ENSC 305W/440W Grading Rubric for Project Proposal

Criteria	Details	Marks
Introduction/Background	Introduces basic purpose of the project. Includes clear background for the project.	**/05%**
Scope/Risks/Benefits	Clearly outlines project scope. Details both potential risks involved in project and potential benefits flowing from it.	**/15%**
Market/Competition/ Research Rationale	Describes the market for a commercial project and details the current competition. For a research project, the need for the system or device is outlined and current solutions are detailed.	**/10%**
Company Details	Team has devised a creative company name, product name, and a logo. Outlines relevant skills/expertise of team members.	**/05%**
Project Planning	Details major processes and milestones of the project. Includes Gantt, Milestone, and/or PERT charts as necessary (MS Project).	**/10%**
Cost Considerations	Includes a realistic estimate of project costs. Includes potential funding sources. Allows for contingencies.	**/05%**
Conclusion/References	Summarizes project and motivates readers. Includes references for information from other sources.	**/10%**
Rhetorical Issues	Document is persuasive and could convince a potential investor to consider funding the project. Clearly considers audience expertise and interests.	**/10%**
Presentation/Organization	Document looks like a professional proposal. Ideas follow in a logical manner. Layout and design is attractive.	**/10%**
Format Issues	Includes letter of transmittal, title page, executive summary, table of contents, list of figures and tables, glossary, and references. Pages are numbered, figures and tables are introduced, headings are numbered, etc. References and citations are properly formatted.	**/10%**
Correctness/Style	Correct spelling, grammar, and punctuation. Style is clear concise, and coherent.	**/10%**
Comments		

September 22nd, 2013

Prof. Lakshman One
School of Engineering Science
Simon Fraser University
8888 University Drive,
Burnaby, BC, Canada V5A 1S6

RE: ENSC440 project Proposal for Wireless Portable Hard Drive Solution

Dear Prof. One,

We are writing this letter regarding our ENSC440 Capstone project proposal. Enclosed is the proposal for our new wireless portable hard drive solution called nDrive. The project is designed to introduce a new mobile hard drive solution with wireless communication and charging technologies. The new device has several main features, including Bluetooth connection for non-volatile data storage, and wireless charging with QI standard.

The proposal provides an overview of our new device in terms of the system overview, product strengths, design considerations, project cost, and project schedules. Also, the proposal includes an introduction to our company and our talented members.

Our company NBS^2 Solution has four motivated and enthusiastic founders who are majoring in electronic and systems engineering: Junfeng Xian, Hongkyu Ahn, Andy Back, and Seung Yeong Park. We believe that our dynamic team is able to accomplish the project within the intensive schedule. If you have any questions regarding our proposal, please feel free to contact us via email at *jxian@sfu.ca* or phone at *778-862-7238*.

Sincerely,

Junfeng Xian
Chief Executive Officer
NBS^2 Solution

Enclosure: *Proposal for Wireless Portable Hard Drive Solution*

NBS^2 Solution

Project Proposal: Wireless Portable Hard Drive Solution

Project Team:

Junfeng Xian

Hongkyu Ahn

Andy Back

Seung Yeong Park

Contact Person:

Junfeng Xian

jxian@sfu.ca

Submitted to:

Lakshman One – ENSC 440

Mike Sjoerdsma – ENSC 305

School of Engineering Science

Simon Fraser University

Issued Date:

September 26th, 2013

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EXECUTIVE SUMMARY

Mr. Smith is on an international business trip to have a meeting with one of the biggest client for his company. To prepare for the trip, he has uploaded all his work related documents to his online cloud storage, so that he could easily access the files from his tablet even when he is abroad. However, while he is on a plane, he just realized that he accidentally included confidential information on the PowerPoint slides he has made, and there is no way to access the files because there are no Internet connections on a plane. Then, he remembered that his colleague gave him the ***nDrive****, so he simply tapped his tablet with* ***nDrive****, and he was able to access his files on the go.*

With increasing number of smartphone and tablet users, cloud computing has become one of the hottest technologies. The advantages cloud computing offers are endless, such as unlimited storage, and cost efficiency. Despite of all the advantages it provides, cloud computing becomes useless once there are no Internet connection, just like what Mr. Smith has experienced, and here is where nDrive comes into play.

The proposed nDrive device is designed to act as a personal local storage that only requires a single tab from the user's smartphone or tablet. The user's portable device will then sync all the files in the system in real-time and user will also be able to monitor and edit files on their mobile devices.

