WEBSA

January 23, 2006

Dr. Andrew Rawicz
School of Engineering Science
Simon Fraser University
Burnaby, British Columbia
V5A 1S6

Re: ENSC 440 - Project Proposal for a Wireless Cell Phone Docking Station

Dear Dr. Rawicz:

The attached document, *Proposal for a Wireless Cell Phone Docking Station*, provides a general overview of Websa Technology Ltd.'s proposed project for ENSC 440. The project objective is to design and implement a communication system between two essential accessories today: mobile phones and residential phones. This docking station system, named the *Wireless Mobile-Dock*, allows the user to dock his or her cell phone and use normal corded or cordless home phones to make and receive cellular phone calls. As such, a local telephone land line may no longer be a necessity.

This proposal will provide an overview of the motivation and basic technical background behind the proposed system we wish to develop. You will also find included in this proposal an outline of possible design considerations, the justification of the proposed design, and the details relating to sources of research information, funding, budget outline, project timelines, company dynamics and composition.

Websa Technology consists of five talented, innovative, and dedicated fifth-year engineering students: Wilson Kwong (CEO), Andy Leung (CFO), Stephen Au-Yeung (COO), Edwin Wong (CTO-Hardware) and Bobby Ho (CTO-Software). Please note that only Wilson Kwong, Andy Leung and Bobby Ho are registered students in ENSC 440 while both Edwin Wong and Stephen Au-Yeung are registered in ENSC 494. If you have any questions about this proposal, or the project in general, please feel free to contact us at websa-ensc440@sfu.ca. Thank you.

Sincerely,

Wilson Kwong
Chief Executive Officer
Websa Technology Ltd.

Enclosure: *Proposal for a Wireless Cell Phone Docking Station*

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WIRELESS CELLPHONE DOCKING STATION

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DATE:

JANUARY 23RD, 2006

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Executive Summary

> *Coming home from a busy day of work, the first thing Ted does is unload all the dead weight that has been with him all day in the kitchen: cell phone, keys, loose change, etc. He soon gets ready for a good night sleep. In midst of reading his novel in his bedroom, Ted hears his cell phone vibrating faintly in the background. Realizing his call might be important, Ted scrambles to pick up his cell phone, knocking his toes into the bedside table…and misses the call.*

Ted's injury could have been avoided had he not have to rush to his cell phone. What if Ted has access to his cell phone from different parts of his home? What if Ted didn't have to worry about his phone being silent or not? What if scattered reception in a room is no longer a problem? Websa Technology has designed the *Wireless Mobile-Dock*, a docking station which allows one to dock his/her cell phone and use normal corded or cordless home phones to make and receive cellular phone calls.

This document proposes the development of a cell phone docking station that extracts the necessary cell phone signal data, voice data for example, and transforms it into a signal that would normally come out from a wall telephone jack. The added benefit of the *Wireless Mobile-Dock* is the elimination of the unattractive wire that is normally required for the connection between the cell phone docking station and the corded/cordless phone.

According to CTIA The Wireless Association for the telecommunications industry, at the end of 2005, wireless subscriptions will have nearly reached 2 billion worldwide [1]. That is, 30.8% of the total world population of approximately 6.5 billion [2] currently uses a wireless subscription service. In the first six months of 2005, total wireless revenues for the US alone was $55.7 Billion USD [1]. The impressive market is made possible by the constantly increasing number of wireless service subscribers. With these numbers, Websa aims to provide wireless subscribers a more comfortable and convenient way to use their cell phones with the introduction of the *Wireless Mobile-Dock*.

Websa Technology is comprised of five highly motivated and extremely hardworking engineering students from Simon Fraser University with background in both hardware and software. Our members are knowledgeable in electronic circuit design, software development, including real-time applications, in various languages and microcontroller application, which are gained from various course work and co-op experiences.

The project engineering cycle has been allotted 13-weeks with a *Wireless Mobile-Dock* prototype completed by mid-April 2006. During this period, research, design, development and integration as well as various documentations will be completed. The projected cost of this project will be $625, with careful allowances factored into the cost. Sources of funding will come from the Engineering Science Student Endowment Fund, the John Wighton Engineering Development Fund and any other sources that may be available.

