Team Project:
Comparative usability testing
(a) UI change of Project I (or new design) +
(b) Comparative usability Testing & Survey of Original Project 1 (or new design) and Modified UI version

User Interface Design and Programming

COMP 350

Instructor

Kyungjae Lee (just call me KJ)

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Upcoming Schedule

- Team project proposal presentation (3/24)
  - Submit Team proposal template + MS PowerPoint presentation
- Data analysis techniques for Team project (3/24)
- Quiz 2 (3/31)
- Team project submission & demo (4/07)
- Final exam (4/14 Monday Building D 217, 2 pm)

COMP350	ON1	10532	14-Apr-2025	14:00 - 17:00	AB-ABD-217

Next week!
Team Project Proposal presentation (10 points)
(Team size: 1-3 people maximum)

– Your team proposal MS PowerPoint slide includes;

a) Overall summary of the project

b) storyboard draft/sketch (showing game/simulation interaction flow + UI screen)

c) Short investigation/research paragraph with reference image and links.

d) Every member in the same team must submit the same proposal file.

Review Lecture 8 slide for (a) Prototyping (b) Survey design & (c) Experimental design.

Your team project!!!

1. Lab Exercises

2. Individual Project

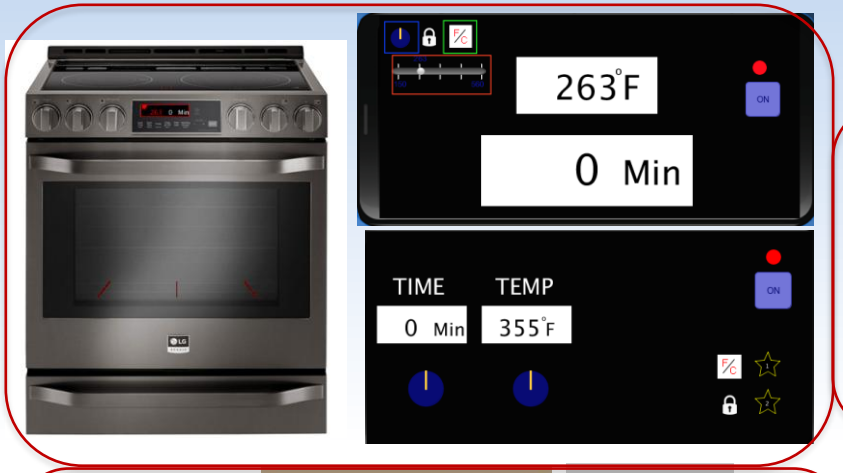
3. Team project
(1 to 3 members)

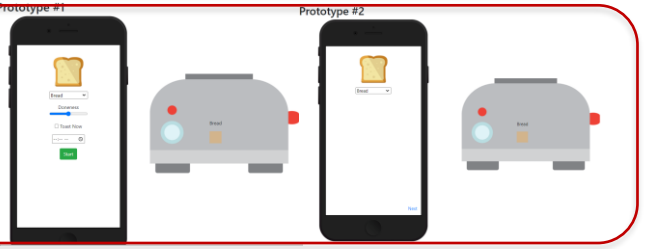
Regard your team as a professional production house/company!

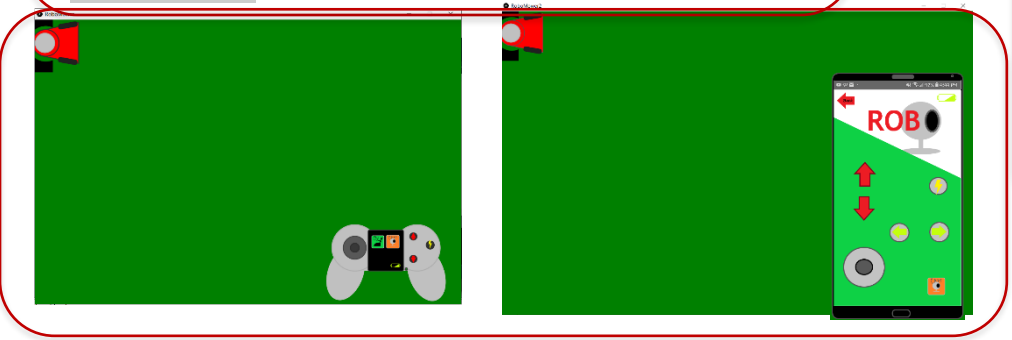
Project management!

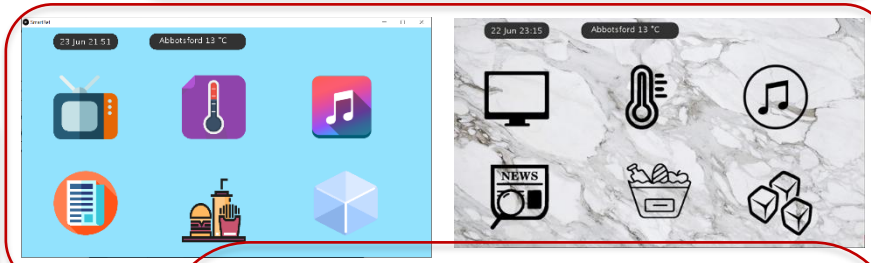
- Appoint a project manager!
- Divide workload through your departments (animation crews, compositing crews etc.)

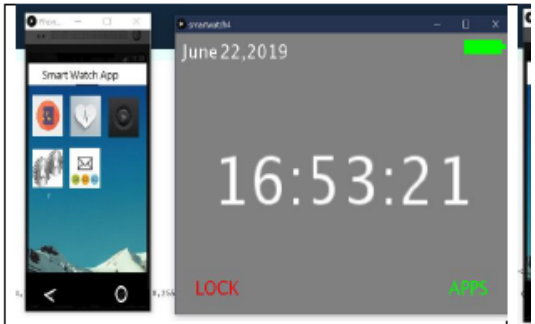
Previous student examples

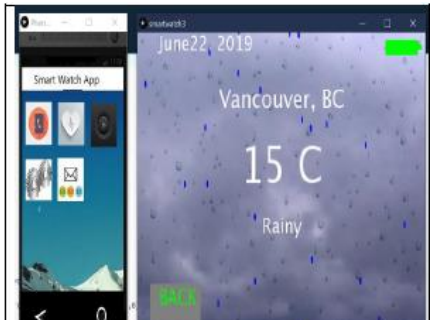


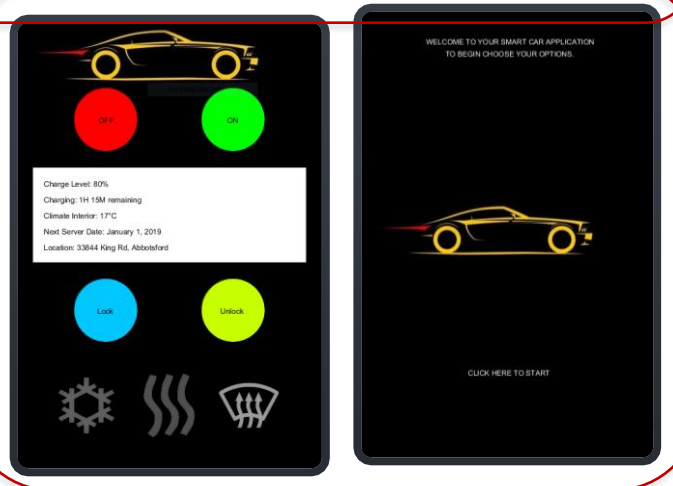












Report sample screenshots

APPROACH

To complete the project I began with the planning aspect. Research on existing products similar to that which I was developing was performed to determine requirements for the product. After finishing the proposal, UML diagrams were used to define the classes and methods which will be used for implementation. Wire framing was performed to determine the visual aspect of the app and implementation began.

