add a planet as well.*

*Timescale: this project would most likely take a lot of planning and research for the equations so before I can begin it would maybe take 2 weeks in researching to properly identify all the different components. I would have to also learn another programming language as well. I think that the actual creation of the program without graphics would take roughly a month or slightly longer and the rest of the time on the graphics.*

## Supervisors

*For my supervisor I chose my Physics teacher to help me to identify and adapt the Physics of the problem and help with calculations and how to approach them. In addition, for the user side of things, I wanted clients with no Physics background to use it to try and gain two perspectives which can meet in the middle to create an enjoyable experience for both parties.*

## Researched Products

*I have identified a handful of existing projects on the App Store with a similar problem, however, the approach taken differs greatly to the way in which I would like to approach my project.*

## Relevant Research

**Graphical user interface, text, application

Description automatically generated**

**Graphical user interface, application

Description automatically generated**

## Surveys

What relationship is present between T (orbital time period) and r (

## Prototypes

## Objectives

1. *Solar System animation is as accurate as possible* 
   1. *The Planets’ orbits are the correct length*
   2. *The Planets’ velocities are accurate relatively*
   3. *The interaction between the Planets is accurate*
   4. *The Planets are scaled correctly* 
      1. *The Planets fit to the screen appropriately*
      2. *The animation elements are to the correct scale: time, speed, size*
2. *Users can customise their experience as much as possible*
   1. *The Planets can be different colours*
   2. *The mass of each planet can be changed*
   3. *The radius of each planet can also be changed*
3. *3D representation is achieved in Augmented Reality and digitally*
   1. *Planets orbit the user*
   2. *The Planets also spin*
4. *Users can save their solar systems* 
   1. *They can return to their previously created projects*
5. *App is accessible* 
   1. *It can be used on different screens*
   2. *Users could login on multiple devices*
   3. *Users can view their account*
6. *Additional modules if possible* 
   1. *Splash page with different facts of the day*
   2. *App experience can be customisable* 
      1. *Changing app appearance*

# Documented Design

# Technical Solution

# Testing

# Evaluation

# References

Accessed: 24.04.22

[***https://solarsystem.nasa.gov/resources/310/orbits-and-keplers-laws/***](https://solarsystem.nasa.gov/resources/310/orbits-and-keplers-laws/)

[***https://www.raywenderlich.com/2212-video-tutorial-ios-animation-with-swift-part-14-3d-animations***](https://www.raywenderlich.com/2212-video-tutorial-ios-animation-with-swift-part-14-3d-animations)

[***https://thepythoncodingbook.com/2021/12/11/simulating-3d-solar-system-python-matplotlib/***](https://thepythoncodingbook.com/2021/12/11/simulating-3d-solar-system-python-matplotlib/)

[***https://developer.apple.com/documentation/realitykit/creating\_3d\_content\_with\_reality\_composer***](https://developer.apple.com/documentation/realitykit/creating_3d_content_with_reality_composer)

***Accessed: 28.04.22***

[***https://www.sciencedirect.com/topics/earth-and-planetary-sciences/obliquity***](https://www.sciencedirect.com/topics/earth-and-planetary-sciences/obliquity)

[***http://www.met.reading.ac.uk/~ross/Documents/OrbitNotes.pdf***](http://www.met.reading.ac.uk/~ross/Documents/OrbitNotes.pdf)

[***https://courses.lumenlearning.com/boundless-algebra/chapter/the-circle-and-the-ellipse/***](https://courses.lumenlearning.com/boundless-algebra/chapter/the-circle-and-the-ellipse/)

[***https://www.google.co.uk/search?q=how+to+calcualte+orbital+period&ie=UTF-8&oe=UTF-8&hl=en-gb&client=safari***](https://www.google.co.uk/search?q=how+to+calcualte+orbital+period&ie=UTF-8&oe=UTF-8&hl=en-gb&client=safari)

***Accessed: 06.05.22***

[***https://www.astronomynotes.com/angmom/s2.ht***](https://www.astronomynotes.com/angmom/s2.htm)

[***https://medium.com/analytics-vidhya/simulating-the-solar-system-with-under-100-lines-of-python-code-5c53b3039fc6***](https://medium.com/analytics-vidhya/simulating-the-solar-system-with-under-100-lines-of-python-code-5c53b3039fc6)

[***www.met.reading.ac.uk/~ross/Documents/OrbitNotes.pdf***](http://www.met.reading.ac.uk/~ross/Documents/OrbitNotes.pdf)

[***https://geo.libretexts.org/Courses/University\_of\_California\_Davis/GEL\_056%3A\_Introduction\_to\_Geophysics/Geophysics\_is\_everywhere\_in\_geology.../03%3A\_Planetary\_Geophysics/3.01%3A\_Orbital\_Mechanics***](https://geo.libretexts.org/Courses/University_of_California_Davis/GEL_056%3A_Introduction_to_Geophysics/Geophysics_is_everywhere_in_geology.../03%3A_Planetary_Geophysics/3.01%3A_Orbital_Mechanics)

[***https://youtu.be/4ycpvtIio-o***](https://youtu.be/4ycpvtIio-o)

***Accessed 10.05.22***

[***https://youtu.be/WTLPmUHTPqo***](https://youtu.be/WTLPmUHTPqo)

***Accessed 12.05.22***

[***https://youtu.be/KOek-B3Rvmg***](https://youtu.be/KOek-B3Rvmg)

[***http://www.stjarnhimlen.se/comp/tutorial.html***](http://www.stjarnhimlen.se/comp/tutorial.html)

***Accessed 13.05.22***

*For making the planets not in AR, maybe have a way to input the coordinates needed*

[***https://www.raywenderlich.com/23483920-scenekit-3d-programming-for-ios-getting-started***](https://www.raywenderlich.com/23483920-scenekit-3d-programming-for-ios-getting-started)

*For removing and adding things in the app*

[***https://youtu.be/itGRaAryUxA***](https://youtu.be/itGRaAryUxA)

***Accessed 15.05.22***

*For potentially creating the orbits in this way*

[***https://youtu.be/lKfqi52PqHk***](https://youtu.be/lKfqi52PqHk)

***Accessed 22.05.22***

[***https://youtu.be/BStRJBM\_mvw***](https://youtu.be/BStRJBM_mvw)

***Accessed 26.05.22***

[***https://www.alphacodingskills.com/swift/swift-math-functions.php***](https://www.alphacodingskills.com/swift/swift-math-functions.php)

[***https://medium.com/@dharmeshr712/swift-arkit-mini-solar-system-b9cf394d274***](https://medium.com/@dharmeshr712/swift-arkit-mini-solar-system-b9cf394d274)