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Glossary

BSM – Base Station Module

MCU – Microcontroller Unit

RSM – Receiver Station Module

SMPI – Smart Mobile-to-Phone Interface

WMD – Wireless Mobile-Dock

WTM – Wireless Transmission Module

1 Introduction

The use of cell phones has increased drastically throughout the last decade with users spending more and more time talking on their cell phones. Even at home, users are constantly making and receiving calls on their cell phones. Increased cell phone usage can be attributed to the fact that there are many cell phone monthly subscription packages that offer subscribers unlimited evening and weekend minutes. That is, subscribers can talk as long as they want on their cell phone during certain hours in the evening and on weekends.

Everyone wants to take advantage of unused cell phone minutes to make their subscription service worthwhile. Some are willing to hold their cell phones to their ears and talk for hours on end. Others are afraid to do so for health reasons. The amount of heat generated from the cell phone after a long conversation can also be quite irritating. One solution offered by manufacturers is the hands-free headset. However, what if the cell phone is running out of battery? How many would be willing to sit by their power outlet and talk while the phone is charging? Of course, there are users who require vast amounts of cell phone minutes because that may be the only phone number they have. For example, businessmen, home-based office personnel, single-person households, etc. are those who usually have a single cell phone number.

At present there are cell phone docking stations available on the market that offer users a choice to use a regular corded or cordless telephone to talk over their cell phone network. However, if the user desires to place the corded/cordless unit a lengthy distance from the base station (for example, if only a certain location in the house has the best cell phone reception) long and unattractive wires need to be used. Currently, there is no solution to this problem because none of these cell phone docking stations on the market offer wireless connection to the corded or cordless phone.

Websa proposes the *Wireless Mobile-Dock* (WMD) system that will help eliminate this problem. The WMD system will offer great flexibility in locations of the cell phone docking unit and the telephone receiver unit. Users also do not have to worry about their cell phone running out of battery as the WMD system has the ability to continuously charge the cell phone even during use. With the WMD system, users are able to eliminate the use of a home telephone land line and reduce their monthly expenses.

This proposal will provide an overview of our product, possible and existing design solutions, and our proposed design solution. Information relating to budget, funding, and sources of information will also be provided. Finally, Gantt and milestone charts will be included.

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2 System Overview

Websa's *Wireless Mobile-Dock* system provides a method for mobile phones to communicate with traditional telephone devices. It allows users to answer incoming cell phone calls or dial outgoing calls using regular home phone equipment. With the increasing usage of mobile communication, Websa's innovative WMD system helps consumers reduce monthly expense by eliminating the need of installing home phone lines. The WMD system offers a high degree of flexibility and convenience for users in that it removes the burden of carrying the mobile phone around the home and or office.

