Project Deliverable C: Conceptual Design, Project Plan, and Feasibility Study

GNG 2101 – Intro. to Product Dev. and Mgmt. for Engineers

Submitted by

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Introduction

This deliverable is based on the creation of a prototyping test plan (prototype 1) following a specific model. This deliverable stands out for its particularity because it relates to our first prototype. The creation of a basic concept will be executed using materials and systems that cost next to nothing. It will therefore be a question for us to obtain feedback for our ideas, then to verify the feasibility and to analyze the critical subsystems to then integrate them into the system in order to reduce the risks and uncertainties. In clearer terms, below we will do our prototyping test plan, analysis and results (which include detailed images of our prototype), as well as the feedback and comments we have gathered.

Summarized Client Feedback

The following points summarize the various elements discussed with the client:

- ➔ Remove the first menu
- ➔ Exclusively use the second menu for Social
- ➔ Replace the back button with "Exit"
- ➔ Will not be using external applications such as CMUS or MUTT. We will integrate all the features directly into the app with the help of libraries.
- ➔ Focus on clicking sequence rather than functionality

Updated and Detailed Concept Design

User Interface / User Experience

In order to provide a good user experience and user interface, we will make sure that the user interface is intuitive and simple to use. This will be accomplished by implementing the features directly into the app, rather than using external applications suchs. Also, we will make sure to use a color scheme which is based on the same hue. To do so, we will adjust the contrast by changing the brightness value of the colors. Also, we will make the buttons large enough so the users can easily press them.

Flow Chart Diagrams

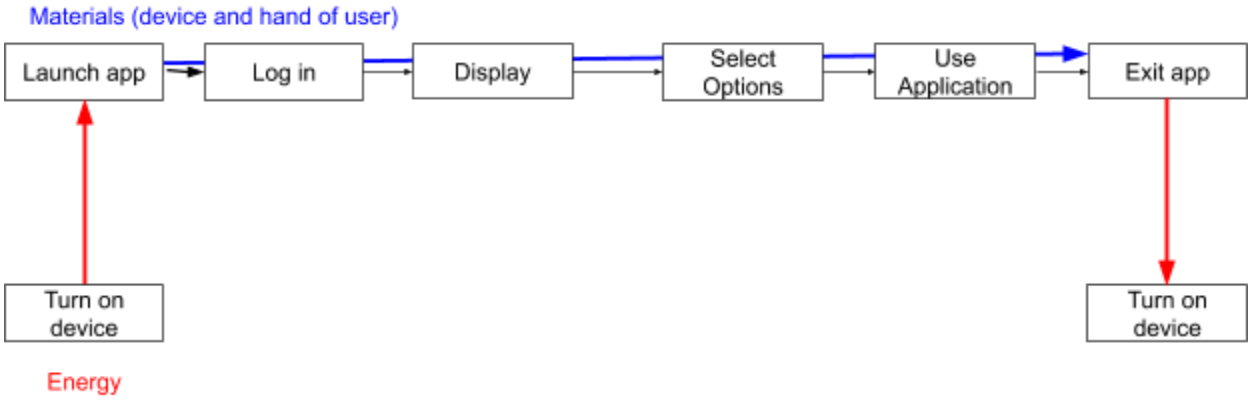

Figure 1- Flow Chart Diagram

Sub Function Critical Connections

All the sub functions are connected because they allow the user to use the Pi menu to its full potential.

Product Assumptions

Our client asked us to implement three features. He wanted us to allow the end-user to easily watch videos, listen to music and read/send emails directly on the app. In order to do so, the most critical assumptions we made were :

- We will find a library in python that lets us play mp3 and wav files. Also, this library would let us pause/play the song and adjust the volume.
- We will find an email parser/writer library in python to simplify the email reading and writing implementation.
- We will be able to integrate video playing in our Tkinter app. We will also be able to pause these videos and adjust the volume if necessary.

