

**GOSH: App for child growth charts in R**

**Team 14**

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# Abstract

When children are born, a lot of information is gathered about them as they develop such as weight, height etc. This data is usually visualized in a graph format and generally on paper. With over 130,000 births last year in London alone, a lot of data has to be collected and resources such as paper used to produce the growth charts for this data. This is where our problem lied. Our problem was to produce an application for Great Ormond Street Hospital that can produce these growth charts and display useful information to the user about the growth of the child for example, what centile the their weight/height lies in etc. Our client also wanted us to make this application available on as many platforms as possible especially mobile devices.

The solution we created was a web app coded in the statistical language R. We used R as it easily allowed us to read and manipulate data from the .csv files in which the information was stored. We used two main libraries from R for our app. Firstly, we used R-Shiny to make our app accessible from the web, allowing our application to be used on all platforms with web functionality. As well as giving us web functionality, R-Shiny provided the resources for us to create a UI for our application. The other library we used was ‘plotly’. This library allowed us to display the growth charts in a visually stimulating format and contained a lot of built in functionality that provides a more robust experience for the user allowing them to zoom in/out, compare data at different points etc. We produced two growth charts for each type of growth and gender. One graph was a measurement/age graph with the child’s data as well as the lines for some centiles so the user can see how child’s growth compares to the rest of the population. The other graph is a z-score/age graph which allows the user to see more explicitly how the child’s growth moves in centiles providing more information to the user.

Given the time restraints and lack of experience with the R programming language, the progress we’ve made with the project is quite remarkable as we met all the essential and most of the optional requirements the client set for us. With this in mind, we can state with confidence that we have produced a complete product. However, the app isn’t ready to be used in hospitals just yet, with more time we could add more functionality and provide a data store such that hospitals can upload their data.

# 1 Introduction

# 2 Requirements

## 2.1 Personas

Typical users who would use this application would be health centres so that they can monitor the growth of their patients when children come in for their routine check-up. The application could be extended in the future so that any user can use the application so parents can produce their own growth charts for their children.

## 2.2 MoSCoW Requirements

|  |  |  |
| --- | --- | --- |
| ID | Requirements | Priority |
| 1 | Plotting of serial measurements of an individual on a normal growth chart with centile detection | Must |
| 2 | Plot height and weight growth charts | Must |
| 3 | Have web app functionality | Must |
| 4 | Use GOSH’s data to produce growth charts | Must |
| 5 | Show some sort of growth trajectory using the data that is inputted | Should |
| 6 | Integrated with SMART on FHIR so it can be compatible with any health centre that uses SMART on FHIR for their data storage | Should |
| 7 | Have some functionality to output data to files or in a pdf format | Could |
| 8 | Have some functionality for data security | Could |
| 9 | Have some functionality for the application to run in a mobile browser | Could |