The implementation/design phase was completed based on what was required for the application to function. Requirements were listed for the design of the program, however they were addressed after the overall functionality and appearance of the application was completed to ensure that a working product was produced.

Usability testing was performed after all implementation was completed. Usability tests performed were a user experience survey and usability testing of the time required to perform the basic functions of the application for new users. User feedback was obtained and comparative analysis was performed which is detailed within this report.

CONCEPTUAL DESIGN

Wireframing

Wireframes were created for both the controller and app version of the program:

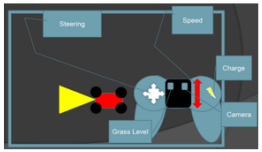


Figure 3. RoboMower Controller Wireframe

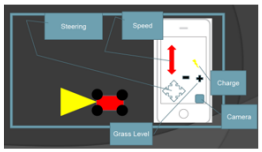


Figure 4. RoboMower App Wireframe

UML Design

A UML Use Case Diagram was created as well as a UML Entity Relationship Diagram to showcase the functional logic of the program.

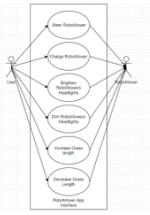


Figure 5. RoboMower UML Use Case Diagram

Figure 6. RoboMower UML Entity Relationship Diagram

DEVELOPMENT

Visual Design

Both applications created have similar structure and functions. Visual structure for the Mower and background is the same for both applications and the controlling interfaces are different.

Application 1 simulates a controller interface using shapes created in processing for the base, buttons and screen of the controller, with only the applications and battery level shown on the touch screen being created using 3D paint and imported into the program.

Application 2 simulates a mobile android phone interface using shapes as the phones base, button, headset, and front facing camera. All buttons, icons, and visuals within the phone interfaces screen are imported images either taken as screenshots from Danielle Hemmerling's phone or created

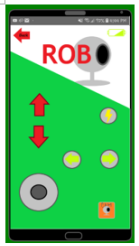


Figure 11. RoboMower2 Android App Screen View

Functional Design

Both applications were created with the same functionality and as such the Classes used to manipulate the devices are the same with minor differences to the location of conditions based on the buttons location on the simulated interface.

Movement

The Movement class is used to control the location of the Mower class. The mower is drawn in the main body of the application "RoboMower" and translated to position x and y dependent on the value within the Movement class. The mower starts off at location x = 10, y = 10 and is increased or decreased based on the mouse's location in relation to the epicenter of the joystick coordinates.fff

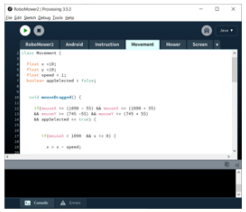


Figure 12. RoboMower Movement Class View

A conditional if – else statement is used to determine if the cursor is located within the parameters of the joysticks coordinates. If so then the class checks the location of the cursor in relation to the epicenter of the joystick and moved the mower + or – speed to translate the mower in the direction desired. The mower is also movable via the w, a, s, and d keys.

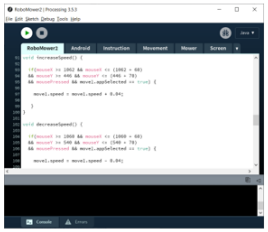


Figure 13. RoboMower Speed Increase Functions

The speed of the mower is defined within the movement class but manipulated by a conditional statement located in the main body of the program. If the mouse is pressed within the coordinates defined over the speed increase button created in the Controller class or located on the image of the screen in app 2, the speed is increased by float 0.04 and vice versa for decreasing speed. The base speed is set to float 1.

The Charge button is manipulated via a function chargeMower(); located in the main portion of the application which specifies when the mouse is pressed within the coordinates for the charge buttons locations, the mower is reset to its origin coordinates and the speed is reset to the starting speed of float 1.

The Movement class was created with the help of processing: https://processing.org/reference/mouseDragged_.html, https://processing.org/reference/mousePressed.html.

Camera

The camera is opened differently for each application.

RoboMower App 1

The first variation of RoboMower opens the camera in the small screen of the controller. A conditional statement within the main body of the program details that if the mouse is pressed within the coordinates of the cam icon, the camera is set to selected and the camera screen is displayed when the camera is set to selected.

during gameplay and clutter the screen space. The health bar can also be challenging to read during intense portions of gameplay. High scores should also be visible during gameplay to give the user a clear goal.

Figure 5: Original In-game UI

3.3 Beginning The Redesign

With the improvements that I needed to make now clear, I set out to redesign my menu, taking into account all of the main issues featured in my original design. I began the process by drafting some protype wireframes to serve as a basis to my redesign.

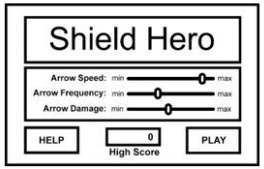


Figure 6: UI Resign Plans

4 NEW DESIGN

After the planning process was complete, I began designing the new UI based off the wireframes I created.

BEFORE

AFTER

n/a

6 USER SURVEY

In an effort to verify that my redesign was a success, I conducted a survey on 10 participants (5 for each design) to find which UI scored better based on interface design rules and user preference.

6.1 Survey Template

Thanks for taking the time to complete this survey. Please spend a couple minutes running my program (try to test every feature you can), then answer the following questions:

[1 = Strongly Disagree] [2 = Disagree] [3 = Neutral] [4 = Agree] [5 = Strongly Agree]

1. The UI was easy to navigate
2. The UI helped me understand the game
3. The UI made me feel in control of the program
4. The UI was aesthetically pleasing
5. The UI was consistent
6. Overall UI Rating [1-5]
7. Additional Comments/Feedback

6.2 Survey Results (Old UI)

1. The UI was easy to navigate

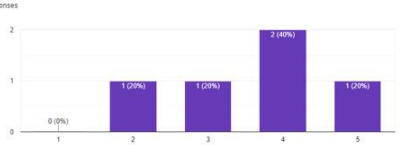


Table of Contents

1. Introduction

The following report is about the development of a Blood Pressure Monitor and survey results of the Blood Pressure Monitor for Smartphone and SmartWatch UI. BPM Smartphone UI uses a cuff and a Smartphone to measure a person's Blood Pressure. While SmartWatch UI uses a Cuff and a SmartWatch to measure a person's Blood Pressure. The application also lets the user set certain settings to imitate a person's lifestyle so that we can generate the proper Blood Pressures and Heart Rate readings.

Presentation's link: https://youtu.be/kF2QzHU2TdE
Application Link:
https://drive.google.com/file/d/1nc76g9DucCuxkQjL8DQAEjBMccw4YjWM/view?usp=sharing

2. Purpose

The purpose of the Application is to imitate a real Smart Blood Pressure Monitor's functionality. In order to do so, we created the above setting to imitate a person's lifestyle. By doing so we can generate a person's Blood Pressure (Systolic and Diastolic Blood Pressure) and Heart Rate. Then when both applications are complete we will use them to gather the data on how users think of our UI and Application. Then we will analyze the data so that we could further improve each UI.

3. Scope

3.1 App UIs

The scope of the app UIs is to display the results from the blood pressure monitor. It will have a section that allows you to change the setting measurements in the BPM and display the results. The results will also be displayed in a graph format for better understanding.