To make the WMD system a possibility, Websa has developed the Smart-Mobile-to-Phone Interface (SMPI). The user first docks their cell phone into the base station module (BSM) of the WMD system. The SMPI will then constantly monitor the mobile phone status. When the cell phone receives an incoming signal, the modem inside the mobile unit notifies the SMPI interface, which then forwards the incoming call signals to the regular phone wirelessly. A receiver station module (RSM) will be connected to a regular corded phone for users to receive the call. A similar concept is applied when users are making outgoing calls. Users will first dial the number on their regular home phone. This number is relayed wirelessly to the mobile unit where the call will then be placed over the cellular network. With the WMD system, clients will experience the same feeling as if they were using regular land line telephone system. This familiarity ensures that users can perform the same actions when dialling outgoing calls and expect the same response when answering incoming calls. The communication channel between the mobile phone and regular home phone is automatically established and the end users will not experience any delays. Figure 2-1 illustrates the interaction between a user and the WMD system.
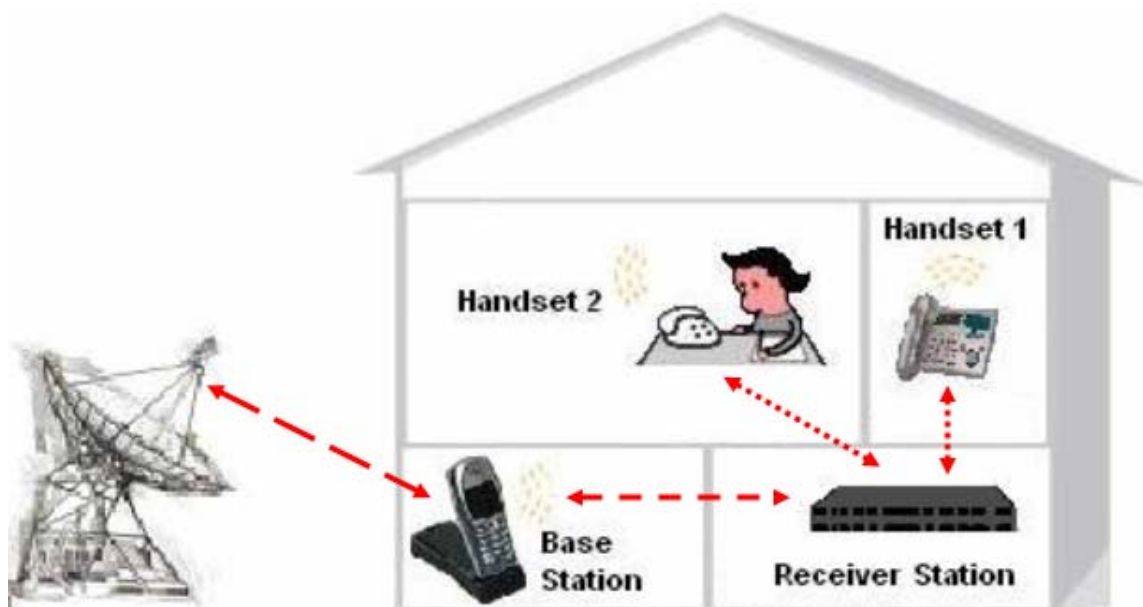

Figure 2-1: Diagram of user interaction with WMD system

Figure 2-2 shows the signal flow diagram of how the system will be implemented. Further detail on the actual design is described in section 4.
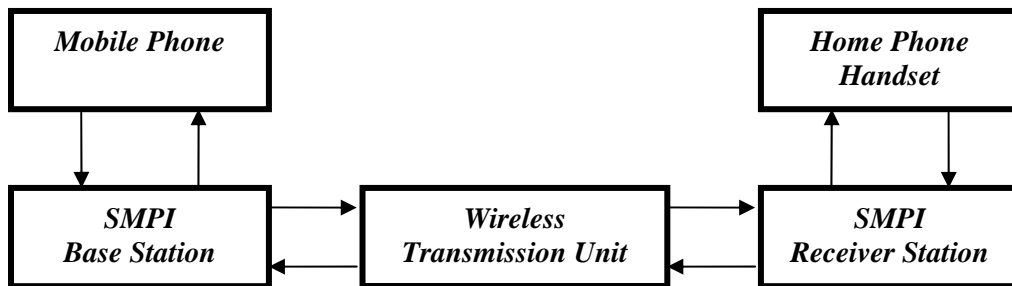

Figure 2-2: Block diagram of the WMD System

The goal of the WMD system is to offer cell phone users an alternative method to talk on their cell phones in a more comfortable and convenient way. The WMD system can also be used in a wide variety of locations including home, office, RV, boats, etc, with the possibility of connection to more than just one handset unit.

3 Possible Design Solutions

Three models were considered for the implementation of the cell phone docking system: the home infrastructure model, the wired model and the wireless model. The following sections provide a brief overview of the three designs.

3.1 The Home Infrastructure Model

In this design, the BSM and home phone are linked via normal telephone cables using the existing home telephone network infrastructure. The implementation of this model allows users to use both land line and cellular network with the same regular telephone that is connected to the telephone wall jack. However, this requires modifications to the user's home telephone media infrastructure implemented inside the house. In addition, for the case of multiple mobile phones, increased modification of the existing telephone line network or construction of a new phone line network may be required. This design introduces high costs users may not be willing to pay for.