NBS^2 team is composed of four talented and dedicated 4th year engineering students with strong backgrounds in various fields such as signal processing, software engineering and digital circuit design. The expected budget sits at $400 currently, and while we are waiting for a reply from Engineering Student Society Endowment Fund, we are actively looking for alternative sources of funding as well. The project will begin at the end of September, and we are aiming to have our prototype finished by the beginning of December.

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1. INTRODUCTION

According to a study by Deloitte, more than 1 billion smartphones are being used across the globe [1]. Figure 1 also depicts the exponential growth in the number of smartphones and tablets.

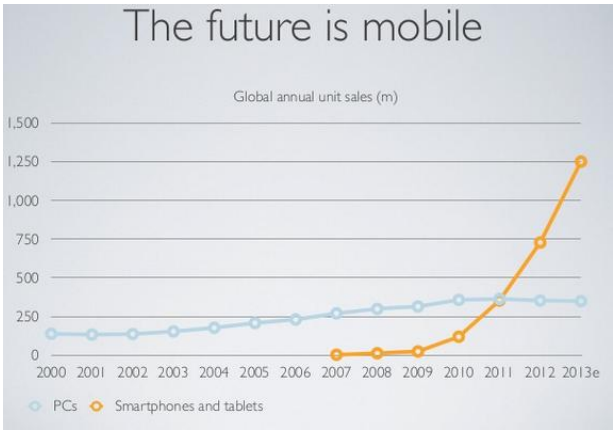

FIGURE 1 GROWTH IN THE NUMBER OF MOBILE FROM ENDERS ANALYSIS [2]

Inevitably, the amount of mobile data traffic is destined to grow rapidly with increasing number of mobile devices. The following figure from Business Insider shows that the amount of mobile data traffic is expected to be doubled within 2 years.

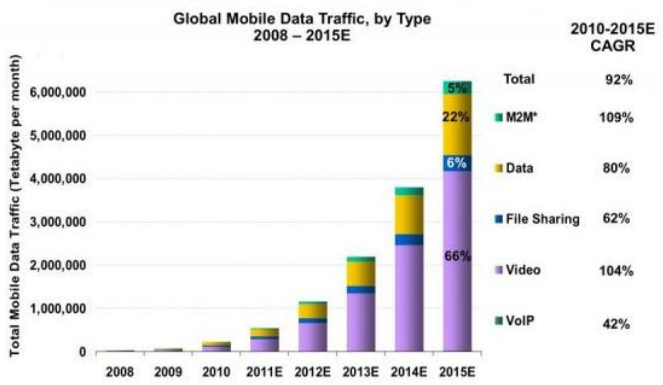

FIGURE 2 GROWTH OF THE GLOBAL MOBILE DATA TRAFFIC FROM BUSINESS INSIDER [3]

In other words, storage spaces should have a capacity to store the increasing amount of data and there many companies are proposing the solutions for the bigger storages such as Cloud storage services. However, one limitation of using cloud services is that the user is required to

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be connected to the Internet via either cellular data network or Wi-Fi network. Also, typical external storages are limited in terms of their usages, since they require external power sources. Moreover, the portable solutions like USB sticks and memory cards are limited in terms of its storage sizes and costs.

The objective of our project is to provide users an easy and flawless experience of having a local wireless personal storage that does not require any Internet connections while maximizing the portability of the storage. Because nDrive is designed to require a minimal interaction with an end user, all the user is required to do is simply tapping their NFC- and Bluetooth-enabled smartphones to nDrive, in order to have their device connected to the personal storage.