The email client would be embedded in the Pi Menu window instead of another terminal window

Prototype Creation and Documentation

Prototypes allow communication, learning, integration and the recognition of milestones. Using the low fidelity prototype produced in this deliverable, a physically focused prototyping process is used to test the functionality or various screens using a system that mimics the actual product. This is

accomplished using powerpoint to imitate the basic functions of the product, which will be documented below, and then tested further on in the deliverable.

Prototype

Figure 2- Prototype When Not Running presents the powerpoint that hosts the prototype from the creator/editors view. Using powerpoint, a prototype was developed to mimic the transitions between the slides and simulate using the actual application. In the picture, all the slides can be seen and the "illusion" of an app is not apparent. This changes when the powerpoint is being played.

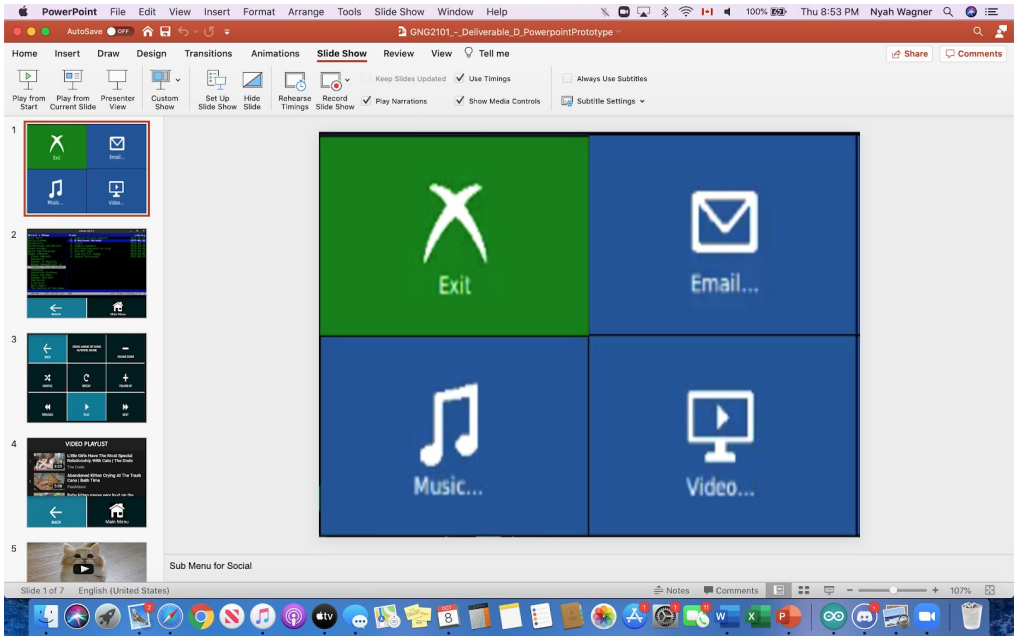

Figure 2- Prototype

Prototype Purpose

With the first prototype, we want to show the client a preview of the app in order to get his feedback on multiple factors. Firstly, we want to know if the user interface is well adapted for the users. This includes the contrast of the colors, the brightness of the screen and the size of the buttons and the text. Secondly, we want to test the user experience. We would like to see if all the features are easily accessible by the user. Also, we want to see if the platform is user-friendly enough for our target users. In order to evaluate this, we want the user to try the prototype on the PowerPoint and try to access all the features.

Prototype Functionality

We designed the first prototype using PowerPoint to recreate the different menus on the final product. *Figure 3 - Progressive Selection Prototype Display* shows the different interface displays of the Pi Menu prototype in the order of progressive selection. The link for the powerpoint itself is https://drive.google.com/file/d/1sAaAif5OtnE54i6XCjiTwLbYNlcRhZZy/view?usp=sharing as well as being included in the Deliverable D submission. The prototype works essentially the same as should the final product minus certain key components that allow the use of the applications. Clicking on the different buttons in the powerpoint, which imitates the screen of the Pi Menu, the user can click and direct themselves to different "areas" of the menu which are actually other powerpoint slides. An example of this would be when the cursor clicks email on the first slide, it directs the user to the powerpoint slide that displays the "email list" (a picture of an email list used to imitate a functioning inbox), as well as the back and main menu page. If the user then clicks on an "email", the user is then taken to the slide with said email (a picture of an email). *Figure 4 - Program Decomposition* exposes the web of the buttons and where the user is directed for each button.