**Table 2.1:** MoSCoW Requirements

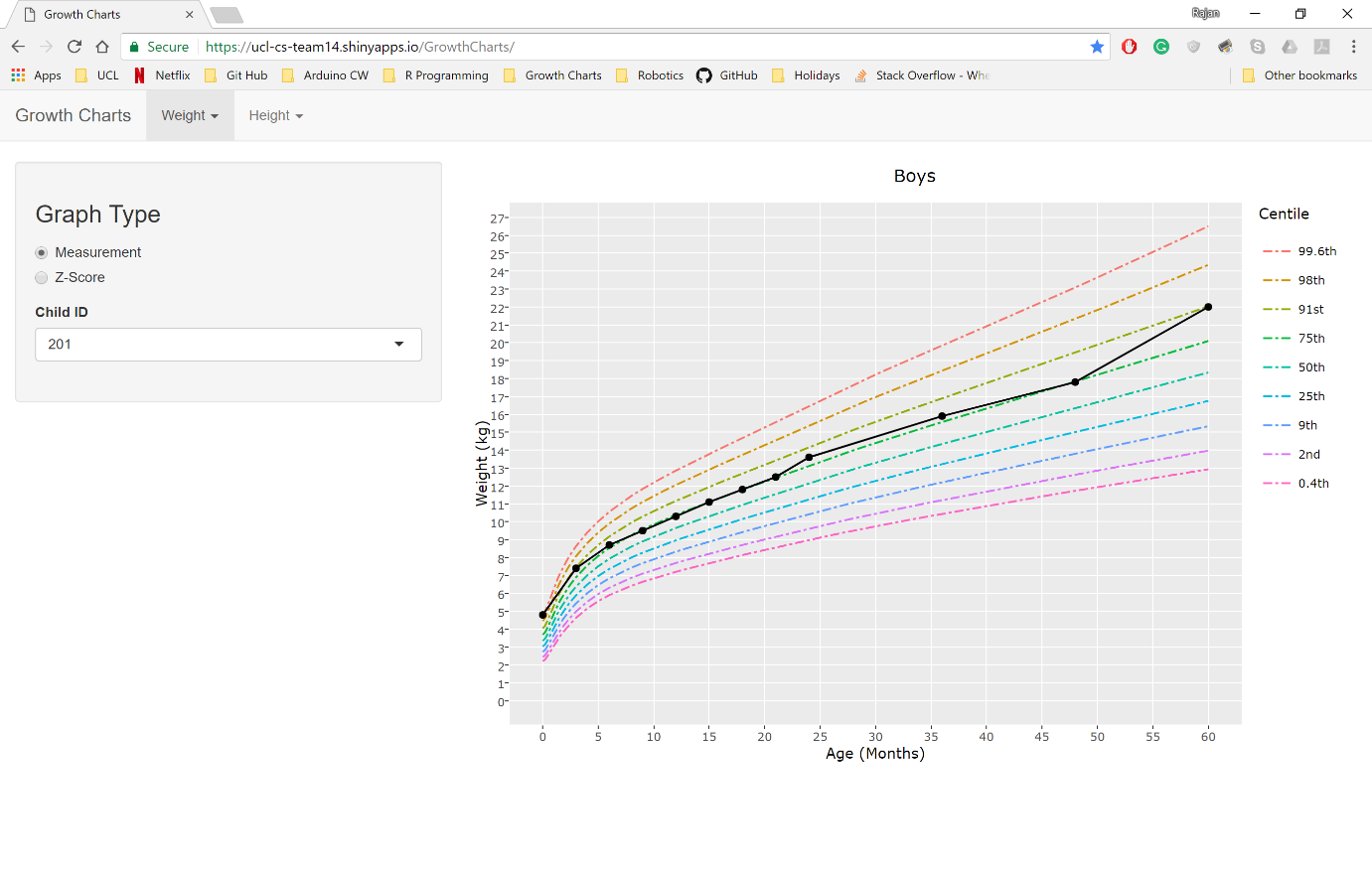
# 3 Research

# 4 Design and Implementation

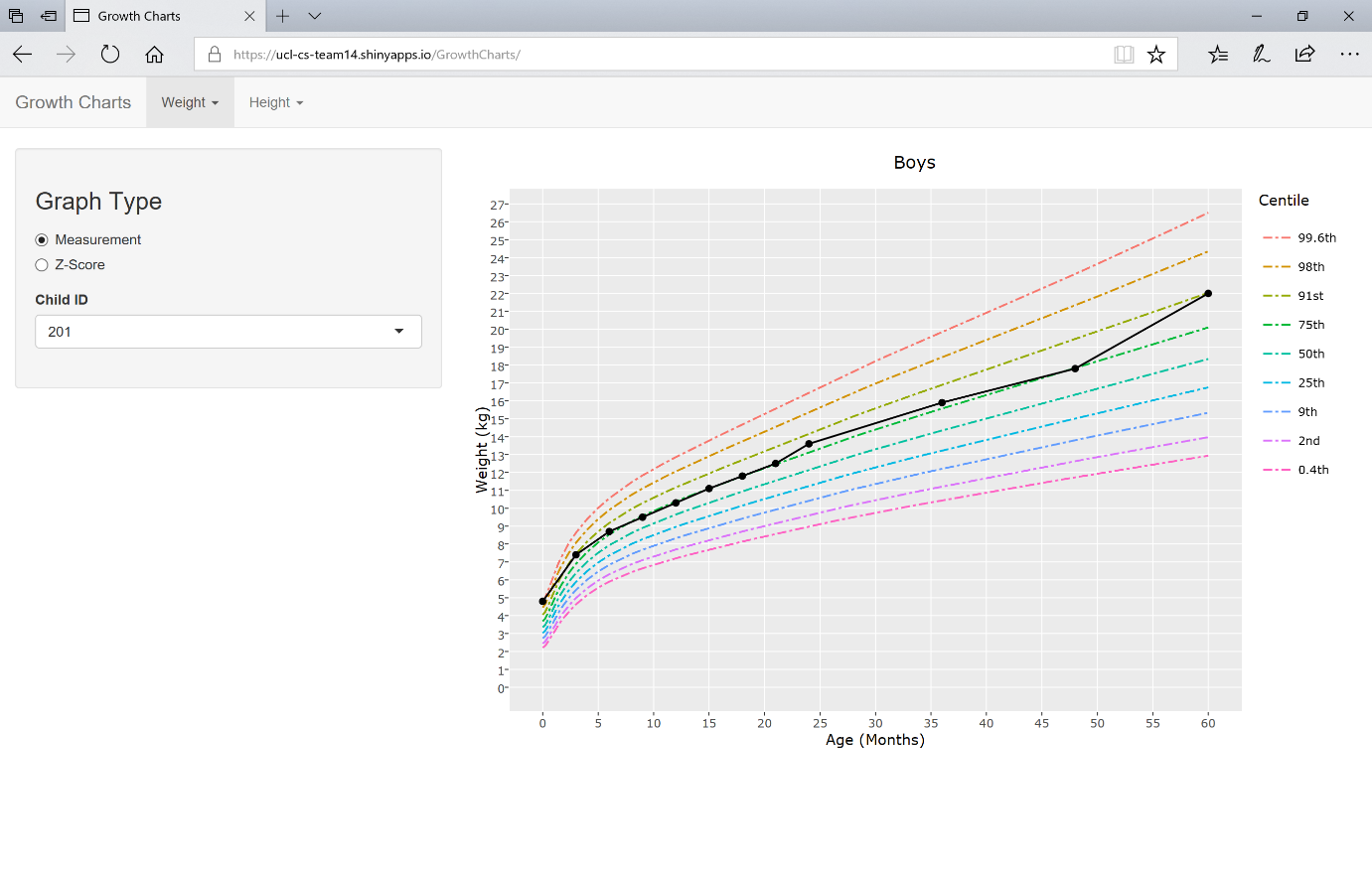
# 5 Testing

## 5.1 Compatibility