Short-range Wireless Innovative Solutions

December 16, 2007

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

Re: Ensc 440 Project Post-Mortem for a Wireless Waiter Calling System

Dear Dr. Rawicz,

The attached document provides the post mortem for our proposed project for ENSC 440. The aim of our project is to implement a wireless waiter caller system for customers in spread out dining establishments.

This document provides details in current state of our prototype, deviations from our original plan, and possible future improvements. Moreover, we will outline the difficulties we met during the course of this project. We will also explain any technical and inter-person experienced gained from this project.

Our company, SWIS, consists of four talented individuals: Aron McKinnon, CEO; Raymond Tan, CTO; Peter Chen, VP Quality Assurance. We believe this team is capable of accomplishing the proposed task in a timely fashion.

If you have any questions or concerns, please do not hesitate to contact us at ensc440-swis@sfu.ca

Sincerely,

Aron McKinnon
Chief Executive Officer

Short-range Wireless Innovative Solutions

POST-MORTEM

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Executive Summary

How many times have you sat at a restaurant, pub, or other sit-in service establishment and wished you had an easy and fast way to communicate to the waiter? This problem is major and plagues the hospitality industry, resulting in aggravated patrons, under-tipped waiters and low quality establishments. Fortunately, this problem has been solved by SWIS with its one of a kind product: SWIS Server Caller (SerCal). Overall, SWIS engineers are determined to solve the potential demand for this and other short-range wireless communication solutions.

The SerCal system works by having a transmitter with a call button placed at each table and the server having a transceiver unit that quietly and conveniently conveys which tables require her attention. The waiter will also be able to convey orders and updates real time to the kitchen via her portable transceiver set. The paging system is a win-win design that pleases everyone! The patrons get prompt service, the waitress is able to service their customers more efficiently and effectively; thus receiving higher tips, and the restaurant owners get a cost-effective solution to a better-managed working environment that attracts more customers, thus increasing profitability.

Figure 1: SerCal Operation

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1.0 Introduction

The SWIS Server Caller (SerCal) is a paging system for restaurants and pubs. The system allows restaurant/pub patrons to electronically “call” their server to let the server know that the patron is in need of assistance or ready to order. The system would consist of a transmitter unit placed discretely on every table, and a portable transceiver unit carried by the server. When a patron presses the transmitter unit, the server would be notified on his/her transceiver unit that a particular table needs his/her attention. The transmitter unit could be decorated to display a sign or menu item. The transceiver unit carried by the server allows the server to know which tables require assistance in a simple glance.

2.0 System description

SWIS aims at designing short-range wireless products for numerous consumer venues. However, our initial product will target restaurants.

The product is a paging system for restaurants and pubs. The system allows restaurant/pub patrons to electronically “call” their waiter to let the waiter know that the patron is in need of assistance or ready to order. The system would consist of a button/transmitter placed discretely on every table, and a watch/receiver unit worn by the waiter. When a patron presses the button/transmitter, the waiter would be notified by his receiver unit that a particular table needs his attention. The button/transmitter unit could be decorated to display a sign or menu item. The receiver unit worn by the waiter resembles a regular watch that allows the waiter to know which tables require assistance in a simple glance.

A prototype of this paging system has already been designed and potential modifications and upgrades to the system can be achieved inexpensively. The system would be marketed directly to pubs and restaurants, which would allow it to be customized to the specific environment.

The main innovation of the idea is the application of various existing technologies, working together to form a new system device. Each button/transmitter unit would be individually numbered so that restaurants can keep track of which button corresponds to a specific table, and alert the appropriate waiter. Each button/transmitter unit broadcasts a different signal and the receiver is designed so that the different transmissions do not interfere with each other. This allows for the waiter to receive patron requests simultaneously. The system uses a radio frequency protocol that would not interfere with other electronics (including cell phones and security systems), or other nearby restaurants using the same system. The button/transmitter unit is enclosed in a water-proof protective case which inhibits it from being damaged from food and drinks. The electronics used are light weight and affordable which keeps the cost of production down. The end result is an affordable and effective restaurant paging system. SerCal also has potential in nursing homes, spas, large banquets, warehouses, and other environments where communication is essential.