3.2 Experimental Design

We designed two scenarios to test which button of the app will be the most important for participants in different UI designs. The first test scenario is when the participants first use our apps. They don't know anything about the app. The second scenario happened after the participants became familiar with the various buttons on our app. We asked our participants to assume that they worked all night and found that their heartbeat was significantly faster.

4. Market Research

4.1 Potential Client

The potential clients of the blood pressure monitor are those who have high/low blood pressure or are always concerned about their blood pressure. These people are usually over 20 years old because they are more likely to have high blood pressure and irregular heart rate as they age.

4.2 Seller Place

People can buy blood pressure monitors almost anywhere. It usually appears in shopping malls, medical equipment stores and online stores. The price of one blood pressure monitor is between $60 - $130.

4.3 Profit Estimation

According to the survey, the blood pressure monitor can bring us a net profit of $10,000 to $100,000 per month. These revenues only include the part of online shopping. Therefore, the actual profit of the blood pressure machine should exceed $10,000 per month.

4.4 Competitive Product

Qardio was founded in 2012. Its purpose is to transform the healthcare industry with simpler, more innovative and more effective solutions for everyone: health-conscious users, patients, doctors and healthcare providers. Its product QARDIOARM is one of the most popular blood pressure monitors globally. The price of this monitor is $129, and this monitor can measure systolic, diastolic blood pressure, heart rate and irregular heartbeat detection.

5. Wireframe and Diagrams

5.1 Wireframe

There are two types of wireframes. One is the UI design of the smartphone, and the other is the UI design of the smartwatch.

As you can see in Figure 1, this is the framework of the smartphone. The phone screen will show the three BP results and BP category graph. The scenario options part will include a scrollbar and three buttons. Finally, the right-down position will be an arm and a cuff. The BP result will only be readable when the arm wears the smart cuff.

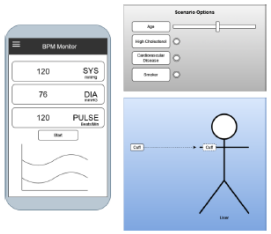


Figure 1 "Framework of Smartphone"

Figure 2 below is the wireframe of the smartwatch. The smartwatch part is the main difference between this wireframe and the first. There will be two pages in the watch section. The first page contains a start button to start testing the BP results. The second page mainly displays BP results and BP category diagrams.

Figure 2 "Framework of Smartwatch"

5.2 Table of Use Case

Table 1 below is the description of the use case diagram.

Name:	BP Machine App
Actor:	User and BP Smart Cuff, Initiated by User opens BPM App
Description:	This use case describes how the user uses BP machine App and the relationship between App and BP smart cuff.
Flow of events	1. The user opens the BPM App.
	2. The user presses the start button in the App and BP smart cuff will check the blood pressure.
	3. The app displays the result of the user's SYS, DIA, and PUL.
	4. The app also displays the user's BP category in the graph
Entry condition:	The app will work when the user opens the BPM App.
Exit condition:	The app will stop when the user closes the BPM App.
Quality requirements:	The app needs to accurately calculate the result of SYS, DIA, and PUL and generate the BP category in the graph.
Exception flow of event:	During BP smart cuff calculation of the result of SYS, DIA, and PUL, the app should disable the user to press the start button again.

Table 1 "BP Machine App"

5.3 Use Case Diagram

The use case diagram contains two actors: user and smart cuff, as shown in Figure 3. The user can press the start button and get the BP result and BP category graph. On the other hand, the BP smart cuff can check blood pressure.

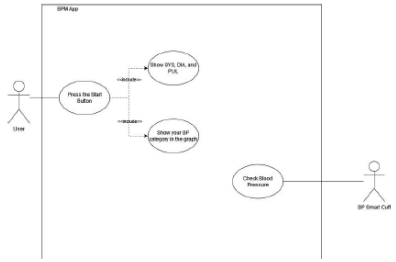


Figure 3 "Use Case Diagram"

5.4 Class Diagram of Phone

Figure 4 below is the class diagram of phone UI. The smart cuff needs to connect to the phone to active the app. As you can see, all BP results and the BP category graph will display on one screen in the phone design. If the user changes the scenario options, it will affect the BP result on the phone.

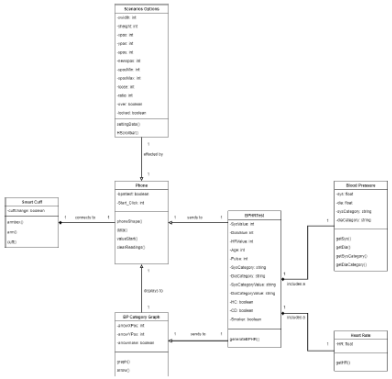


Figure 4 "Phone Class Diagram"

5.5 Class Diagram of Watch

The main difference between phone UI and watch UI is the watch one has two screens. As you can see in Figure 5, the initial screen of the smartwatch is the start page. When the user clicks the button on the start page, it will go to the result page. The result contains blood pressure, heart rate, and the BP graph.

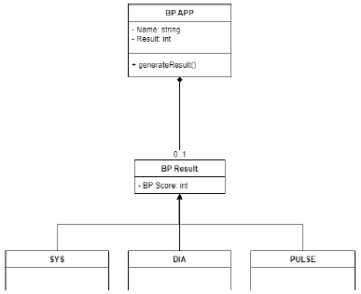


Figure 7 "Inheritance Diagram of BP Result"

5.8 State Diagram

Figure 8 below is the procedure of the BP App. When the smart monitor app is opened, the user allows changing scenario options. If the scenario option changes, the BP result will be affected. Pressing the start button will start to inflate/deflate. The app will then display BP results and a BP category graph. If the user wants to recheck the BP result, he can change scenario options and press the start button again. Otherwise, he can close the smart monitor app.

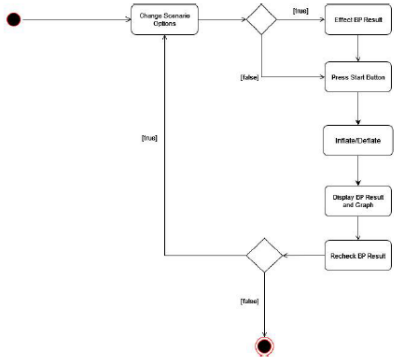


Figure 8 "State Diagram"

5.9 Sequence Diagram

The sequence diagram contains a user, BP app, and BP smart cuff, as shown in Figure 9. When the user presses the start button, the BP app will tell the smart cuff to check blood pressure. If the user changes scenario options, the BP smart cuff will return the changed BP result. Otherwise, the BP smart cuff will return the normal BP result. After receiving the results, the BP app will display them. Finally, the user can close the BP App.

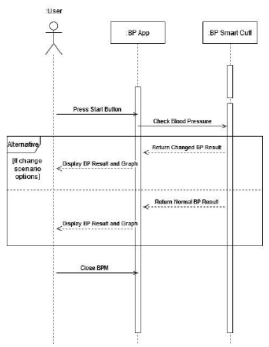


Figure 9 "Sequence Diagram"

6. Project Management

6.1 Production Budget Sheet

After estimation shown in Figure 10, this project needs $437,320 to run. These budgets include salaries, hardware, rent office fee, and hydro/gas fee.

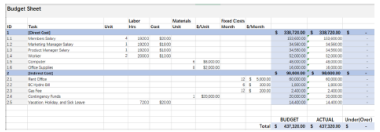


Figure 10 "Budget Sheet"

6.2 PERT Chart

Table 2 below shows the time and predecessors of each task.