Testing

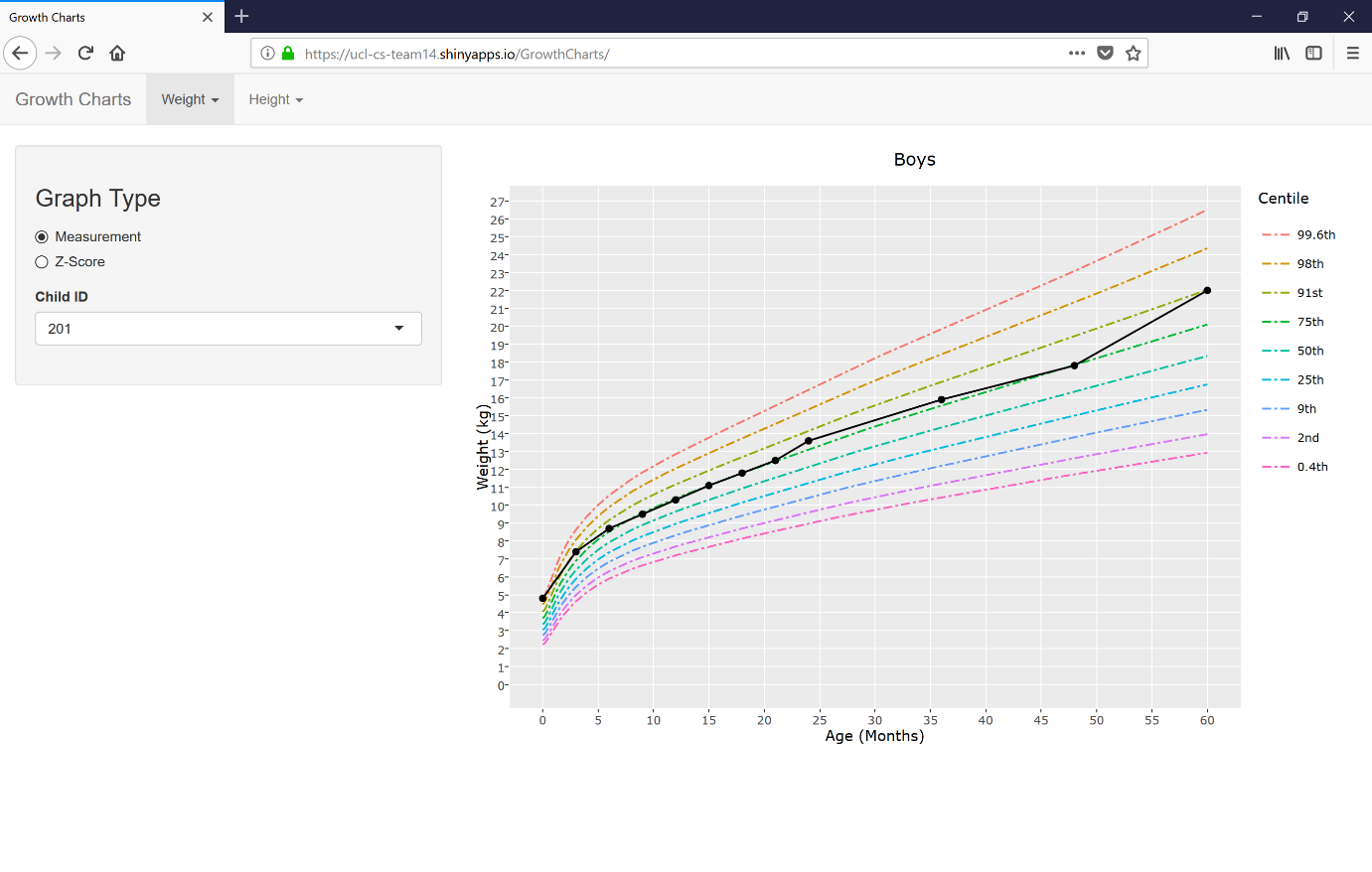
|  |  |  |
| --- | --- | --- |
| Browser | Version No. | Result |
| Chrome | 65.0.3325.162 | Fully functional |
| Microsoft Edge | 41.16299.248.0 | Fully functional |