3.2 The Wired Model

Because the first design is quite troublesome to implement and high costs can be incurred by the user, we came up with the wired model solution as shown in Figure 3-1. The user will dock their cell phone into a base station as described. A telephone handset then plugs directly into the base station via a regular telephone line. This model is a much simpler solution but the range is limited to how long a wire can reach. Long telephone wires can be used but can make the home unattractive. Long wires are also potential hazards if not tied down properly. A solution to this would be to use a wireless connection.
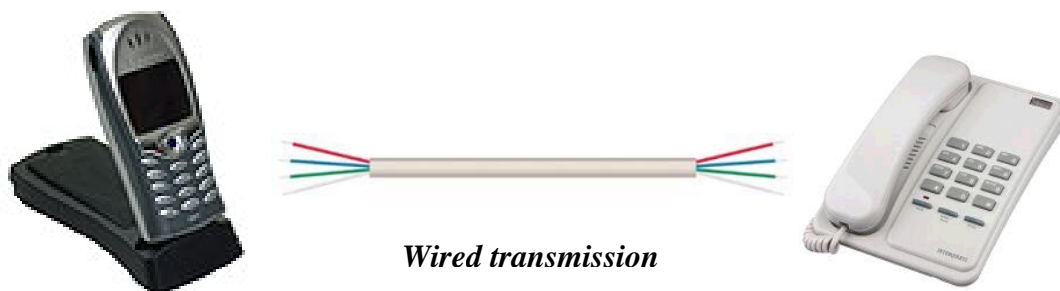

Wired transmission

Figure 3-1: Conceptual view of wired model system

3.3 The Wireless Model

In this model, the BSM is communicating with the home phone wirelessly. Upon receiving the incoming signal, the microcontroller unit (MCU) passes the signal to the wireless transmission unit. Another MCU is placed on the receiving side to accept the wireless signals. Similar concepts are applied when there is an outgoing phone call. The implementation of this model is more complicated than that of the wired model due to the introduction of the wireless transmission unit. However, it offers a great flexibility in

future product expansion (i.e. multiple phone interfaces and center routing). The wireless model also provides an easy way to setup the BSM as no modification to the existing home phone or phone lines are required. Figure 3-2 illustrates the idea behind the wireless model of the system.
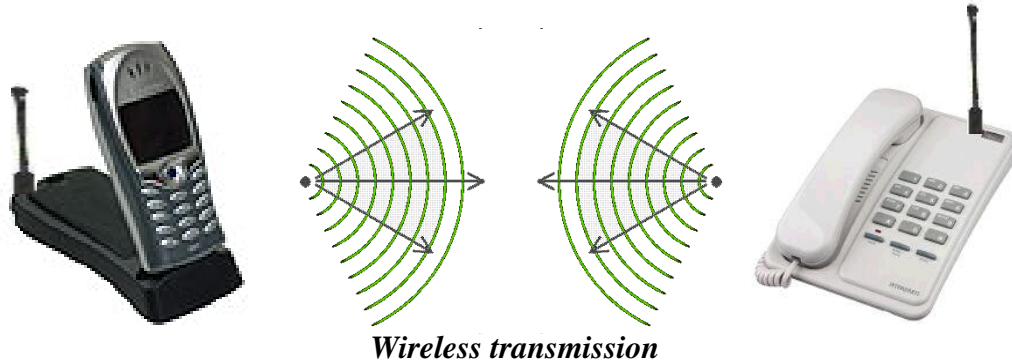

Wireless transmission

Figure 3-2: Conceptual view of wireless model system

4 Proposed Design Solution

The wireless model depicted in section 3.3 is adopted for the implementation of the WMD system. As mentioned in section 2, the information (data or voice) is transmitted wirelessly with a frequency range set in the "free" zone to avoid interference with other wireless communication devices. The system is split into three main modules: the cell phone base station module (BSM), the wireless transmission module (WTM), and the home phone receiver station module (RSM).

The BSM is responsible of interfacing with the mobile phones. Its tasks include monitoring cell phone status, sending and extracting data/voice to/from the cell phone and establishing connections. The BSM will also offer cell phone battery recharge to ensure the cell phone does not run out of battery during prolonged usage.

The WTM is responsible for relaying information between the BSM and the RSM. The information will be divided into fixed packet size before transmission. The WTM is accountable for creating headers such as starting bit, error check bits and end bits. It is capable of reporting errors (for example, if the error checks fail on the receiving side).

Finally, the RSM interfaces with the regular telephone handset. The RSM is responsible for activating the ringer circuit, monitoring the handset status, sending and receiving data/voice to and from the transmission unit and establishing phone connections. The RSM and the BSM together form the Smart Mobile-to-Phone Interface (SMPI).