TASK	TIME (DAYS)	PREDECESSORS
A. Discuss Topic	1	-
B. Assign Task	1	A
C. Develop BP/HR Generator	2	B
D. Develop Inflate/Deflate	2	B
E. Develop BP Category Graph	2	C, D
F. Design Base UI	2	E
G. Design Photos UI	2	F
H. Design Watch UI	2	F
I. Draw Diagrams and Charts	3	G, H
J. Calculate Budget Sheet	1	B
K. Usability Testing and Survey	3	G, H

Table 2 "PERT Chart Table"

Based on the table above, we estimate we need to spend 13 days to finish the project, as shown in Figure 11.

Figure 11 "PERT Chart"

7. Prototypes

The following sections will discuss in detail the actual implementation of the 2 UIs. To simulate readings of different ages and conditions, a settings panel is created for users to test the app under different conditions. Besides, a screenshot of a person's upper arm with a rectangular cuff on is also placed by the app UI to imitate the scene. The cuff's color will become darker as the monitor starts to function as feedback. Therefore, in each prototype, 3 components will be presented: UI, settings panel, the upper arm scene.

As for the reading generations, both prototypes share a common code. Depending on the age, High Cholesterol, Cardiovascular Disease, and smoker values of the settings panel, SYS, DIA, HR values will be randomized within a certain range. Then, based on the SYS and DIA values, BP categories are assigned. For example, the older the age, the higher the random min and max. Thus, the more dangerous BP categories are assigned.

Moreover, both prototypes also share code that counts the button clicks and outputs the result to an .csv file as log data. This file will be used for usability and performance analysis as users are asked to play around with the app during the survey.

7.1 Smartphone App UI

For the smartphone app, it comes with a settings panel and a screenshot of an arm with a simile of a cuff. The smartphone app UI display is separated into three parts; the data results that will show the measurement results of the Systolic, the Diastolic and the pulse, the start button that will start the recording and the graph that shows the results.

The results section is on the top part of the phone screen which shows the default zero until the start button is pressed. When the button is pressed the Systolic number will go up and down showing how the BPM is recording the user's blood pressure. After the results are done, on the right side of the results will have a description of what the numbers will mean such as Optimal, Normal, High-Normal and the three grades of hypertension. The start button lays on the middle of the screen for easy spotting. Lastly, to display the results in a more easy to understand manner, there is a graph on the bottom of the screen that places a circle where the user's category in their results lay.

Figure 12 "Smart Phone App UI"

7.2 Smartwatch App UI

Like the smartphone app, the smartwatch app also comes with the same settings panel and a screenshot of the arm with the cuff on. Obviously, the UI of the app is quite different. Since the smartwatch has a display-size disadvantage naturally, multiple challenges must be overcome when implementing an equally functional app as the mobile version.

First of all, the information provided by the apps must be equivalent. Squeezing the text word for word into a much smaller screen is possible but obviously unusable. The text will become too little for the users to read. To address this issue, this prototype adopts two approaches to hopefully lower the density of the content on the screen: use multiple screens and appropriate substitution.

With the multi-screen approach, the app's functionality is distributed into 3 pages. Each page only serves a simple purpose which not only lowers the information density but also avoids excessive information deviating the users from their purposes. In this case, the first as Figure 13 shows is called "Start Page" which enables the monitor to start to measure with the "START" button pressed. The second page is called "Result Page" which displays the readings after the measurement as Figure 14 shows. Finally, Figure 15 "Graph Page" illustrates each of the previous measures using line segments which is an extra feature compared to the smartphone UI. The top endpoint of the line segment represents the SYS value and the bottom endpoint represents the DIA value. To navigate among the 3 pages, the button in green enables users to go back to the Start Page and the blue button takes the users to the Graph Page. Compared to the wireframe proposed, "Result Page" and "Graph Page" were supposed to be on the same page, and the way to navigate between the two is through a

scroll bar as discussed earlier. However, due to the project being developed with Processing 3.5.4, drawing different elements on the screen as page switches are much more feasible than moving elements up and down with a scroll bar. As a result, this action might cause a downside of this UI as more memory load is required on the user side to learn about the pages.

Additionally, to further replace text usage, the appropriate substitutions are in places, such as icons, colors, and abbreviations. The back button uses to represent "Back" and the graph button uses to represent "Graph". Besides, different colors are used to represent the BP categories as Figure 16 shows. Ideally, experienced users should be able to identify each category based on colors only which eliminates the use of a graph like in the smartphone prototype. However, for those who are new to the App or color blind, color indication is not enough. Thus, abbreviations of the BP categories are added in to be more specific which can also fit into the limited spaces. Since icons, colors and abbreviations are used instead of plain text in English, some people might have difficulties understanding them. Unfortunately, this is the trade-off between clarity and simplicity for small screen devices.

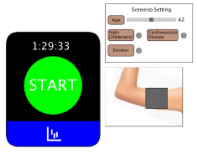


Figure 13 "Start Page"

Figure 14 "Result Page"

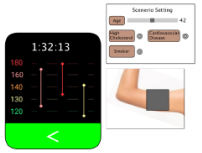


Figure 15 "Graph Page"

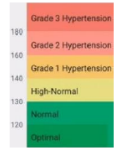


Figure 16 "Color Indication for BP levels"

8. Survey

In this part of the report, we will detail what each part of the survey is designed for. Here is the link to access our Survey Questions online: https://forms.gle/8kFyJkRpjkp3ymG87.

8.1 Tell Us About You

Firstly, this part of the survey is to gather information on the Application users. We will only gather their age, gender, Blood Pressure measuring habits, Heart Rate measuring habits and if they own a Blood Pressure Monitor.

8.2 Smartphone Blood Pressure Monitor UI Questions

The next part is designed to get the user's inputs on the Smartphone Blood Pressure Monitor UI. In this part, we ask the user to upload their usage logs. Then after another series of basic questions was asked with a Likert Scale. Afterward, the users will be asked to upload a log for a test scenario according to what we designed in the survey.

8.3 Smartwatch Blood Pressure Monitor UI Questions

This part of the survey is designed the same as the above but the only difference is it's for the Smartwatch Blood Pressure Monitor UI.

8.4 What is Your Preference

This question is to ask what the user's preference is after they have used both UI Applications.

8.5 Any Advice

Finally, we will ask a final advice question to get some advice from our users to make future improvements to the UI.

9. Survey Result Analysis

9.1 Participants

There are 11 participants in this survey. Among them, two were 19-24 years old, five were 25-34 years old, two were 41-56 years old, and two were over 56 years old. Four of them are women, and seven are men. Most of them said that they never measured their blood pressure and heartbeat. Furthermore, most of them do not own a blood pressure monitor of their own.

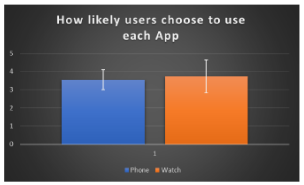


Figure 22 "Mean of Probability Continue to use the App"

9.3 Two Scenarios Comparision of Phone

As we mentioned in 3.2 before, we prepared two scenarios to test which button is the most important for our participants in different scenarios. The first scenario is participants do not know anything about our app. The second scenario is participants become familiar with our app. We count the numbers participants press on each button in the phone UI based on this purpose.

The phone UI has four buttons (High Cholesterol Button, Cardiovascular Disease Button, Smoker Button, and Start button). Below two figures represent the multiple comparison testing of the HC button. Figure 23 is the result of the first scenario. Figure 24 is the result of the second scenario.