| Morzilla Firefox | 59.0 | Fully functional |
| Safari | 11.0.2 | Fully functional |



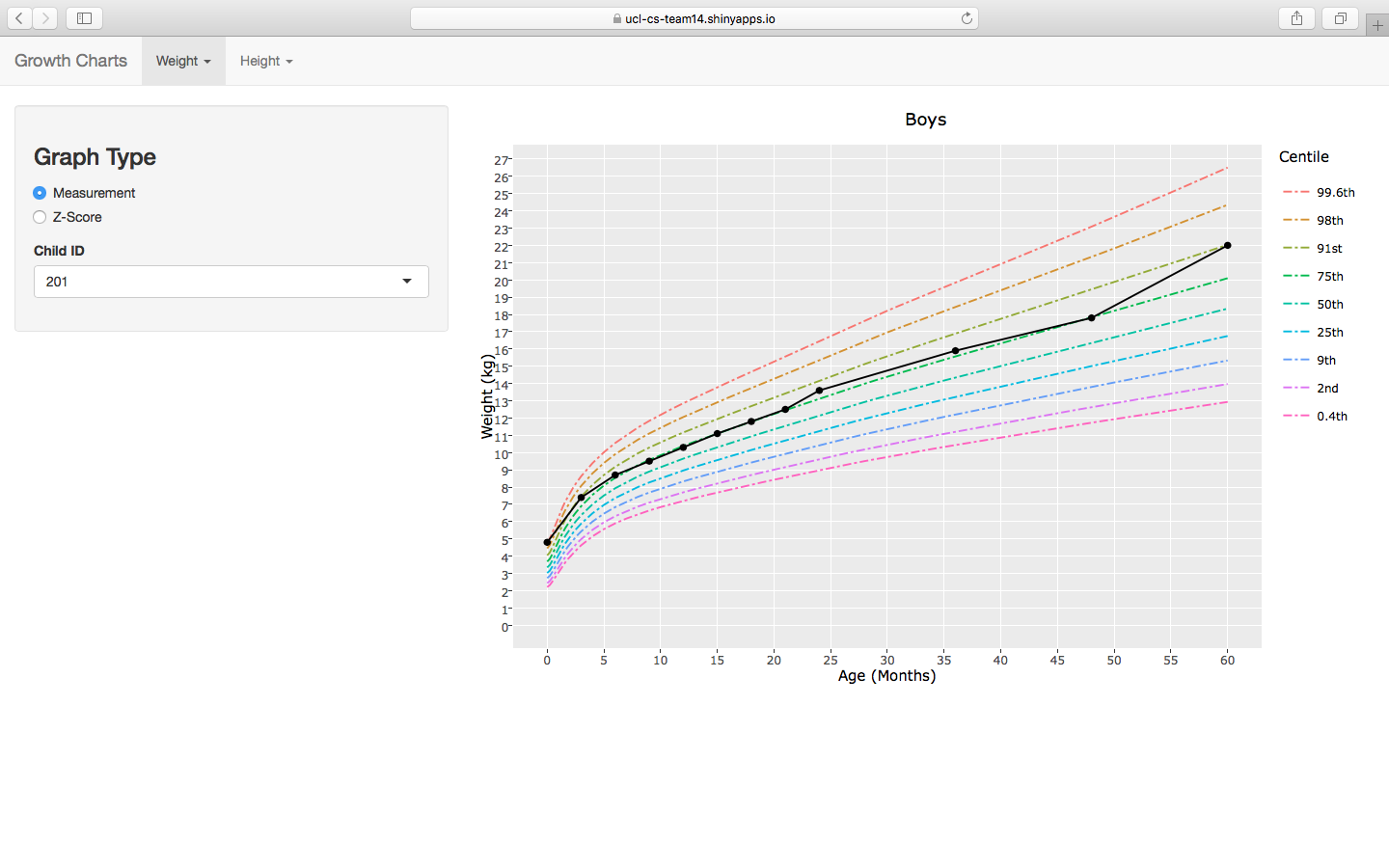
**Figure 5.1:** Google Chrome Screenshot