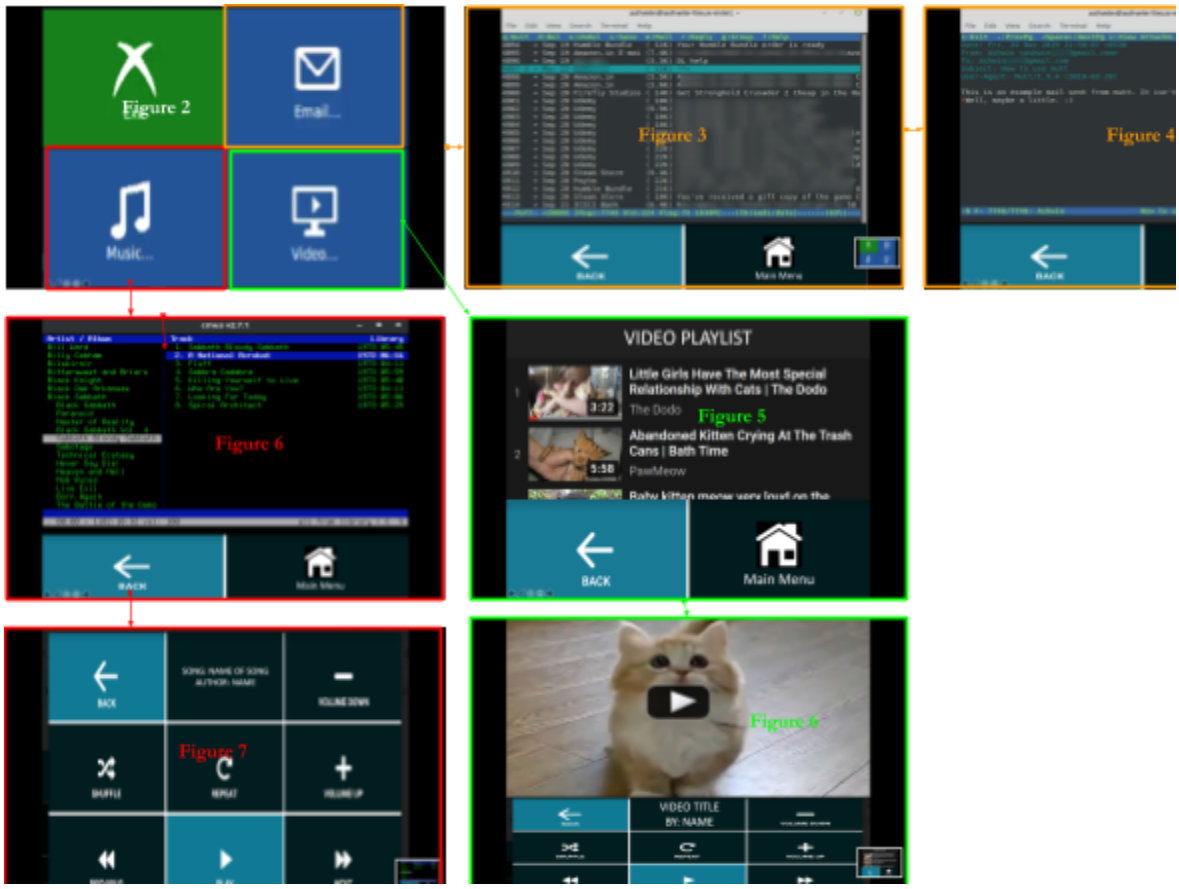

Figure 3 - Progressive Selection Prototype Display

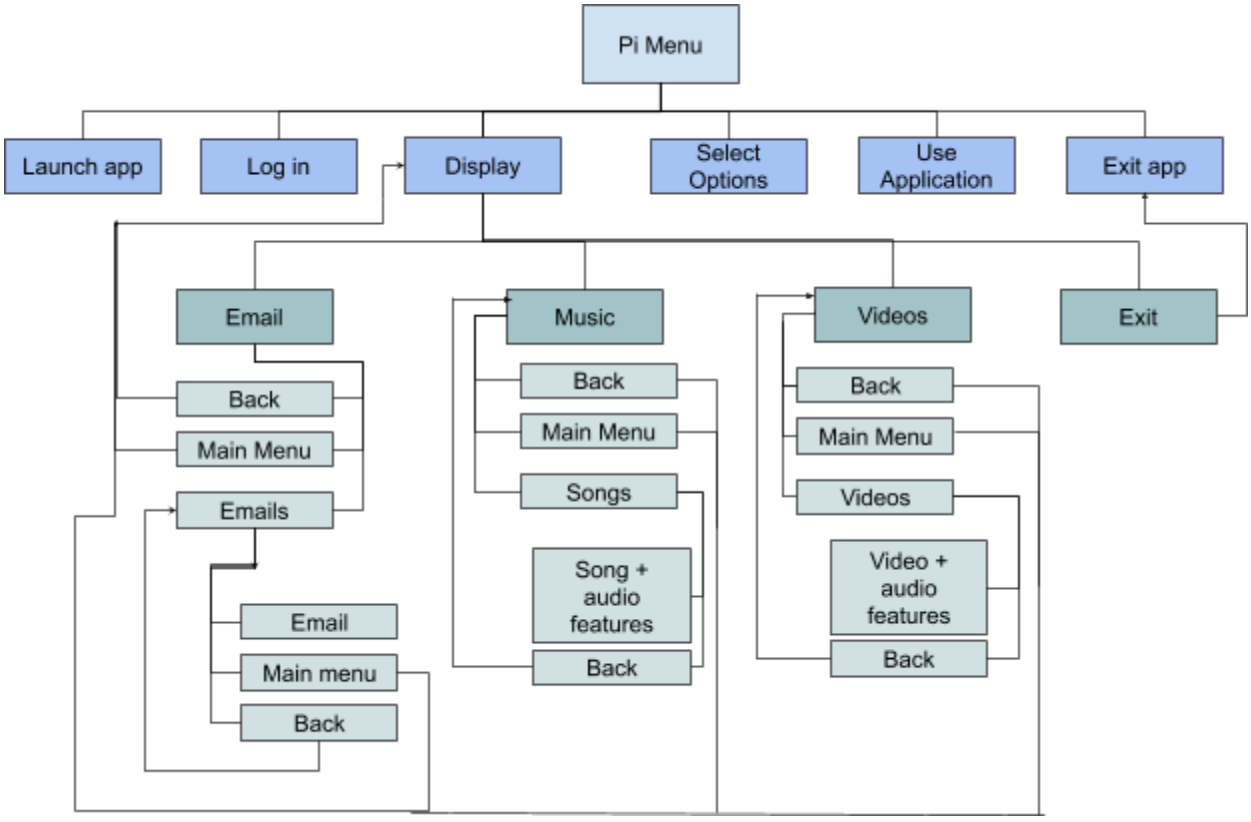

Figure 4 - Program Decomposition

Prototype Testing

Documented Testing Results

Table 1 - Expected and Actual Results

	Expected	Actual
Success Rate (**Success rate/ completion rate:** is the percentage of users who were able to successfully complete the tasks.)	Task is to reach the playlist page and return to the main menu. We expect 5 out of the 6 (83.33%) team members to successfully complete this task with no assistance.	6 out of 6 (100%) members were able to complete this task with no assistance. This went well beyond our expectations and we are very pleased.
Number of errors (This metric provides an idea	We are expecting to have non errors	In the prototype, there are no errors, however this prototype

about the average number of times where an error occurred per user when performing a given task.)		does not fully represent the finished product. Because of this, errors might appear in further developed prototypes that are more complicated.
Time Based Efficiency (Time it takes to complete one task). In our case, we tested the time to reach the music app, the video app and the mail app from the main menu.	5 seconds	3.2 seconds
Average User Satisfaction Scale (On a scale of 1 to 10) (How many members of the team are satisfied with the design)	6.6	7*tested with team members and satisfaction tabulated
System Usability Scale (out of ten)	9.2 We expected the average usability reported by the test users to be 9.2 given the fact that this is our first prototype.	9.8 Each member of the team gave the usability of the menu a score on a scale of ten. The average score was 9.8