SWIS plans on marketing the SerCal as a high-tech device that lifts up the image of restaurants. It is a product that will be welcomed by waiters/waitress with good etiquette. It is a cool-looking and inexpensive device that speeds up customer service with cut-down on response time thus definitely being an ideal image for a waiter/waitress.

3.0 Current State of the Device

As described in our proposal, the SerCal system allows the customers and servers to interact in a relatively short time. Currently, our prototype only has the user interface implemented on the PDA device and the Table Unit indicators. The Bluetooth communication between the Server Unit and the Kitchen Unit is still incomplete. Moreover, the Table Unit yet still can't communicate with the Kitchen Unit. We are currently missing the UI for the Kitchen Unit as well. However, the Server Unit UI has been implemented and fully functional.

4.0 Problems encountered

During the course of the Project, there were a few problems which the SWIS engineers faced. A set of problems faced mostly during the initial stage was the design problem, including what type of components to use and what wireless schemes to adopt. SWIS had numerous options initially with regards to software and hardware options. We initially planned to go ahead with wireless RF communications and just simple LEDs and push buttons for the Table Unit and an LED grid display for the waiter's Server Unit. The Kitchen Unit was also just a box with light up buttons. However, we soon realise the problems with this design which included the high cost of RF transceivers, the necessity to work from scratch and redo what was available in the market, and the aesthetics on the system.

The later problems we faced also included collecting relevant information, sourcing for available products, and deciding which products would feasibly come together to form a complete system. After much researching and brain storming, SWIS finally came up with a final design which was in many ways different from its original one. We settled with Bluetooth wireless, and decided to

replace the Server and Kitchen Units with a PDA and a Laptop instead. These changes allow us to focus on building software which could run on most generic computer systems.

Lastly, at the software development stage, we encountered numerous obstacles that made our lives very difficult. First, we originally planned to use JavaME to program the PDA. However, because the company website that provides the Bluetooth Protocol Stack package was down, we were unable to continue programming using the Java language. Instead, we switched to the development suite provided by the company that made the PDA OS. This development suite uses C/C++ instead of Java. However, because this suite is designed specifically for the development of applications on the PDA, it proves to be a much better choice than Java. Another problem we faced was how to implement the Bluetooth. We had spent a huge amount of time on researching for Bluetooth implementations. However, it has proven to be very difficult as there are very few sources that provide the necessary information.

5.0 Comparison of estimated and actual budgets and timelines

5.1.1 Original Budget

Component	Cost	Quantity
Table control panel:		
Transmitter	$22	1
Antenna	$9	1
LEDs (large)	$0.08	4
Programmable Circuit board	$18	1
Control box casing	$10	1
Toggle buttons	$5	4
Switch	$1	1
Subtotal:	$80.32	2
Kitchen control panel:		
Transmitter	$22	1
Antenna	$9	1

LEDs (large)	$0.90	10
Programmable Circuit board	$18	1
Control box casing	$10	1
Toggle buttons	$5	10
Switch	$1	1
Subtotal:	$119	1
Wrist watch display:		
Receiver	$31	1
LEDs (small)	$0.071	50
Wrist watch casing	$ 15	1
Programmable Circuit board	$18	1
Antenna	$9	1
Switch	$1	1
Subtotal:	$77.55	1
Miscellaneous:		
Batteries	$2	10
Estimated shipping costs	$50	-
Total cost		**$427.19**