HC_Button_Counter

Student-Newman-Keuls[a,b,c]

Age_Group	N	Subset 1
4	2	.5000
2	5	.8000
1	2	1.0000
3	2	1.5000
Sig.		.864

Figure 23 "First Scenario HC Button of Phone UI"

HC_Button_Counter

Student-Newman-Keuls[a,b,c]

Age_Group	N	Subset 1
3	2	.0000
1	2	.5000
4	2	1.0000
2	5	1.4000
Sig.		.660

Figure 24 "Second Scenario HC Button of Phone UI"

As you can see above, the highest score age group of the first scenario is group 3(41-56 years old). On the other hand, the highest score age group of the second scenario is group 2(25-34 years old). However, a higher score does not mean the HC button is more important to these two age groups. Since all age groups are in subset1, the importance of the HC button to them is the same.

Below two figures represent the multiple comparison testing of the CD button. Figure 25 is the result of the first scenario. Figure 26 is the result of the second scenario.

CD_Button_Counter

Student-Newman-Keuls[a,b,c]

Age_Group	N	Subset 1
1	2	.5000
4	2	1.0000
2	5	1.2000
3	2	2.5000
Sig.		.761

Figure 25 "First Scenario CD Button of Phone UI"

9.2 Usability Testing

In the survey, we purposely asked participants about the time it takes to become familiar with the UI, the color contrast of the UI, whether the spacing between elements is enough, whether the APP is easy to use, and whether they are willing to continue using our APP. A total of five questions to help us better complete usability testing.

9.2.1 Time spent getting familiar with the UI

For getting familiar with our UI, both UIs have excellent performance. As shown in Figure 17 below, 73% of the participants said they could be familiar with the UI of the phone within 1-3 minutes, and only 27% said that it would take 3-5 minutes.

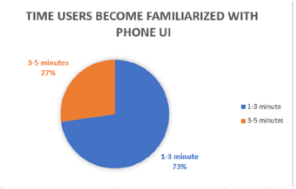


Figure 17 "Time Users Become Familiarized with Phone UI"

Similar to above, 82% of the participants indicated they could become familiar with the UI of the smartwatch within 1-3 minutes. Only 18% said they need 3-5 minutes, as shown in Figure 18.

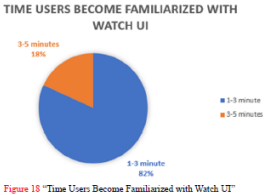


Figure 18 "Time Users Become Familiarized with Watch UI"

9.2.2 Color Contrast

Through data analysis, participants were more satisfied with the color contrast of the smartwatch UI. As shown in Figure 19, the mean of the phone UI is 4, and the mean of the watch is 4.45.

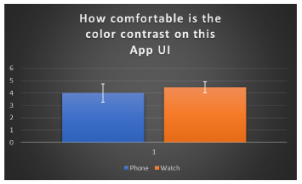


Figure 19 "Mean of Color Contrast"

9.2.3 Space Sufficiency

Based on our calculations with the data, our participants prefer the spacing of the smartwatch. The phone UI has a mean value of 3.18. On the other hand, the watch UI has a mean value of 3.45, as shown in Figure 20.

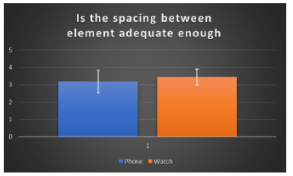


Figure 20 "Mean of Space Sufficiency"

9.2.4 Ease of Use

The phone UI has a slightly higher mean for ease of use than the watch UI. As you can see in Figure 21, the phone UI has a mean value of 4.18, and the watch UI has 4.09. It may be because the phone UI only has one screen to show results, which has less complexity than the watch UI.

Figure 21 "Mean of Ease of Use"

9.2.5 How Likely Continue to Use Our App

Based on data analysis in Figure 22, participants have a slightly more probability of continuing to use the watch UI than the phone one. As you can see, the mean of phone UI is 3.55, and the mean of watch UI is 3.73.

CD_Button_Counter

Student-Newman-Keuls[a,b,c]

Age_Group	N	Subset 1
3	2	.0000
1	2	.5000
2	5	1.2000
4	2	1.5000
Sig.		.858

Figure 26 "Second Scenario CD Button of Phone UI"

The highest score age group of the first scenario is group 3 (41-56 years old). On the other hand, the highest score age group of the second scenario is group 4(above 56 years old). If we look carefully, we can find the score of age group 3 in the first scenario is much higher than other age groups. However, all age groups are still in one subset, which shows the CD button still has the same importance for them.

Below two figures represent the multiple comparison testing of the Smoker button. Figure 27 is the result of the first scenario. Figure 28 is the result of the second scenario.

Somker_Button_Counter

Student-Newman-Keuls[a,b,c]

Age_Group	N	Subset 1
2	5	.6000
1	2	1.0000
4	2	1.0000
3	2	2.5000
Sig.		.439

Figure 27 "First Scenario Smoker Button of Phone UI"

Somker_Button_Counter

Student-Newman-Keuls[a,b,c]

Age_Group	N	Subset 1
3	2	.0000
1	2	.5000
2	5	.6000
4	2	2.0000
Sig.		.331

Figure 28 "Second Scenario Smoker Button of Phone UI"

The highest score age group of the first scenario is group 3(41-56 years old). On the other hand, the highest score age group of the second scenario is group 4(above 56 years old). We can see both scores of the highest age group are more than two times higher than other age groups. However, the result shows the smoker button still has the same importance for all age groups.

Below two figures represent the multiple comparison testing of the Start button. Figure 29 is the result of the first scenario. Figure 30 is the result of the second scenario.

Start_Button_Counter

Student-Newman-Keuls[a,b,c]

Age_Group	N	Subset 1
4	2	1.5000
1	2	2.5000
3	2	2.5000
2	5	3.2000
Sig.		.947

Figure 29 "First Scenario Start Button of Phone UI"

As you can see above, the highest score age group of both the first and second scenario is group 3(41-56 years old). The result shows the graph button has the same importance to all age groups.

10. Future Improvements

10.1 Smartphone App UI

While the smartphone app UI replicated most of the wireframe, there are more improvements that could be made towards the app. The settings section should be placed as the first screen before starting the monitor. Doing so will allow for the user to know that is where one's own information is considered for the BPM results. In placing the settings into the phone, the checkboxes for the different consideration for the user should be more obvious when clicked.

Beyond the project scope the graph that displays the results should have another page that records the past results to have the user see compare the past results to the current results.

10.2 Smartwatch App UI

The only objective that this prototype did not achieve compared to the wireframe is the dynamic historical data diagram. Currently, the graph on the "Graph Page" is just a .JPG image. Eventually, the line segments will update according to the latest measured readings. Since the graph only contains a summarized version of the readings, users must be able to view each individual reading in more detail on a separate page. Besides, when the records keep populating, one screen will not fit all the line segments. Thus, for example, the graph should be able to scroll horizontally. Unfortunately, a full on implementation of the dynamic graph requires more time and effort.

To go beyond the project scope, multiple new features can be implemented. For example, according to the diagnosis, the App can provide reasonable suggestions on users' daily routine, lifestyle and diet. In addition, a doctor page can be implemented to allow users to share the statistics with their family doctors. The doctors can also chat with the users directly through the App.