2. SYSTEM OVERVIEW

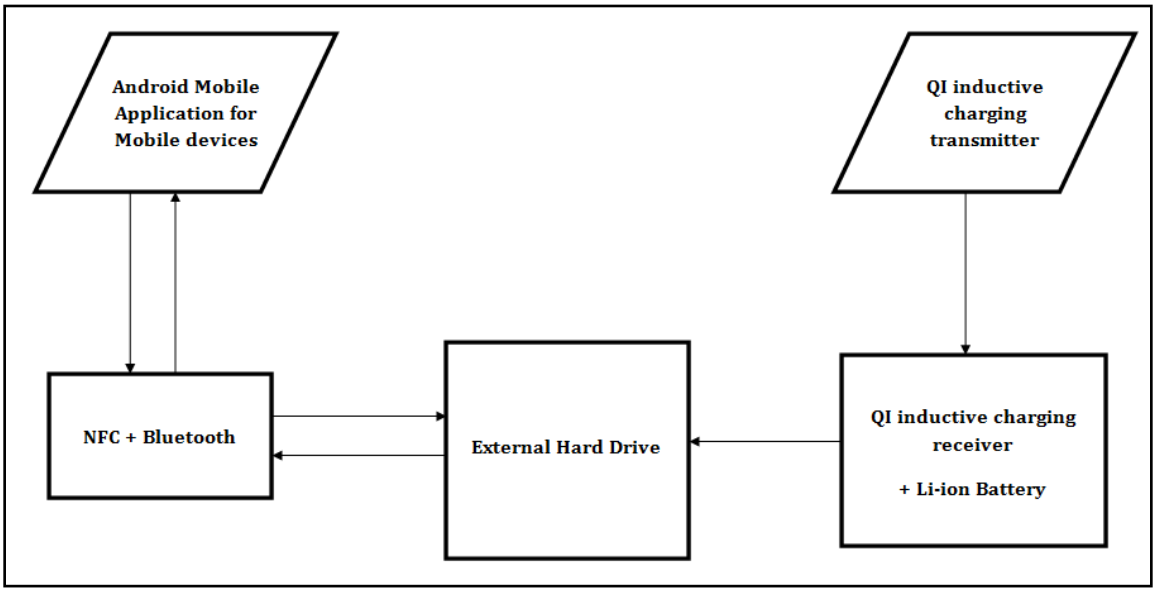

FIGURE 3 NDRIVE STORAGE SOLUTION SYSTEM OPERATION OVERVIEW

Figure 3 shows the conceptual operation overview of the storage solution. Our project design can be divided into two major hardware systems and one Android application for mobile devices that will be used to communicate with our hardware device. The first major hardware system consists of Bluetooth and NFC modules. Bluetooth is the main communication method for transferring data from mobile devices to the external hard drive. Two modules will, then, be

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integrated into one component. NFC is used to assist the Bluetooth pairing process and the communication of these two modules will be made through the UART interface. This Bluetooth + NFC component will utilize the storage in the form of an external hard drive, which will allow users to transmit any types of data from their mobile devices [4]. Also, the device will enable users to retrieve the stored data via Bluetooth. For the portability of a storage device, the device will be powered by a rechargeable battery. Furthermore, the built-in inductive charging receiver will provide the Qi standard wireless charging solution that is compatible with any commercially available Qi wireless transmitters. This solution will no longer require a charging cable and maximize the portability of the device. The Android application with graphic user interface will include Bluetooth API to communicate with the nDrive storage and NFC API to assist Bluetooth pairing. Also, the application will feature a file browser to explore the hard drive, which is formatted to FAT32.

3. PROJECT BENEFITS AND RISKS

Benefits

These days, the form factor of external hard drives is getting smaller and smaller in terms of size and weight. Thickness is getting as thin as 5 mm while the weight is only 0.206 lb, which is about the same as a light bulb [3]. By taking this advantage of hard drives and providing an embedded power source to nDrive, we believe the portability of the device can be maximized. In other words, it can easily be put into a pocket or a backpack. With an nDrive, we can keep information and user data from mobile devices like smartphones and tablets all the time.

Furthermore, nDrive provides a large storage capacity by using a hard drive as a storage solution to overcome the limitation of the existing portable storages like USB sticks and SD cards. Thus, nDrive will meet the needs for the mobile device users wanting to have a bigger storage while preserving the portability.

nDrive provides the solution to make an easy connection between mobile devices and a portable hard drive. Bluetooth technology has been a good solution for data transferring

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because of its low power consumption; however, it requires several cumbersome steps to make a connection such as pairing. Our team is suggesting near field communication (NFC) to replace the pairing process. Using NFC, mobile devices can be connected to nDrive by simply placing them near together. This will establish a Bluetooth connection between the devices.

Risks

Hard drives are made from aluminum platter that spins around when data is being read or written onto it [6]. Because of this, hard drives are more fragile and may be damaged if they are dropped. One solution to solve this problem is to make a case so that it does a shock migration.

It may also encounter some security issue. The data may be shared with other people since one can just touch their mobile to the hard drive to connect each other.

These potential risks are manageable. For example, we could make a mechanical system that migrate external forces in order to damage external force to the drive. Also, for security, pass code may be added in the application side.

4. MARKET AND COMPETITION

The storage market can be separated into the non-internet based and internet based storages. The most popular product for non-internet based storage solutions are external hard drives. Currently, external hard drives require the physical cable or LAN connection to a host laptop or devices. Some of them sport high speed connections like Thunderbolt or USB 3.0, however, a certain type of cable is always required [5].

For the internet based storages, Cloud storages, provided by many IT companies such as, Amazon, Google and Microsoft, are most well known and widely used. Cloud storages allow users to access to their data, but users have to ensure the internet connection in order to use the storage. Without the internet connection, users cannot store and retrieve data.