In our first phase of development, only a one-to-one interface (one cell phone and one home phone) is considered. Multiple interfaces and center routing are not included in the current development due to the tight time constraint but is planned for the next product release.

5 Sources of Information

The development of the *Wireless Mobile-Dock* requires extensive understanding of the cell-phone data port, electronic components, wireless networking, telephone circuitries and software development. Our team members have gained their specific field of knowledge through various sources such as course material, component specification sheets, and the internet. Members of Websa will also seek knowledge that will be required for successful completion of this project.

Our project advisory board includes Dr. Andrew Rawicz, Brad Oldham, Esmaeil Tafazzoli Moghaddam, and Lisette Paris Shaadi. Dr. Andrew Rawicz is the professor of ENSC 440 while the other members are the teaching assistants of ENSC 440. Brad, Esmaeil and Lisette are talented senior engineering students. Their wide field of knowledge and experience will prove to be a great source of help. For assistance on important engineering documentation such as functional specifications and design specifications, we plan to seek advice from Steve Whitmore and Mike Sjoerdsma, who are experienced technical writers in engineering. Furthermore, David Chen, Jack Lin and Sean Hou, three undergraduate engineering students with project experience background in telecommunication and wireless networking, will also provide invaluable resources.

Our team is also able to obtain help and insight from industry professional, Jim Zeng. Jim received a Master's degree from Beijing Telecommunication University and a Master's degree in software engineering from University of British Columbia has a solid background in data networking and software development. He has also been working in the telecommunication industry for over 10 years. His experience and knowledge will definitely benefit our project development.

Industry standards for wireless transmission protocols will also need to be met. We will be consulting various documents on the standards and requirements in this area.

Finally, during the course of this project, we will seek help when needed from various SFU Engineering Science faculty members with related experience in the telecommunications field as sources of information.

6 Budget and Funding

6.1 Budget

Table 6-1 shows the estimated cost breakdown for the prototype development of the WMD system. As Websa is currently engaging in the design stages, the amount of budget may vary as the development progresses. Consequently, an estimation of 15% contingency fund has been considered for excess funds and unexpected expenses.

Table 6-1: Budget Summary for Websa WMD system Development.

Module	Component/ Description	Cost
Communication Device	Sony Ericsson T68i	N/A
	Sony Ericsson T610	N/A
	Telephone Handset	N/A
Base Station	Sony Ericsson T68 Serial Data Cable	$50
	Microcontroller	$10
Receiver Station	Integrated DTMF transceiver	$20
	Microcontroller	$20
Wireless Transmission	North American Data Access Arrangement	$120
	915MHz Multi-channel RF transceiver	$160
	Antenna	$25
	Antenna Connectors	$120
Electronic Components	Various components for ringer circuit, MAX3232, crystal oscillators, and DACs	$20
Sub total		**$545 CDN**
Contingency	Including but not limited to shipping/handling fee, wireless transaction payment fee, and unexpected costs overrun. (15%)	$80
Total		**$625 CDN**

6.2 Funding

Websa Technology is currently applying to various grants; in particular, the Engineering Science Student Endowment Fund (ESSEF) and the Wighton Engineering Development Fund. Each member is confirmed to receive 50 dollars funding from Engineering Science department. Furthermore, the company will try to approach faculty members for donations. In addition, each team member will contribute personal capitals to cover the difference between the actual budget and the granted funds.