To further optimize the interactions, more gestures can be utilized such as drag and swipe. Dragging across the screen can be enabled to scroll the page up & down which will allow more content to be put on one page. Swiping up, down, left, and right, can be used as the new method for users to navigate through different pages. Thus, the back and the graph buttons are no longer required which releases room for more content.

10.3 Survey

Based on observations, most of the survey participants showed signs of exhaustion and loss of patience as they tended to skip downloads or upload random unwanted files. Not taking the survey seriously makes sense since the project is not in their interest in any way. In other words, the development team must provide survey participants with enough incentives and support. In the next round of survey, the project team plans to reward every participant with $5 for them to buy a cup of coffee. In addition, every survey will be conducted over Zoom. By monitoring and passively assisting the participants, confusions can be clarified as quickly as possible. Also, any attempts to ruin the survey results can be avoided.

Another main factor that was causing this issue is the length and complexity of the survey process. Since the targeted audience has little knowledge of computer, the instruction must be clear and precise which makes the questions longer to some degree. As a result, the questions are clear and precise, but the participants will just not even bother to read them through. Therefore, the team must look for other methods to communicate such as playing a video instruction, or conducting a QA section to fill out the survey questions for the participants.

11. Conclusion

In conclusion, this report describes the smart app UIs and the survey data analysis. Market research on the feasibility of the app UIs and how the prototype is made and designed. Thereafter the survey was made and analyzed for strengths and weaknesses of the two app UIs. Based on the survey results, the participants preferred the SmartWatch app over the SmartPhone app.

Report sample 2

Abstract

This is a project for design of two chat windows prototypes. Through this chat windows design compression project, we can see that different web designs bring different sensory experiences to different people.

This project has three parts, which are pre-production, prototype, and user survey.

Pre-production

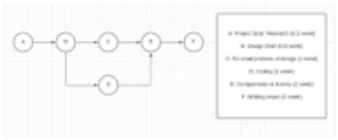
In this age of information explosion, social network applications are potential products. Everyone need to social. Advertising is a good way to make money (The Siliconreview, 2019). Refer to the Snapchat or LinkedIn, they all make money through advertising in their social network, and the Return on Investment is positive (Newberry, 2019).

There apps are chat applications. The target customer is the people who want to communica and chat with other people.

The project will fouces on designing chat windows. As the draft shows that there are two kinds of styles. The first one will show the name and message sent time, and those texts will show on left.

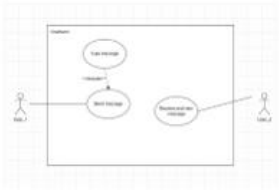
The second design will show the user head portrait, and the texts will display on left side and right side. The sender's texts will display on right side and the receiver's texts will show on left side.

Here is the PERT chart. The project develop process will follow the chart. For example, after the design draft finished, the programmer will start coding. During the coding process, the draft will still keep fixing small details.



Here is the state diagram. It will show the project develop process.

Here is the use case diagram. The user 1 can type and send messages. The user 2 will receive and view messages that sent from user 1.



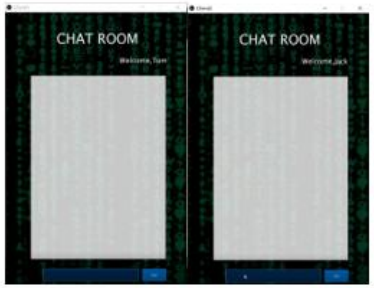
Here is the budget sheet of the project.

Budget Sheet	
Server & Monitor	$1,250
Storage	$1,000
Salary	$5,000
Keyboard & Mouse	$500
Total	$7,900

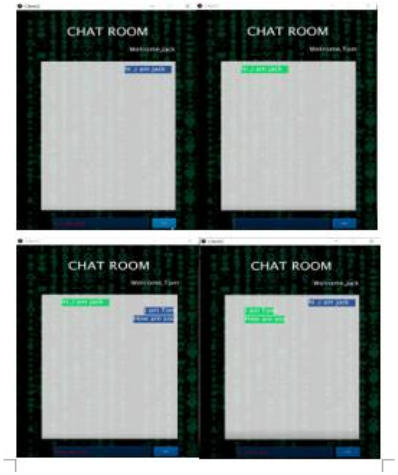
Prototype

Design_1

Here is the style of design 1. The windows style is same expecting the name at top right corner.

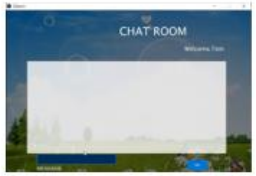


Here is style after user chatting. Jack sent a message to Tom. This message will show on the right side. Tom received the message and the text will display on the left side.

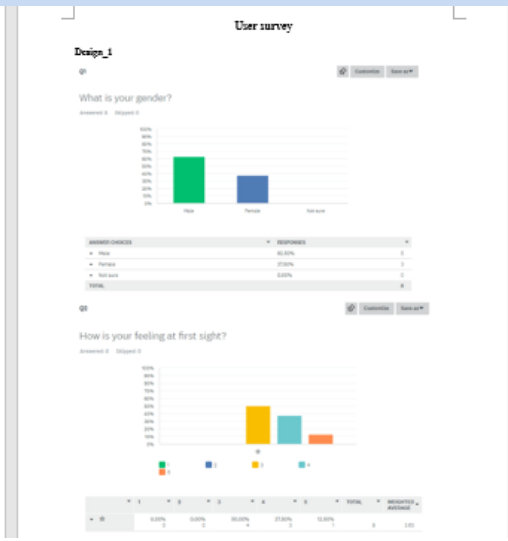


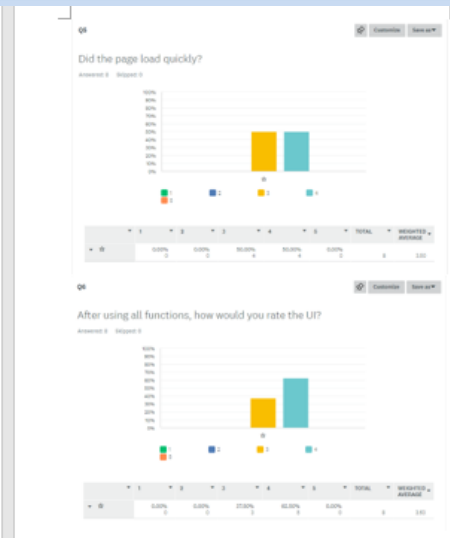
Design_2

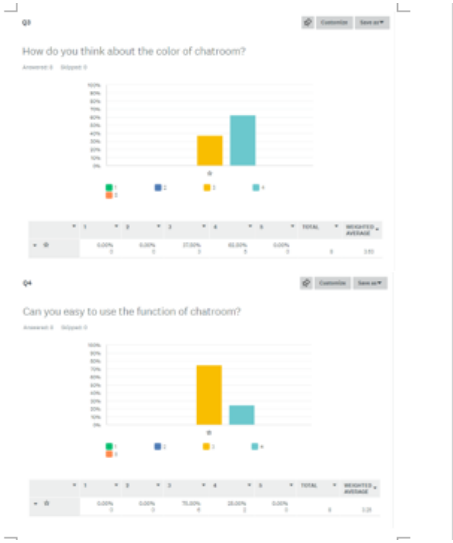
Here is the second design. The base design such as chatbox, text display area are same. The change of the design is the text display.



For example, Tom sent a message. The message will show as blue on text display area, also coming with special sending time. On the window of receiver Jack, the text will show as green.