**Figure 5.2:** Microsoft Edge Screenshot



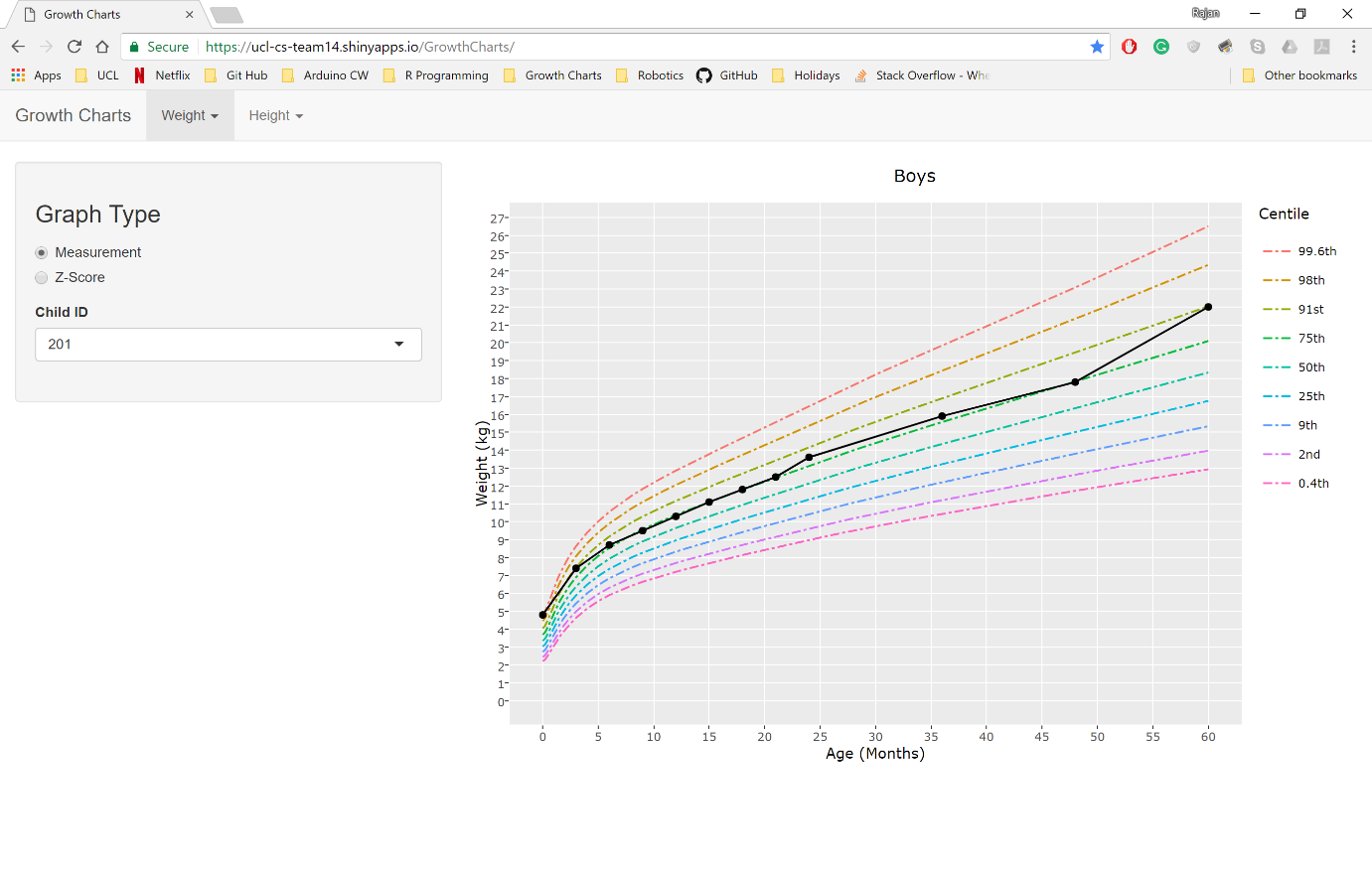
**Figure 5.3:** Mozilla Firefox Screenshot