7 Time Schedule

Figure 7-1 and Figure 7-2 display the Gantt chart and Milestone chart, respectively. These charts outline our project development timelines as well as major milestones that need to be achieved. We will be following these time schedules to ensure our project will be completed professionally and on time while meeting all deadlines.
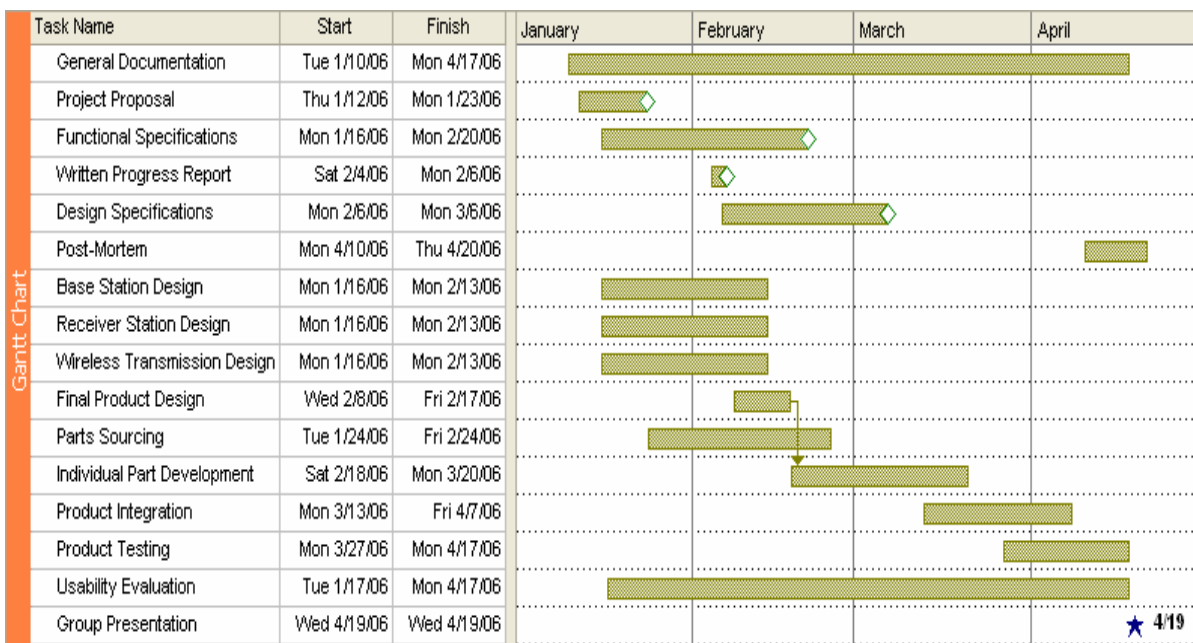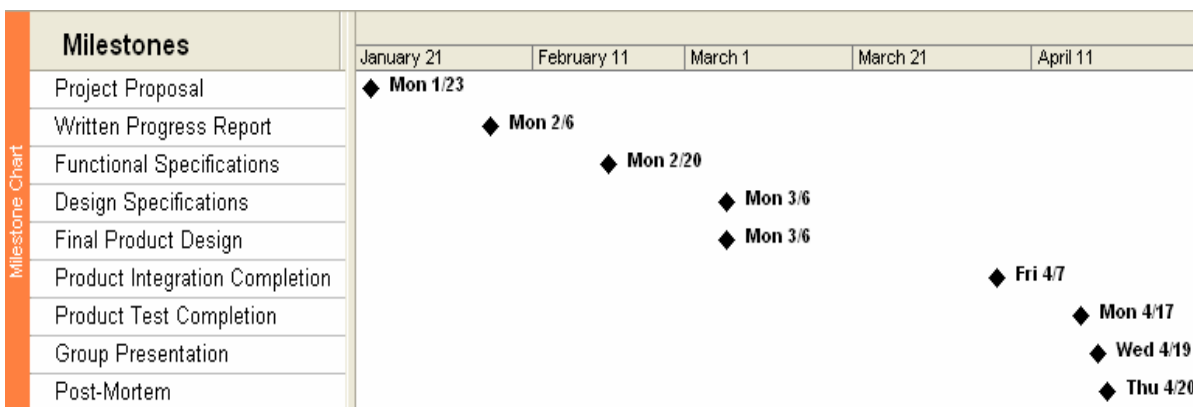

Figure 7-1: Gantt Chart

Figure 7-2: Milestone Chart

8 Company Organization

Websa Technology is founded by five aspiring engineers: Wilson Kwong (CEO), Andy Leung (CFO), Stephen Au-Yeung (COO), Edwin Wong (CTO-Hardware) and Bobby Ho (CTO-Software). These five individuals have a great desire to push household telecommunication to the next level. The team at Websa possess a variety of talents in electronic systems design, firmware and software programming, and project management. The talent amongst this team creates an excellent chemistry for the development of Websa's innovative product: The *Wireless Mobile-Dock*. Each team member will be assigned a dedicated rule according to his specialities while still having the chance to excel in areas where they wish to gain more experience in.