User feedback

- The color of design 2 is not clear, which sometimes cannot indistinguishable
- At the design 1, the background is too dark, maybe a lighter color background is better
- At the design 1, this font does not display well. It would be better to change it to a clearer one or make it bigger

Conclusion

By designing two different style windows of chat application, it shows that different design styles have different effects on different people.

In the future, it will continue to discovery more different style of chat application windows, which meets more people's aesthetic preferences.

Reference

Newberry, Christina. (2019, September 29). *How to Prove and Improve Social Media ROI (+ Free Tools)*.
https://blog.hootsuite.com/measure-social-media-roi-business/

The [illegible]. (2019, June 03). *How Do Social Media Apps Make Money?*
https://thesiliconreview.com/2019/06/how-do-social-media-apps-make-money/

Comparative UI design & Testing

Each team must come up with 2 prototypes with different user interface designs presenting the same/similar contents, and complete a comparative analysis through user studies.

- **Formalize your team! Team size: 1 to maximum 3 members**

- **Design applications with two different user interfaces with same/similar contents**
  - To perform comparative usability testing analysis, you must develop two separate prototypes with same/similar content showing different user interfaces.
  - **Feel free to re-use/change your project 1. Feel free to combine projects of team members**
  - Feel free to choose your own development tools/language (e.g., Processing pde, C++, Java, Python, JavaScript, C#, Unity etc.) as long as your prototype includes (a) minimum 5 user interface components to provide various user interactions (b) object-oriented mechanism (parent-child classes), (c) array of class-based objects, (d) data generation (file I/O) to trace/analyze interesting motion (e.g., user interaction to evaluate speed/accuracy, object movement x, y coordinates etc.)

Team Project Coding Technical Requirements

- Should define a project goal, target customer, and usability of your project design.
- If reusing Project 1, you must add minimum 60% new/different contents
- Should include following techniques;

1. Simulation(or Game levels) Full cycle: Start screen > main play screen> End screen)
2. Data structure & algorithms
    1) Incorporate Finite State Machine (minimum 3-4 states, next week's topic) [10 points]
    2) Incorporate both search and sort algorithm to find an interesting movement pattern of specific objects. An example could be to search/find a coordinate of a specific object through a user input (e.g., object location, how many enemy objects destroyed) . Record random movement of objects showing x, y coordinates, compare movement ranking, and generate a sorted output to an external file.
    3) Loops (while, for), noise( ), random( )
    4) Conditional statements (if, else, else if, or switch)
    5) Static array[ ] & ArrayList
    6) Stack (multiple Must design/apply (e) push and pop stack structure to properly associate hierarchical objects to build gestures for 2D transformation.
    7) Separate class designs including multiple Inheritance (parent-child) including minimum 3 levels (grandparent-parent-child), abstract class and interface class.
    8) Multiple custom function/method blocks & mouse interaction and keyboard interactions
    9) Minimum 5 Custom UI components (e.g., slider, button, text box, bar graph etc.)
3. Team report + usability testing video (YouTube link or video files)
4. Creativity, completeness and uniqueness (No snake game ever!)

Submission

Part I Prototyping (60%): Submit **two prototypes** (including all source codes, images, sound etc.)

Part II. Report MS Word, MS Excel & MS PowerPoint presentation (40%)

a) On your report, describe pre-production: background research, wireframe sketch, 4 UML diagrams (Class diagram showing inheritance, Use case, State, and Sequence diagrams)

b) Describe development process of two prototypes (feel free to re-use your writing from Project 1)

c) Design a survey (e.g., 1-5 Likert scale) based on 5 UI factors (e.g., interface design rules), and find out user feedbacks from minimum 10 people comparing your two designs along with user profile section.

d) Write data analysis: Use MS Excel to find (1) a confidence interval and (2) to generate confidence intervals with error bars on bar charts and (c).

   a) In addition, interview each user, document it, and write a short analysis showing comparative user satisfaction feedback revealing strength, weakness, and future improvement of each design.

   b) **Experimental design** measuring **user performance** (e.g., measuring accuracy and speed)

   c) **Survey** (e.g., preference) to compare two different UI designs

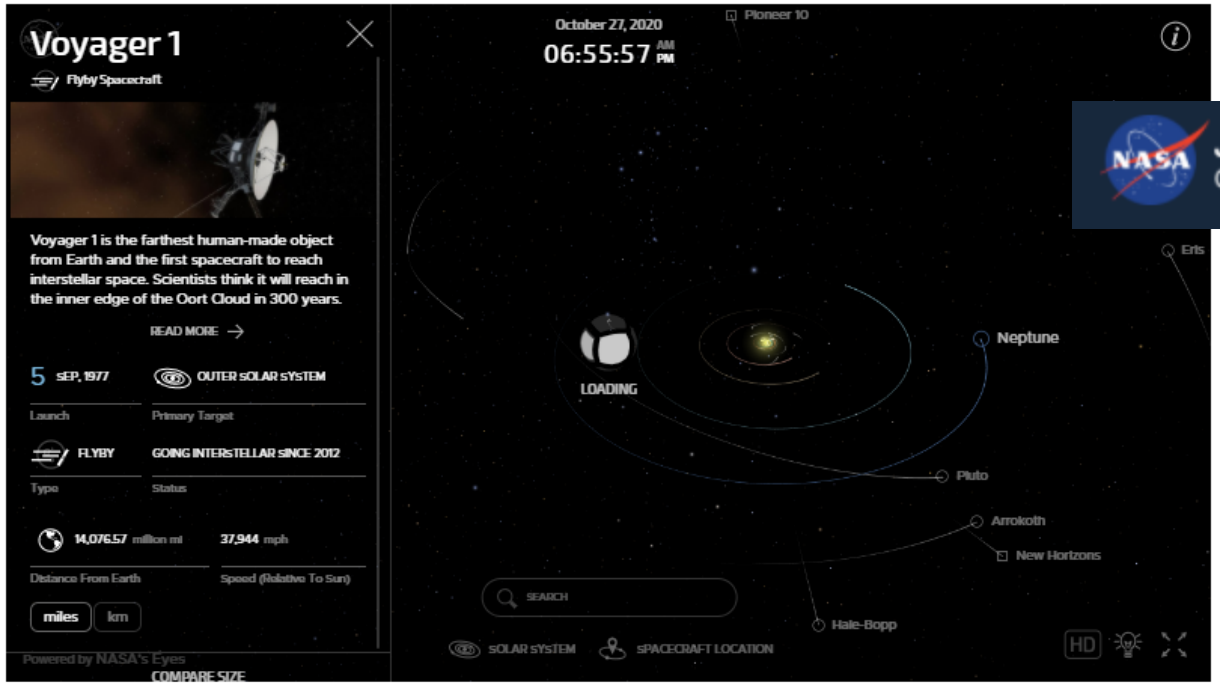
   d) **Data analysis** to compare two different UI designs: Not just comparing means, but must use an advanced techniques involving p-value (e.g., Independent sample t-test, Two-sample t-test or ANOVA)