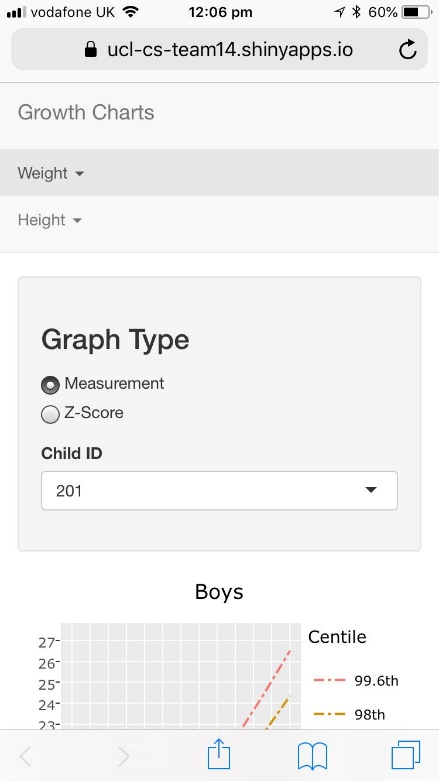
**Figure 5.4:** Safari Screenshot

## 5.2 Responsive Design Testing

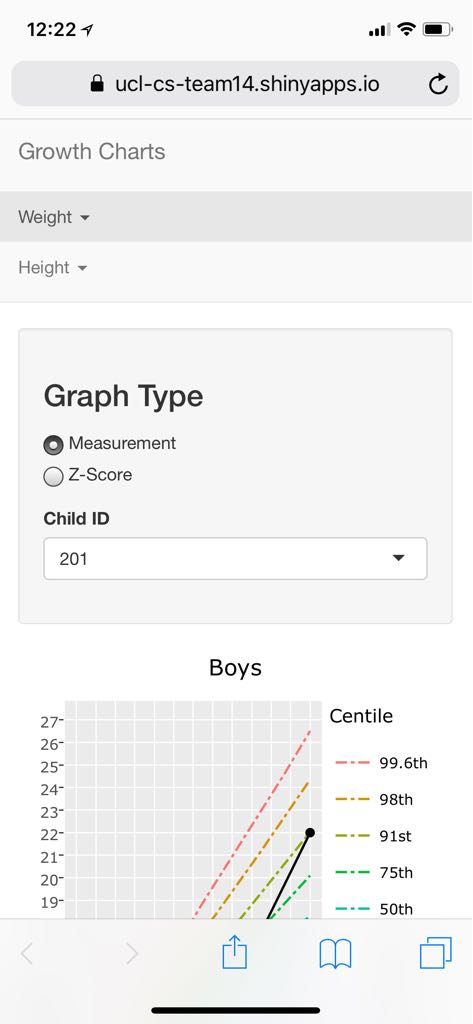
|  |  |
| --- | --- |
| Screen | Result |
| Laptop (width 2736px) | Fully functional |
| iPhone 7 | Fully functional |
| iPhone X | Fully functional |
| iPad | Fully functional |