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By providing an easier connectivity solution with Bluetooth + NFC, we believe that nDrive will create a new category in the storage market between the non-internet based and internet based markets because there is no need for any physical cables or an internet access. Our product technically lies in the category of the non-internet based storage; however, it is distinguishable from the existing products because of its unique connectivity solution which is Bluetooth with NFC pairing. Also, nDrive will provide the maximized portability by eliminating any cables since it will be powered by the Qi wireless charging solution. In addition, users can stay connected to the device with their mobile devices without needing to access the internet unlike the existing Cloud storage services. nDrive will allow users to carry their own storage and store any types of data securely and easily anywhere and anytime. Besides, it will benefit from the large size and fast speed of the existing external storages and the convenient connectivity solutions.

5. TEAM ORGANIZATION

NBS^2 Solution is a young company with four motivated and enthusiastic founders who are majoring in electronic and systems engineering. They are Junfeng Xian, HongkyuAhn, Andy Back, and SeungYeong Park.

Junfeng Xian: Chief Executive Officer (CEO)/Chief Financial Officer (CFO)

Junfeng is a fifth year Systems Engineering student at Simon Fraser University. During his studies, he has developed very strong software and hardware skills. His greatest interest is firmware design. His software skills include SolidWork, VHDL, C/C++, and assembly language. He has shown his ability and qualification through many projects. Junfeng has gained strong fundamentals in the fields of electronic systems. He has also shown excellent leadership skills throughout his professional and academic career. His work experience at Broadcom has sharpened his analytic and communication skills. With all these qualifications, he is best suited to serve as an effective CEO and CFO.

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Hongkyu Ahn: Chief Marketing Officer (CMO)

Hongkyu is a fourth year Engineering Electronics student at Simon Fraser University. He is highly interested in developing hardware systems of electronic devices. His fields of knowledge include microelectronics, electronic systems design, multimedia communications, communication networks, computer aided design, and digital signal processing. He has been exposed to a wide variety of analytical devices. His skills include embedded systems design, C/C++ and VHDL programming, and research and development. His previous work experience helped to diagnose network systems. His expertise and qualities make him a strong asset for the company as CMO.

Andy Back: Chief Information Officer (CIO)

Andy Back is a fourth year Electronics Engineering student at Simon Fraser University. His strengths and interests focus on software development. He has expertise in developing android mobile application through many work terms. He has work experience in various programming language such as C/C++, C#, VHDL, and Python. Andy is proficient in developing tests on OS level for an internal end-to-end diagnostic tool. His strong understanding of software development cycle will enhance the software system of our product. With his various abilities, Andy will fill the role of CIO of the company.

Seung Yeong Park: Chief Technical Officer (CTO)

Seung is a fourth year Electronic Engineering student at Simon Fraser University. Seung has a deep understanding of hardware architectures and digital design on an FPGA. He has developed his expertise in the hardware design through numerous work terms. He has experience in schematic captures with OrCad or Allegro design entry HDL, and PCB Layout or stack up tools. He has also demonstrated his aptitude in VLSI design. He is also proficient in handling lab equipment such as oscilloscopes, function generators, and power spectrum analyzer. He is also comfortable with various programming languages such as C/C++ and VHDL. His distinctive skills in the field will bring a unique quality and efficiency to his job as CTO.

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6. PROJECT SCHEDULES

Project plan and management are important because it helps to schedule all critical events during the project as well as ensuring to meet the deadline. The Gantt chart below shows the timeline for this Wireless Portable Hard Drive Solution project. Also, four individual Gantt charts for the group members are listed, which shows the specific activities and contribution for each member on the project. We will try our best to follow these schedules and complete the project by December 2nd, 2013.

Wireless Portable Hard Drive Solution
NBS2 Solution
Project Lead: Junfeng Xian
Start Date: September 3, 2013 Tuesday