Analyzation and Evaluation of Performance

At first, we believed the prototype would be: effective, efficient and satisfactory to a majority of users. Our testing involved having multiple members of our team go through the prototype in order to test various aspects of the user experience. After extensive testing, we discovered that our design was actually quite intuitive. The results can be seen in the table above.

We measured effectiveness through the System Usability Scale. We measured the efficiency through the Time Based Efficiency. Finally, we measured the Satisfaction of users through the Average User Satisfaction.

Success Rate

6 out of 6 (100%) members were able to complete this task with no assistance. This went well beyond our expectations and we are very pleased with the results.

Time Based Efficiency

3.2 seconds was the average time it took the testers to complete one task. This went well beyond our expectations and showcases how efficient our design turned out to be.

System Usability Scale

Each member of the team gave the usability of the menu a score on a scale of ten. The average score was 9.65. This went well past what our team believed would be possible. This shows that our design is intuitive and easy to use.

Outline

The intent for the upcoming meeting is to present everything worked on up to this point. Which includes:

1) The functioning prototype (*Figure 1- Prototype*). This includes our structural design of the menu.
2) Ideas regarding the implementation of certain features. These include:
    a) Aspects of the menu
    b) Ideas regarding the email functionality (MUTT implementation)
    c) Ideas regarding the music functionality

Information Gathering Procedure

We would like to gather feedback regarding our initial prototype. This will include our implementation of email and music-playing functionality. Overall, we would like to know if the client is satisfied with the quality of our work so far. Furthemore, we would like to receive feedback regarding the UX and UI aspects of our design. We will ask the client if our product is:

- Consistent
- User-friendly
- Usable
- Visually Appealing
- Efficient and clean

In order to gather the information detailed above, we will ask the client a series of probing questions:

1) How do you feel about the user experience of our prototype? Is it simple to use?
2) How do you feel about the design of the prototype? Is the text size big enough? Is the color contrast strong enough?
3) If you could change one thing, what would it be?
4) What aspect of the design do you like the most?
5) Do you feel satisfied with the direction of the Pi Menu so far?
6) Is the design easy to look at?

Preliminary Bill of Materials and Parts

A detailed preliminary bill of materials and parts (BOM) for the final prototype is featured in *Table 2 - Pi Menu BOM* below. This table presentes expenses needing purchase approval. It includes web links for each product in the BOM. Up to $100 will be given for the project.

Table 2 - Pi Menu BOM

#	Products	Price($)	Links
1	Raspberry Pi	0	https://www.raspberrypi.org/products/raspberry-pi-4-model-b/
2	Sd Card	0	https://www.amazon.ca/dp/B07F22X6C4?psc=1&th=1&linkCode=gs2&tag=darkcoder0005-20
3	Touchscreen	0	https://www.amazon.ca/SunFounder-Raspberry-Touchscreen-1024%C3%97600-Capacitive/dp/B07ZH6L9L4/ref=sr_1_5?crid=1E70806JJ2HLC&dchild=1&keywords=touch+screen+7+inch&qid=1602204907&sprefix=touchscreen+7+in%2Caps%2C300&sr=8-5
4	Power cable	0	https://www.amazon.ca/

			AmazonBasics-Power-Cord-10-Black/dp/B072LNKHBB/ref=sr_1_5?dchild=1&keywords=power+cable&qid=1602204881&sr=8-5
5	HDMI cable	0	https://www.amazon.ca/6-6feet-Lead-Snowkids-Compatible-Ethernet-Function/dp/B07K7HBZX2/ref=sr_1_5?crid=1NLBSZ5A07439&dchild=1&keywords=hdmi+cable&qid=1602204854&sprefix=hdmi+c%2Caps%2C174&sr=8-5
6	Raspberry Pi OS (Raspbian)	0	https://www.raspberrypi.org/downloads/
7	Python	0	https://www.python.org/
8	Tkinter	0	https://docs.python.org/3/library/tkinter.html
Total		0	

After analysing the BOM for the Pi Meni, it is determined that no purchases are required for the final prototype.