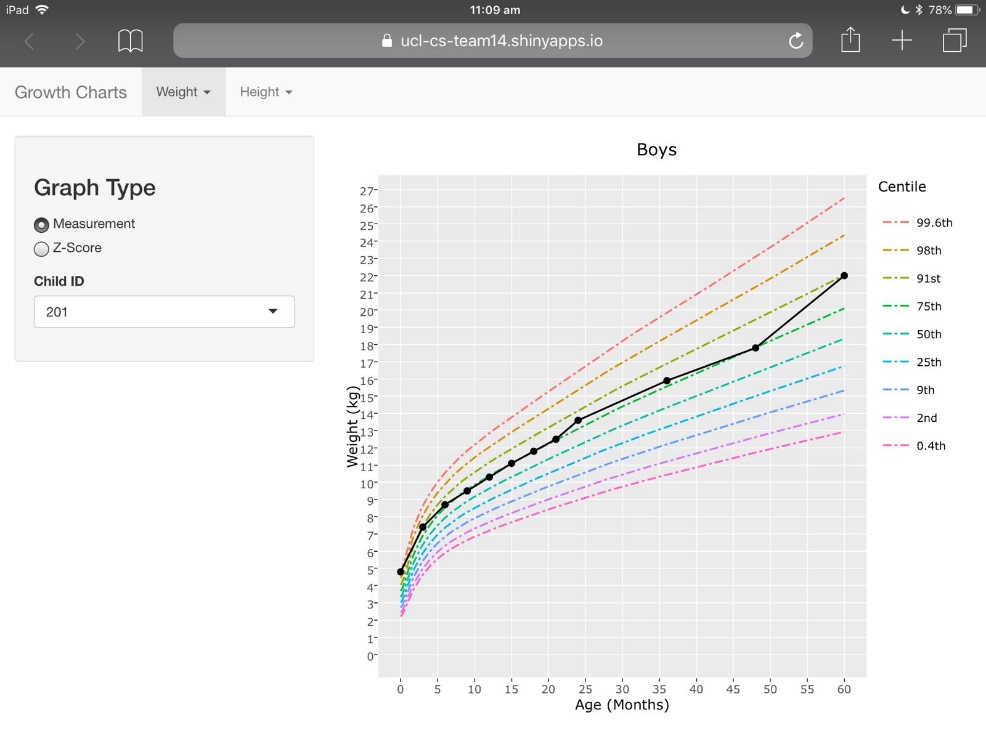
**Figure 5.5:** Laptop Screenshot



**Figure 5.6:** iPhone 7 Screenshot



**Figure 5.7:** iPhone X Screenshot



**Figure 5.8:** iPad Screenshot

## 5.3 User Acceptance Testing

A survey was carried out by different users asking a variety of questions. These are the results from the survey:

# 6 Conclusion and future work

## 6.1 Summary of Achievements

**Achievement Table:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ID | Requirements | Priority | State | Contributors |
| 1 | Plotting of serial measurements of an individual on a normal growth chart with centile detection | Must | **✓** | All |
| 2 | Plot height and weight growth charts | Must | **✓** | All |
| 3 | Have web app functionality | Must | **✓** | All |
| 4 | Use GOSH’s data to produce growth charts | Must | **✓** | All |
| 5 | Show some sort of growth trajectory using the data that is inputted | Should | **✓** | Rajan |
| 6 | Integrated with SMART on FHIR so it can be compatible with any health centre that uses SMART on FHIR for their data storage | Should | **X** | All |
| 7 | Have some functionality to output data to files or in a pdf format | Could | **X** | All |
| 8 | Have some functionality for data security | Could | **X** | All |
| 9 | Have some functionality for the application to run in a mobile browser | Could | **✓** | All |
| Key Functionalities (must have and should have) | | **83%** completed | | |
| Optional Functionalities (could have) | | **33%** completed | | |

# 7 References

# 8 Appendix