WBS	Tasks	Task Lead	Start	End	Duration (Days)
1	**Topic selection and project proposal**	Junfeng Xian	9/3/13	9/26/13	24
1.1	Topic selection		9/3/13	9/16/13	14
1.2	project proposal		9/17/13	9/26/13	10
2	**Research and functional Specification**	Junfeng Xian	9/3/13	9/30/13	28
2.1	NFC, BT concepts and modules selection		9/3/13	9/30/13	28
2.2	Android app programming		9/3/13	9/30/13	28
2.3	Power supply and wireless charger circuit		9/3/13	9/30/13	28
3	**Project funding and parts ordering**	Junfeng Xian	9/16/13	10/5/13	20
4	**Project design**	Seung Yeong Park	9/27/13	10/17/13	21
4.1	BT and NFC firmware combiation	Junfeng Xian	9/27/13	10/17/13	21
4.2	Hard drive selection	Hongkyu Ahn	10/7/13	10/12/13	6
4.3	Power supply and wireless charger design	Seung Yeong Park	9/27/13	10/17/13	21
4.4	Android app design	Andy Back	9/27/13	10/17/13	21
5	**Project implementation**	Hongkyu Ahn	10/18/13	11/6/13	20
5.1	Integrate NFC and BT to device	Junfeng Xian	10/18/13	11/3/13	17
5.2	Android app development	Andy Back	10/18/13	11/3/13	17
5.3	Communicate between Android app and device	Hongkyu Ahn	11/4/13	11/6/13	3
5.4	Power supply and wireless charger integration	Seung Yeong Park	10/18/13	11/6/13	20
6	**Project testing and verification**	Hongkyu Ahn	11/7/13	11/26/13	20
6.1	Unit Test and system test		11/7/13	11/21/13	15
6.2	Debug and modification		11/7/13	11/21/13	15
6.3	Integration test		11/22/13	11/26/13	5
7	**Project documentation**	Junfeng Xian	9/3/13	12/2/13	91
7.1	Lab journal, meeting minutes, Canvus discussion		9/3/13	12/2/13	91
7.2	Functional specification		10/1/13	10/17/13	17
7.3	Oral progress report		10/25/13	10/31/13	7
7.4	Design specification		10/18/13	11/7/13	21
7.5	Progress report		11/8/13	12/2/13	25
7.6	Post-mortem		11/29/13	12/2/13	4
8	**Project demo, presentation and final report**	Junfeng Xian	11/29/13	12/2/13	4

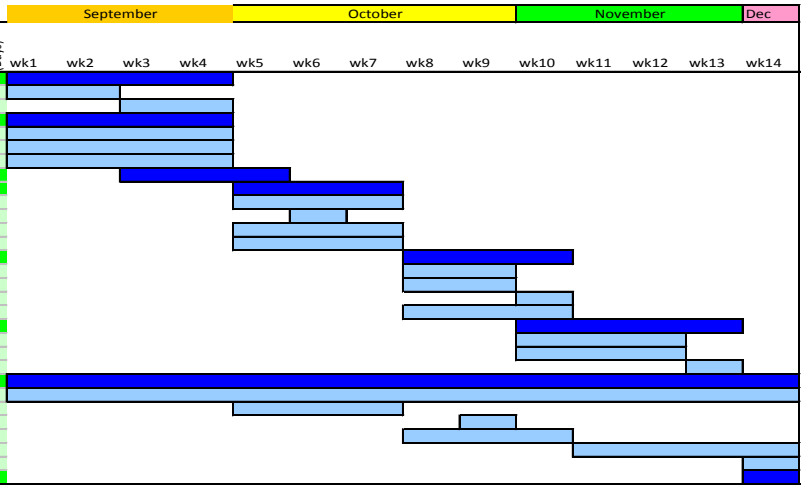

FIGURE 4 GROUP GANTT CHART

Individual Schedule - Junfeng Xian
Company: NBS2 Solution
Start Date: 03/09/2013

WBS	Tasks	Start	End	Duration (Days)
1	**Topic selection and project proposal**	#REF!	#REF!	#REF!
2	**Research and functional Specification**	9/3/13	9/30/13	28
2.1	NFC, Bluetooth concepts and modules selection	9/3/13	9/30/13	28
3	**Project funding and parts ordering**	9/16/13	10/5/13	20
4	**Project design**	9/27/13	10/17/13	21
4.1	Development platform (Raspberry Pi) set up	9/27/13	9/27/13	1
4.2	Bluetooth modules functionalities	9/28/13	10/2/13	5
4.3	NFC modules functionalities	10/3/13	10/7/13	5
4.4	algorithm	10/8/13	10/17/13	10
5	**Project implementation**	10/18/13	11/6/13	20
5.1	Modify firmware codes on NFC module	10/18/13	10/20/13	3
5.2	its APIs	10/21/13	10/22/13	2
5.3	Integrate NFC to Bluetooth module	10/23/13	10/27/13	5
5.4	Bluetooth and NFC handover coding	10/28/13	11/1/13	5
5.5	Communicate with Android app	11/2/13	11/3/13	2
5.6	Systems test on Bluetooth and NFC modules	11/4/13	11/6/13	3
6	**Project testing and verification**	11/7/13	11/26/13	20
7	**Project documentation**	9/3/13	12/2/13	91
8	**Project demo, presentation and final report**	11/29/13	12/2/13	4