Project Plan Update

During the last meeting with the client, the client told us about many features he would like implemented into the Pi Menu. This includes:

- Email Functionality
- Music Playing Functionality
- Video Playing Functionality

Also, the client found the user experience very not intuitive and easy to understand in the current prototype. To enhance the accessibility of the Pi Menu, we will have to refactor the current user experience (UX) and user interface (UI). Furthemore, he would like us to remove broken features from the code.

Gantt chart

	Deliverable C: Conceptual design and project plan			Thu 20-10-01		
	Deliverable C Preparations	**5 days**	**Fri 20-09-25**	**Thu 20-10-01**		
	C1: Conceptual Design	**5 days**	**Fri 20-09-25**	**Thu 20-10-01**		
	Functional Decomposition	2 days	Fri 20-09-25	Sat 20-09-26		Nyah,Josie
	Create 3 conceptual designs	2.78 da	Mon 20-09-28	Tue 20-09-29	19	Nyah,Behra
	Analyze and evaluate concepts and choose promising solution(s)	1 day	Wed 20-09-30	Wed 20-09-3	20	Behram,Ilya
	Develop group design, visual representation, and explanation	1 day	Thu 20-10-01	Thu 20-10-01	21	Behram,Jos
	MS Project Plan	**4 days**	**Mon 20-09-28**	**Thu 20-10-01**		
	Update MS gantt chart	1.6 day	Tue 20-09-29	Tue 20-09-29		Josie
	Feasibility Study	**5 days**	**Fri 20-09-25**	**Thu 20-10-01**		
	Identify and discuss the uncertainties and risks associated with you project	2 days	Wed 20-09-30	Thu 20-10-01		Josie
	Conduct a feasibility study and provide a report that discusses each of the five T	3 days	Mon 20-09-28	Wed 20-09-3		Nyah
	Deliverable D: Detailed design and prototype 1			Thu 20-10-08		
	Deliverable D Preparations	**5 days**	**Fri 20-10-02**	**Thu 20-10-08**		
	Summarize the client feedback with changes and improvements to design	**0.5 day**	**Fri 20-10-02**	**Fri 20-10-02**		**Nyah**
	Team meeting to discuss client meet and deliverble D task dividing	0.5 day	Fri 20-10-02	Fri 20-10-02		Behram,Ilya
	Write summary of feedback for Deliverable D	0.5 day	Fri 20-10-02	Fri 20-10-02	31	Ilyas
	Develop an updated and detailed design for physical and software prototypes	0.5 day	Fri 20-10-02	Fri 20-10-02	31	Nyah
	Define critical product assumptions	1.5 day	Sat 20-10-03	Sun 20-10-04	33	Sebastian,Z
	Modify Pi Menu Code and search for suitable libraries for Pi Menu	5 days	Fri 20-10-02	Thu 20-10-08		Sebastian,Z
	Create first product prototype	**1.5 day**	**Fri 20-10-02**	**Mon 20-10-0**		
	Create Simulation Protoype on MS Powerpoint	1.5 day	Fri 20-10-02	Mon 20-10-0	31	Josie
	Carry out prototype testing, analyze and evaluate performance compared to the target	**1 day**	**Tue 20-10-06**	**Tue 20-10-06**		
	Run through and review MS Powerpoint	1 day	Tue 20-10-06	Tue 20-10-06	37	Behram,Ilya
	Provide Feedback of Presentation Prototype	0.5 day	Wed 20-10-07	Wed 20-10-0	39	Behram,Ilya
	Document MS Powerpoint	0.5 day	Wed 20-10-07	Wed 20-10-0	40	Nyah