Table 1: Original Budget

5.1.2 Final Budget

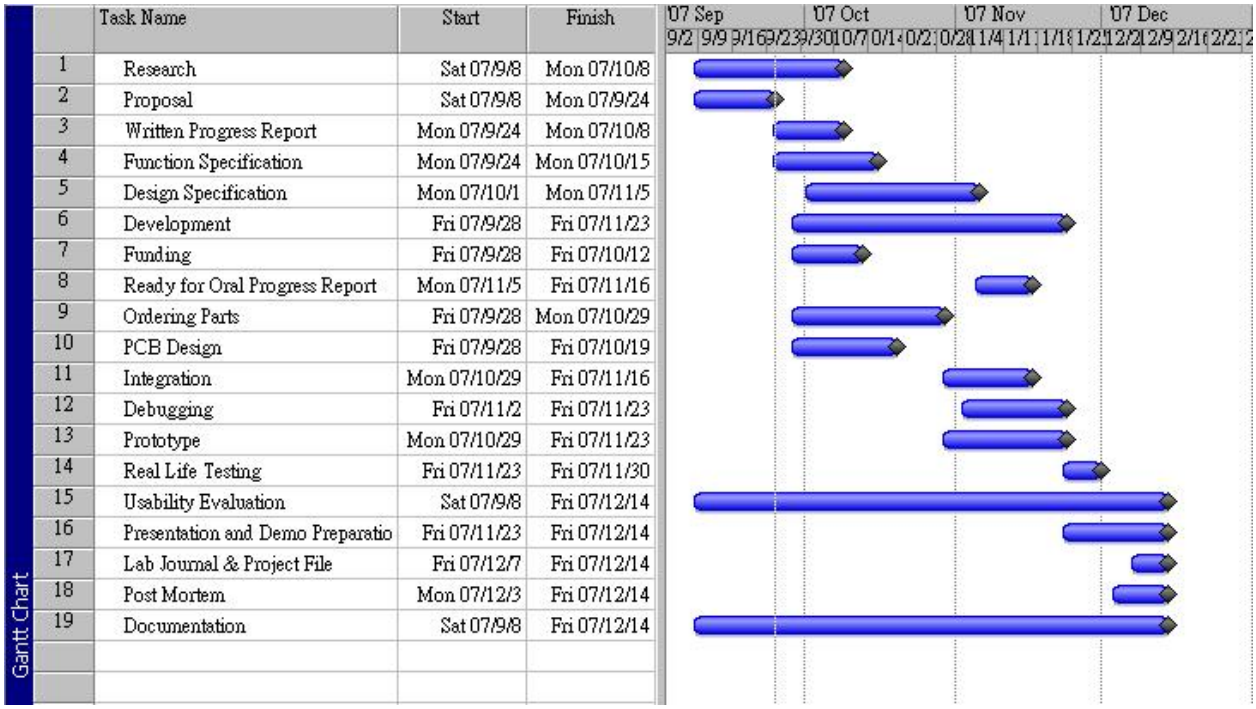
Component	price	quantity	subtotal
Logitech V270 Bluetooth mouse	$27.50	2	$55
Tungsten E2 palm top	$244	1	$244
Blue tooth Dongle	$20	1	$20
Toggle switches	$4	4	$16
Misc. (LEDs, casing, circuitry)	$10	-	$10

TOTAL			$345

Table 2: Final Budget

From the above 2 budget tables, we can see that the actual budget was around $100 less than the initially planned one. This was because there was a major revision on the parts to be used for the prototype. While we saved a lot by doing away with the transceiver and printed circuit boards and also changed the type of buttons used, the majority of the final cost borne came from the PDA we had to purchase to display our software for the Server Unit. However, SWIS feels that the final budget and allocation of funds was still the most cost efficient and was satisfied with its capital cost.