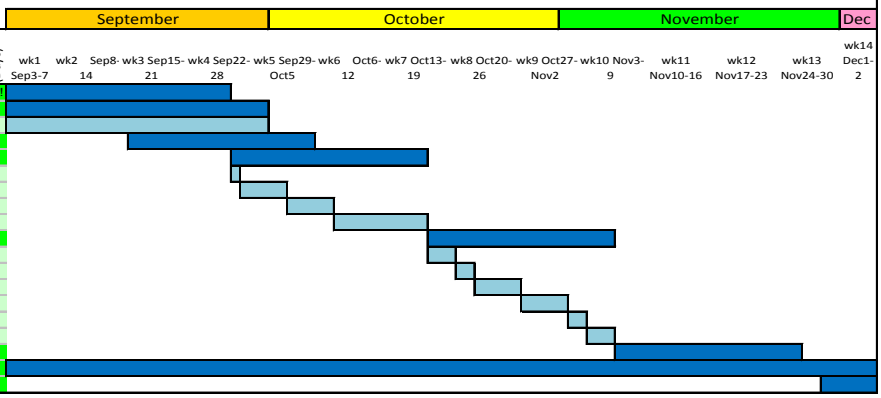

FIGURE 5 INDIVIDUAL GANTT CHART --- JUNFENG XIAN

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Individual Schedule - Hongkyu Ahn

Company: NBS2 Solution

Start Date: 03/09/2013

WBS	Tasks	Start	End	Duration (Days)
1	**Topic selection and project proposal**	#REF!	#REF!	#REF!
2	**Research and functional Specification**	9/3/13	9/30/13	28
2.1	Android app programming	9/3/13	9/30/13	28
3	**Project funding and parts ordering**	9/16/13	10/5/13	20
4	**Project design**	9/27/13	10/12/13	16
4.1	Environment setup for android app development	9/27/13	10/5/13	9
4.2	Hard drive selection	10/7/13	10/12/13	6
5	**Project implementation**	10/9/13	11/6/13	29
5.1	File system viewer and GUI	10/9/13	10/20/13	12
5.2	Communication with bluetooth and NFC	10/21/13	11/6/13	17
6	**Project testing and verification**	11/7/13	11/26/13	20
7	**Project documentation**	9/3/13	12/2/13	91
8	**Project demo, presentation and final report**	11/29/13	12/2/13	4

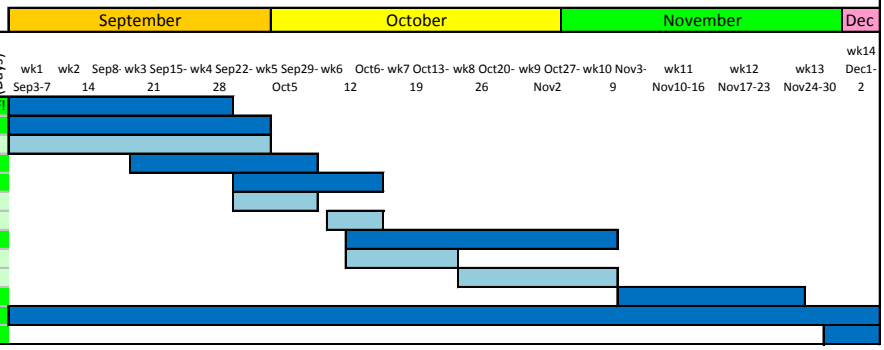

FIGURE 6 INDIVIDUAL GANTT CHART --- HONGKYU AHN

Individual Schedule - Andy Back

Company: NBS2 Solution

Start Date: 03/09/2013

WBS	Tasks	Start	End	Duration (Days)
1	**Topic selection and project proposal**	#REF!	#REF!	#REF!
2	**Research and functional Specification**	9/3/13	9/30/13	28
2.1	Environment Setup for Android App Development	9/25/13	9/25/13	1
2.2	Finalize the features to be added	9/26/13	9/26/13	1
2.3	on the GUI	9/27/13	9/27/13	1
3	**Project funding and parts ordering**	9/16/13	10/5/13	20
4	**Project design and implementation**	9/28/13	11/6/13	40
4.1	NFC connection on Android smartphone	9/28/13	9/30/13	3
4.2	Bluetooth connection on Android smartphone	10/1/13	10/3/13	3
4.3	NFC to Bluetooth Handover	10/4/13	10/7/13	4
4.4	LED and Vibration and NFC to BT is successful	10/8/13	10/8/13	1
4.5	File System Viewer	10/9/13	10/11/13	3
4.6	GUI (PNG files for buttons and images)	10/12/13	10/14/13	3
4.7	System tests on Android app	10/15/13	11/6/13	23
5	**Project testing and verification**	11/7/13	11/26/13	20
6	**Project documentation**	9/3/13	12/2/13	91
7	**Project demo, presentation and final report**	11/29/13	12/2/13	4