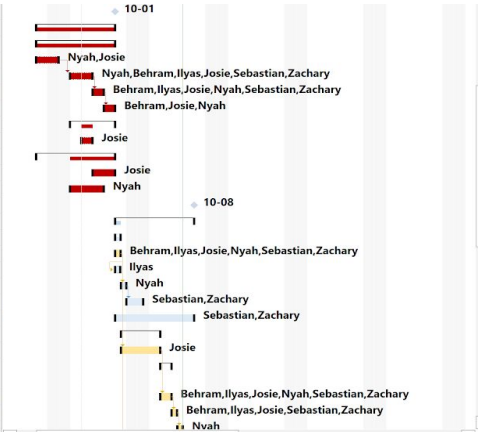

Figure 5: Gantt chart part 1

	Deliverable D Preparations	**5 days**	**Fri 20-10-02**	**Thu 20-10-08**		
	Summarize the client feedback with changes and improvements to design	**0.5 day**	**Fri 20-10-02**	**Fri 20-10-02**		**Nyah**
	Team meeting to discuss client meet and deliverble D task dividing	0.5 day	Fri 20-10-02	Fri 20-10-02		Behram,Ilya
	Write summary of feedback for Deliverable D	0.5 day	Fri 20-10-02	Fri 20-10-02	31	Ilyas
	Develop an updated and detailed design for physical and software prototypes	0.5 day	Fri 20-10-02	Fri 20-10-02	31	Nyah
	Define critical product assumptions	1.5 day	Sat 20-10-03	Sun 20-10-04	33	Sebastian,Z
	Modify Pi Menu Code and search for suitable libraries for Pi Menu	5 days	Fri 20-10-02	Thu 20-10-08		Sebastian,Z
	Create first product prototype	**1.5 day**	**Fri 20-10-02**	**Mon 20-10-0**		
	Create Simulation Protoype on MS Powerpoint	1.5 day	Fri 20-10-02	Mon 20-10-0	31	Josie
	Carry out prototype testing, analyze and evaluate performance compared to the target	**1 day**	**Tue 20-10-06**	**Tue 20-10-06**		
	Run through and review MS Powerpoint	1 day	Tue 20-10-06	Tue 20-10-06	37	Behram,Ilya
	Provide Feedback of Presentation Prototype	0.5 day	Wed 20-10-07	Wed 20-10-0	39	Behram,Ilya
	Document MS Powerpoint	0.5 day	Wed 20-10-07	Wed 20-10-0	40	Nyah
	Provide a detailed preliminary bill of materials and parts (BOM) for final prototype	1.5 days	Fri 20-10-02	Mon 20-10-05	31	Behram
	Project plan update	4 days	Mon 20-10-05	Thu 20-10-08		Josie
	Self assessment	0.25 da	Thu 20-10-08	Thu 20-10-08	41	Behram,Ilya
	Deliverable E: Project progress presentation	5 days	Wed 20-10-14	Tue 20-10-20		
	Deliverble E Preparations	**6 days**	**Thu 20-10-08**	**Thu 20-10-15**		
	Team Meeting to discuss deliverble E task dividing and contents	1 day	Thu 20-10-08	Thu 20-10-08		
	Summarize all the key components of your project deliverables to date	**5 days**	**Fri 20-10-09**	**Thu 20-10-15**		**Nyah**
	Customer Needs Summarization and Next Steps	3 days	Fri 20-10-09	Tue 20-10-13	47	Josie
	Benchmarking Summarization	3 days	Fri 20-10-09	Tue 20-10-13	47	Zachary
	Target Specification Summarization	3 days	Fri 20-10-09	Tue 20-10-13	47	Sebastian
	Design Concept Summarization	3 days	Fri 20-10-09	Tue 20-10-13	47	Ilyas
	Decision Matrix	3 days	Fri 20-10-09	Tue 20-10-13	47	Nyah