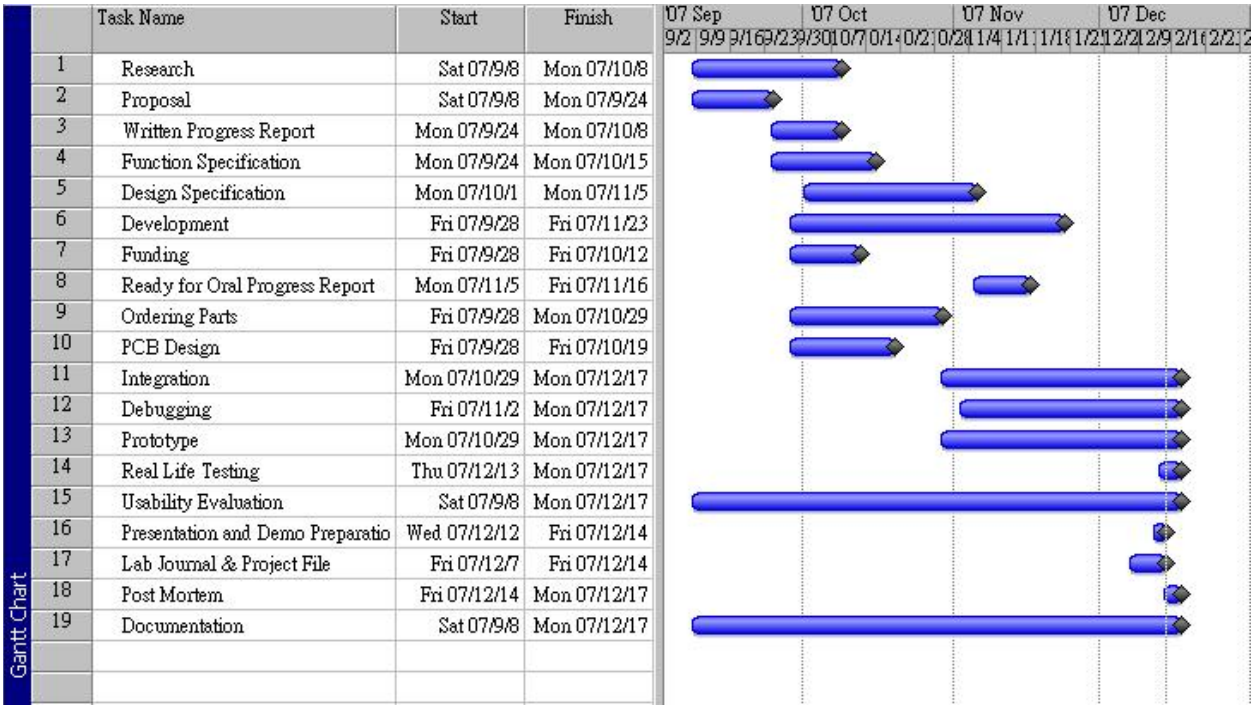
5.2.1 Initial Timeline



	Task Name	Start	Finish
1	Research	Sat 07/9/8	Mon 07/10/8
2	Proposal	Sat 07/9/8	Mon 07/9/24
3	Written Progress Report	Mon 07/9/24	Mon 07/10/8
4	Function Specification	Mon 07/9/24	Mon 07/10/15
5	Design Specification	Mon 07/10/1	Mon 07/11/5
6	Development	Fri 07/9/28	Fri 07/11/23
7	Funding	Fri 07/9/28	Fri 07/10/12
8	Ready for Oral Progress Report	Mon 07/11/5	Fri 07/11/16
9	Ordering Parts	Fri 07/9/28	Mon 07/10/29
10	PCB Design	Fri 07/9/28	Fri 07/10/19
11	Integration	Mon 07/10/29	Fri 07/11/16
12	Debugging	Fri 07/11/2	Fri 07/11/23
13	Prototype	Mon 07/10/29	Fri 07/11/23
14	Real Life Testing	Fri 07/11/23	Fri 07/11/30
15	Usability Evaluation	Sat 07/9/8	Fri 07/12/14
16	Presentation and Demo Preparatio	Fri 07/11/23	Fri 07/12/14
17	Lab Journal & Project File	Fri 07/12/7	Fri 07/12/14
18	Post Mortem	Mon 07/12/3	Fri 07/12/14
19	Documentation	Sat 07/9/8	Fri 07/12/14