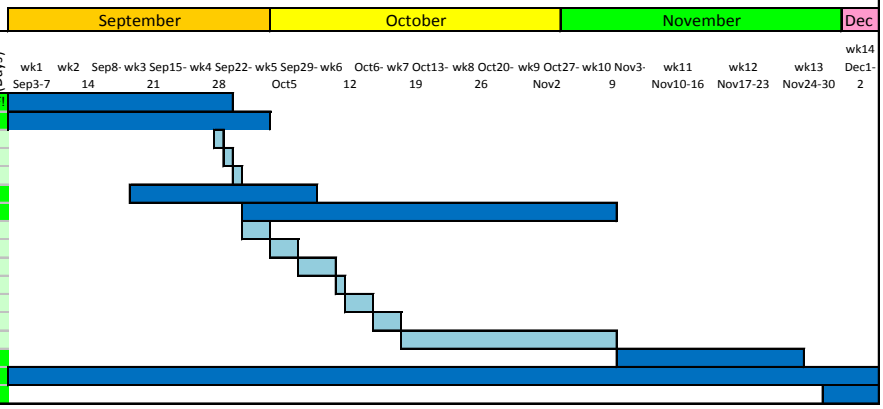

FIGURE 7 INDIVIDUAL GANTT CHART --- ANDY BACK

Individual Schedule - SeungYeong Park

Company: NBS2 Solution

Start Date: 03/09/2013

WBS	Tasks	Start	End	Duration (Days)
1	**Topic selection and project proposal**	#REF!	#REF!	#REF!
2	**Research and functional Specification**	9/3/13	9/26/13	24
2.1	Power supply circuit, charging solution	9/3/13	9/26/13	24
3	**Project funding and parts ordering**	9/16/13	10/5/13	20
4	**Project design and implementation**	9/27/13	11/6/13	41
4.1	necessary components	9/27/13	10/1/13	5
4.2	simulate	10/2/13	10/5/13	4
4.3	components	10/6/13	10/12/13	7
4.4	simulate	10/13/13	10/16/13	4
4.5	integrate all relevant circuits and simulate	10/17/13	10/27/13	11
4.6	draw a PCB layout and order PCB	10/26/13	11/6/13	12
5	**Project testing and verification**	11/7/13	11/26/13	20
6	**Project documentation**	9/3/13	12/2/13	91
7	**Project demo, presentation and final report**	11/29/13	12/2/13	4

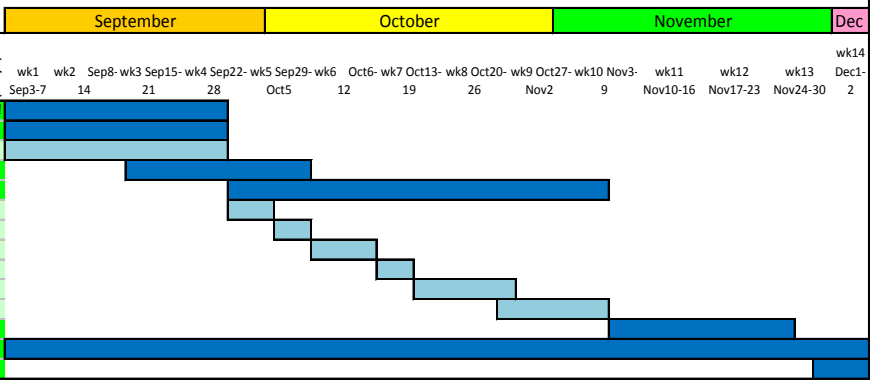

FIGURE 8 INDIVIDUAL GANTT CHART --- SEUNG YEONG PARK

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The following figure describes the milestones of the project. The project is divided into nine stages, which include:

Project Proposal – Introduction, project planning, topic selection, budgets and team organization (Sep 26th, 2013).

Functional Specification – Documentation on project in detail, device features, input and outputs (Oct 17th, 2013).

Progress Presentation – Listing accomplishments and obstacles (Oct 31st, 2013).

Project Integration – Completion on device prototype integration (Nov 6th, 2013).

Design Specification – Documentation on requirements for the project, specification and designs (Nov 7th, 2013).