Figure 6: Gantt chart part 2

	Define critical product assumptions	1.5 day	Sat 20-10-03	Sun 20-10-04	33	Sebastian,Z
	Modify Pi Menu Code and search for suitable libraries for Pi Menu	5 days	Fri 20-10-02	Thu 20-10-08		Sebastian,Z
	Create first product prototype	**1.5 day**	**Fri 20-10-02**	**Mon 20-10-0**		
	Create Simulation Protoype on MS Powerpoint	1.5 day	Fri 20-10-02	Mon 20-10-0	31	Josie
	Carry out prototype testing, analyze and evaluate performance compared to the target	**1 day**	**Tue 20-10-06**	**Tue 20-10-06**		
	Run through and review MS Powerpoint	1 day	Tue 20-10-06	Tue 20-10-06	37	Behram,Ilya
	Provide Feedback of Presentation Prototype	0.5 day	Wed 20-10-07	Wed 20-10-0	39	Behram,Ilya
	Document MS Powerpoint	0.5 day	Wed 20-10-07	Wed 20-10-0	40	Nyah
	Provide a detailed preliminary bill of materials and parts (BOM) for final prototype	1.5 days	Fri 20-10-02	Mon 20-10-05	31	Behram
	Project plan update	4 days	Mon 20-10-05	Thu 20-10-08		Josie
	Self assessment	0.25 da	Thu 20-10-08	Thu 20-10-08	41	Behram,Ilya
	Deliverable E: Project progress presentation	5 days	Wed 20-10-14	Tue 20-10-20		
	Deliverble E Preparations	**6 days**	**Thu 20-10-08**	**Thu 20-10-15**		
	Team Meeting to discuss deliverble E task dividing and contents	1 day	Thu 20-10-08	Thu 20-10-08		
	Summarize all the key components of your project deliverables to date	**5 days**	**Fri 20-10-09**	**Thu 20-10-15**		**Nyah**
	Customer Needs Summarization and Next Steps	3 days	Fri 20-10-09	Tue 20-10-13	47	Josie
	Benchmarking Summarization	3 days	Fri 20-10-09	Tue 20-10-13	47	Zachary
	Target Specification Summarization	3 days	Fri 20-10-09	Tue 20-10-13	47	Sebastian
	Design Concept Summarization	3 days	Fri 20-10-09	Tue 20-10-13	47	Ilyas
	Decision Matrix	3 days	Fri 20-10-09	Tue 20-10-13	47	Nyah
	Feasibility Study	3 days	Fri 20-10-09	Tue 20-10-13	47	Behram
	Project Plan update	0.5 day	Wed 20-10-14	Wed 20-10-1		Josie
	Presentation Review	1.25 da	Wed 20-10-14	Thu 20-10-15	54	Behram,Ilya
	Peer Assessment	0.25 da	Thu 20-10-15	Thu 20-10-15	56	Behram,Ilya
	Deliverable F: Business model			Thu 20-10-22		

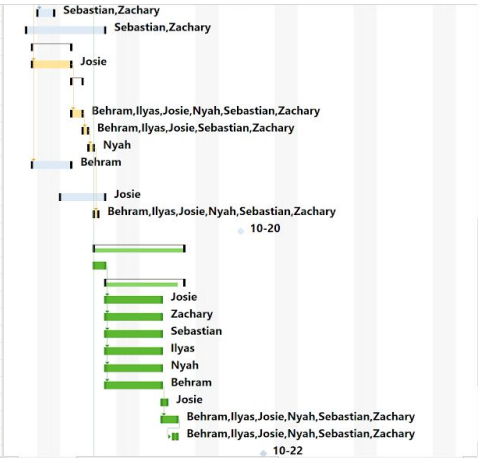

Figure 7: Gantt chart part 3

Conclusion

The detailed concept stage relating to prototype 1 allowed all of our team members to be more committed and motivated to finish the project in the sense that the theoretical and conceptual stage has passed. This allowed the production of a partial creation of our application in order to solidify ideas surrounding functionality. This brings the major challenge of creating the second prototype.