Regardless of our titles, each member of Websa is expected to contribute equally in the research and development of the system, with specific areas designated to specific individuals. Andy will be response for product management, marketing and feature analysis. Bobby will lead in the area of software development where his primary task is to construct the Smart Mobile-to-Phone Interface. Edwin and Stephen are the hardware gurus who are dedicated to overall system design and the wireless transmission unit development. Wilson will overlook the whole project development with focus on the design and implementation of home phone interfaces.

While each member of the team has specific tasks, the group is meeting on a weekly basis to provide an update of their progress. Each member will briefly report his progress status and raise any outstanding issues for discussion. Meeting agendas are prepared each week and minutes are recorded. The meeting minutes will serve as our weekly task outline as well. Any delays in the development process must be carefully analyzed by the product team and suitable solution(s) will be sought to resolve the problem in a timely manner. In addition, product requirements and system design are subjected to change for development needs.

Websa members have been friends prior to the formation of the company. The members of the company also have prior experiences working in teams and have proven that the chemistry is present and positive.

9 Company Profile

Wilson Kwong – Chief Executive Officer (CEO)

Wilson is an Electronics Engineering student who is currently undertaking his fifth and final year of studies at Simon Fraser University. He has recent co-op experience at Chevron Canada Limited and Rockwell Software. Through these work terms, Wilson acted as computer help desk support at Chevron and was assigned the role of automation software support specialist at Rockwell Software. Both experiences involved various hardware aspects as well. With Wilson's strong foundations in hardware and experiences in software, combined with excellent time management, organization skills and work ethics, Wilson will undoubtedly lead the company to great success.

Andy Leung, Chief Financial Officer (CFO)

Andy is a fifth year Electronics Engineering student specializing in both hardware and software development. Aside from engineering skills, he also developed strong management and marketing skills through business-related courses. Andy completed a research work term with Dr. Albert Leung working on a Tire Pressure Sensor System. Through the work term, he was granted exposure to the field of digital and analog circuit design. He also strengthened his hardware design technique and debugging/testing skills throughout the work term. Andy is a team player and has been involved in many team projects. Andy's skills and experiences make him an asset to the Websa Technology Ltd.

Stephen Au-Yeung - Chief Operations Officer (COO)

Stephen Au-Yeung is a fifth year electronics engineering student at Simon Fraser University. His main interests are circuit design and software programming. His previous experience includes taking part in the building process of the new sonar system in the Simon Fraser University Underwater Research Lab (URL) with Dr. John Bird. He also had exposure to FPGA programming and communication systems. In addition, Stephen has shown strong communication and team management skills, which are important assets for the prosperity of Websa Technology.

Edwin Wong - Chief Technology Officer (CTO) Hardware

Edwin Wong is a fifth year Computer Engineer student at Simon Fraser University. Edwin has extensive experience in both hardware and software through course work, projects, and internship work. Edwin is also currently engaging in a co-op term with Broadcom Corporation. He hopes to support the team with his experiences ranging from operating system understanding and software development to microelectronics and electronic system design.

Bobby Ho – Chief Technology Officer (CTO) Software

Bobby joined SFU Engineering in 2001 and is working towards a Computer Engineering degree. Bobby has studied electronics and software engineering for the past 5 years. He has great interest in data network communication and embedded operating systems design. Having worked at Redback Network Inc. for over 8 months, he gained valuable experience in C programming and product management. As such, Bobby is an invaluable asset to the team.

10 Conclusion

Websa Technology is dedicated in producing a cellular phone docking station that will be affordable and easy to use. Our goal is to help users maximize comfort, convenience and efficiency while engaging in conversations over their cell phones through the introduction of the WMD system.

We are committed to the completion of a working prototype on time and within the allotted budget as outlined in our Gantt chart, milestone chart and budget table. We believe that with the diverse knowledge, talent, and excellent work ethics in our team, along with excellent sources of information, we will be able to realize our concepts and see the project to completion.

11 References

[1] CTIA The Wireless Association Oct. 2005. *Wireless Quick Facts*. 16 Jan. 2006
<http://files.ctia.org/pdf/Wireless_Quick_Facts_October_05.pdf>

[2] U.S. Census Bureau 26 April 2005. *World POPClock Projection*. 16 Jan. 2006
<http://www.census.gov/ipc/www/popclockworld.html>