Test Completion – Completion on prototype systems and integration tests, and project verification (Nov 26th, 2013).

Progress Report –Listing accomplishments and obstacles (Nov 28th, 2013).

Project Demo and Presentation – Demonstration of product to ENSC faculty and professors (Dec 2nd, 2013).

Final Report – Completion on prototype documentation (Dec 2nd, 2013).

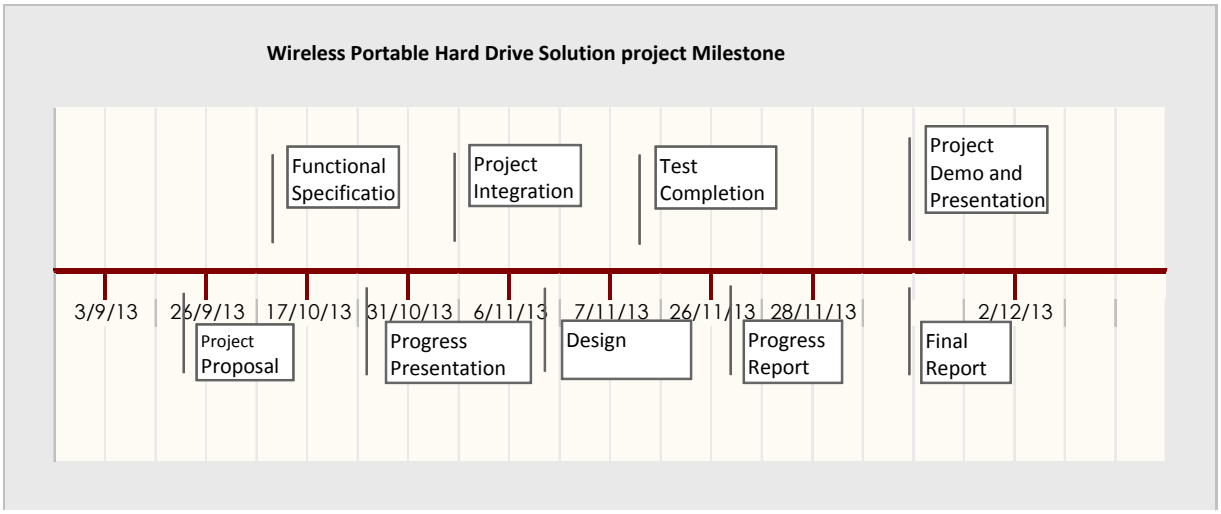

FIGURE 9 PROJECT MILESTONE

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7. PROJECT BUDGET AND FUNDING

The nDrive prototype includes different electronic modules and circuits. The table below list of parts and modules that is required in this project. After comparing several vendors' websites, and intensive calculation, the total cost of the prototype is $400 CAD. If it is possible to embed all modules and circuitries into a single PCB, the actual product price can be much lower than this amount. Also, the product price can vary depending on the capacity of the hard drive. For example, the cost may be reduced by $50 by using a 512GB hard drive instead of 1TB storage.

TABLE 1 PRICE LISTING FOR EQUIPMENT

Equipment List	Estimated Unit Cost
Raspberry Pi Model B	$65
Bluetooth Module	$35
NFC Module PN532 Breakout Board	$55
SD card	$25
512GB hard drive	$50
Power Supply and circuit components	$50
Wireless charger and circuit components	$80
Wireless charger transmitter	$40
Android App and development kits	$0
Total Cost	$400

For a real product, we need to consider PCB manufacturing cost and external casing for the device. The prices in the table include taxes and shipment. The core components of this prototype account for approximately 60% of the development cost.

In this project funding, we appreciate that Engineering Science department offers Simon Fraser Engineering Science Student Endowment Fund (ESSEF). NBS^2 Solution should obtain funding from the Engineering Science Student Endowment Fund in the amount of $400 CAD, which

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would cover the majority of the project cost. As an alternate source of funding, each member in our company is also willing to contribute an even amount of money on the remaining cost.

8. CONCLUSION

In the world of innovations geared towards each individual, there is a need to continue develop easier solution for the current technology. We are living in the world that majority of information is shared and stored wirelessly. We concluded that a large demand for these types of products exists in a wide variety of applications. The product has a clear advantage over current hard drive systems. Our design will give easy solution to store and receive data between mobile devices and a portable hard disk wirelessly without having an internet access.

While our product is a challenging project requiring expertise in multiple engineering disciplines, we are confident that our technical team will develop an excellent product. Our team members are eager to use their skills so that NBS^2 may achieve its goals to construct a storage system that will improve the quality of life of its customers.

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