UX Study Overview Template

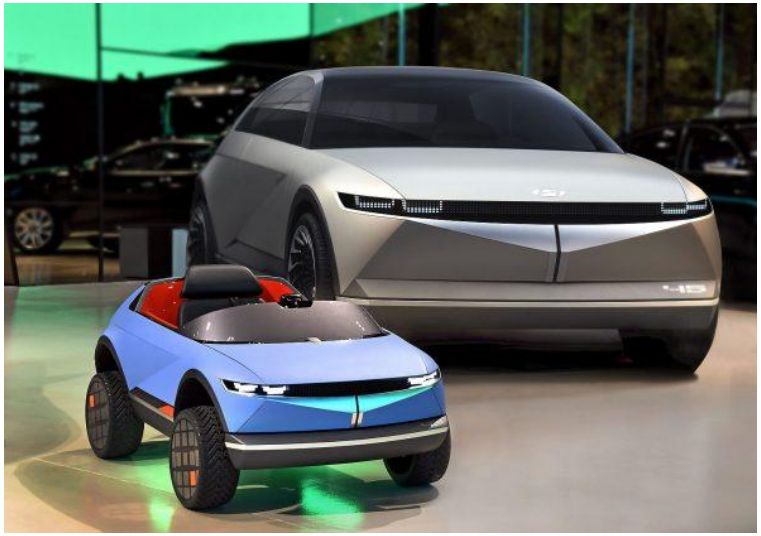
Team project idea

UI design in 2D+3D environment

- Virtual reality market trend
  - Here's why you will be hearing more about virtual reality
  - BC's $125 million tech fund
  - BC Interactive Digital Media Tax Credit
  - Vancouver VR/AR ecosystem
  - AR/VR for aerospace industry
    - CANADA'S KEY AEROSPACE CENTRES



To learn more about Voyager, zoom in and give the spacecraft a spin. View the full interactive experience at Eyes on the Solar System. Credit: NASA/JPL-Caltech



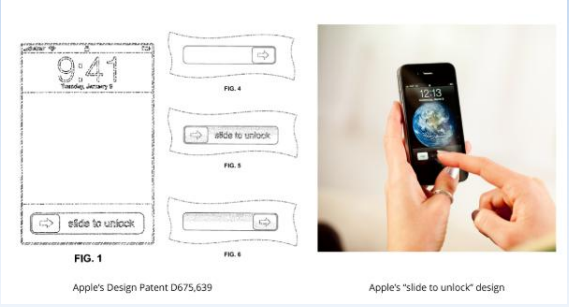
[Smart car cockpit UI for kids?]

Core Project Concept

1. Focusing on literature review, project proposal, and business/marketing plan. Your report should include following sections;
   a) Research a target industry for your prototype application
   b) Investigate any existing products.
   c) Include wireframe/sketch of your product
   d) Identify output formats (e.g. mobile, desktop VR, AR etc) for your product.
   e) Include a budget sheet (etc. work hours, hardware + software cost, marketing cost etc.)
   f) Investigate any potential market value, client, promotion strategy, and/or seller place.

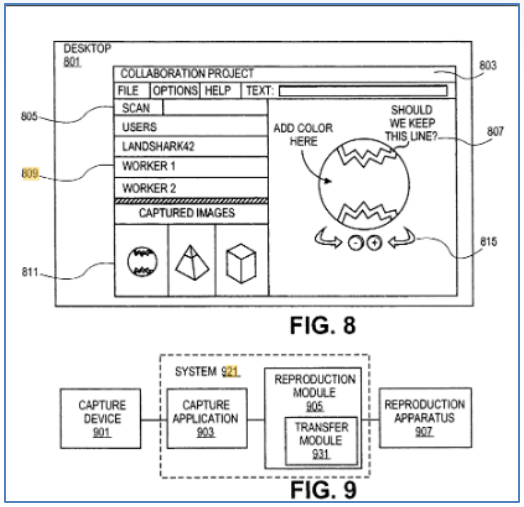
2. Design a simple prototype (either using Java Processing library, Unity 3D, or any other language/tool)
   – Your prototype application must show graphic simulation of both **GUI controller** and 3D objects/environments

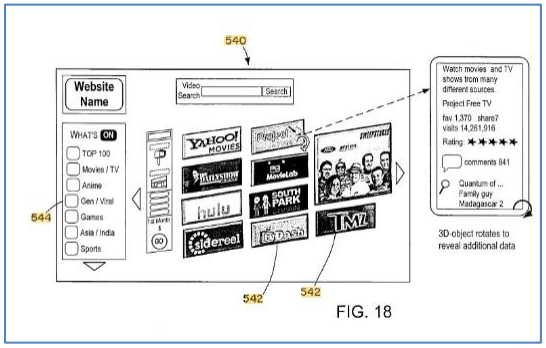
Patent example



Apple's Design Patent D675,639

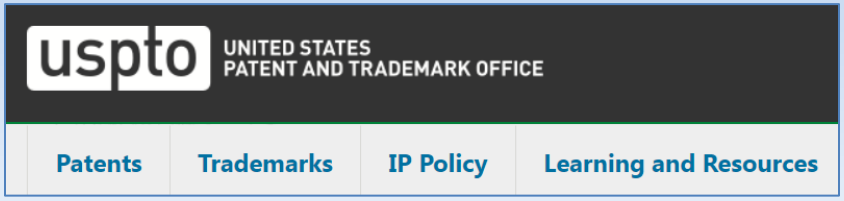
Apple's "slide to unlock" design

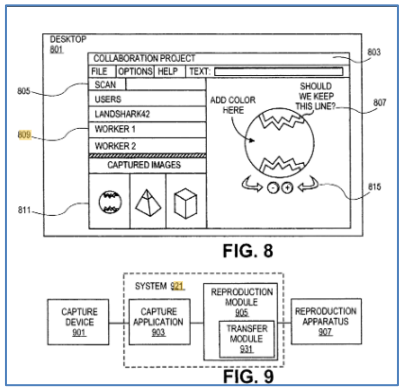


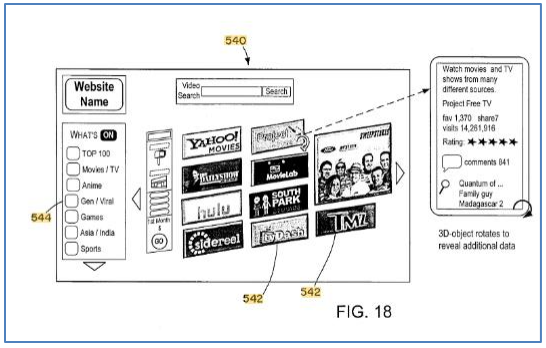


- Swipe To Patent: Design Patents In The Age Of User Interfaces
- Microsoft Seeks a Patent for an All-New 3D Mobile Device GUI
- Apple Wins a Patent for a 3D User Interface using Depth Sensors
- Samsung Patents 3D Display With Image Recognition, 3D User Interface

Patent guideline







[Design patents hot in GUI/UX]

[What is the Difference Between Copyright, Patent and Trademark?]

[GUI Design Patents: What to know]

- [Can You Patent Your Mobile App?]
- [How You Can (but shouldn't) Patent an App Idea]
- **[Filing Canadian patent applications]**
- [User Interfaces: Navigating the Patent Eligibility Landscape]
- [USPTO Classification Resources]
- [Animation Patents (Class 345/473)]
- **[Patenting Software]**
- [Protecting your Software: Software Copyrights vs. Software Patents]

Literature review

History

- 3D user interface
- New Directions in 3D User Interfaces

- Application example (VR/AR for Bakery & Coffee shop)
  - AR bakery
  - Disney patents augmented reality cakes
  - 3D bakery model
  - Cake through 3D printer
  - Burnaby bakery will offer crazy 3D punk rock cakes
  - Starbucks' first in-store augmented reality experience
  - **starbucks offers 'willy wonka' AR experience in world's largest store**

  - **Starbucks Roastery's AR game**
  - **Starbucks Holiday AR arrives on Instagram**