Figure 2: Original Timeline

5.2.1 Final timeline



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17	Lab Journal & Project File	Fri 07/12/7	Fri 07/12/14
18	Post Mortem	Fri 07/12/14	Mon 07/12/17
19	Documentation	Sat 07/9/8	Mon 07/12/17

Figure 3: Final Timeline

From the two schedule figures above, we can see that our design and implementations have all been delayed by about a week. This is largely due to the major setback in our software development of the Server Unit and the Kitchen Unit.

6.0 Possible changes and improvements

SWIS feels that probably one of the most useful improvements that can be made to the final system is an added feature which would allow end users to customize the interface of the SerCal on their own. To achieve this, separate software would have to be provided to allow different hospitality environments to customize the paging options of the SerCal and the user interface. We believe that this would be a great improvement and a selling point of the SerCal as customers would no longer be constrained by the limited framework that SWIS provides but are instead able to customize their own unique Caller network with our easy-to-use software.

Another possible improvement would be implementing the code in such a way that even mobile phones can be configured as the Server Unit. This can be done by re-writing the Server Unit software in Java. The reason is in these days, most mobile phones have Java on them.

Yet another possibility is to allow the user to customer the menu items by simply importing different text file. This can be done through the use of excel files and then hot-sync to the PDA devices.

Wi-Fi communication protocol between the server, kitchen, and buttons is seen as more beneficial than Bluetooth, as the range improvements and no direct line of sight is needed. Also the SerCal setup could be maintained via a website which would allow customization and easy improvements and updates.

7.0 Ecological Footprint Assessment

In our SerCal System design, ecological footprint assessment wasn't considered a great deal in the making of the prototype. However, now that our prototype is near completion, we can start thinking about making it more ecological friendly. We will separate the assessment into 3 parts: Table Unit, Server Unit, and Kitchen Unit.

First, for the Table Unit, we are currently using a Bluetooth mouse for the Table Unit. This means we can't change how they are manufactured. However, if we re-design the Table Unit using different components, we can reduce the ecological footprint by taking out the unnecessary components that were used in the mouse but not by our Table Unit. Moreover, we can reduce the size of the unit so the casing will be smaller, thus save material.

Secondly, for the Server Unit, since we are using a PDA, there really isn't anything we can do about it. However, if we re-write the software in such a way that it can be used by mobile phones, we can greatly reduce the ecological footprint. The reason is because nowadays, almost everyone is carrying a cell phone, if we can turn these cell phones into Server Units, our customers won't need to buy new PDA's.

Lastly, because the Kitchen Unit is basically just software on a computer, we can't really reduce much. One thing we can do is to let the customer download the software instead of selling CDs.

8.0 Individual Project Reflections

Aron M^{c}Kinnon:

The Ensc 305/440 course has proved to be a valuable and important component of my engineering learning experience. As an inspiring entrepreneur, I was able to place myself in a situation similar to that of creating a small start up company, in which I was able to discover some pitfalls and benefits of different techniques.

Among these entrepreneurial techniques, is communication. The benefits of increased communication throughout our project was made obvious, as our group members became more comfortable with each other, communication increased, and our productivity increased with it. It may have proved beneficial to spend more time in the first few weeks of the project to spend time to try to become more familiar with the other members, by playing a game, or doing some other fun activities, which could have allowed us to understand each other easier on more serious tasks.

I found that splitting up the groups and doing tasks independently was not productive. The amount of work/research/understanding gained working directly with another member more than doubled and the quality of work was substantially better.

I enjoyed the course, but feel that if we had more time we could have brought the project to a conclusion. I strongly recommend combining this course and Ensc 201.

Raymond Tan:

I feel that ENSC 305 and ENSC 440 have greatly enriched my experience as an engineering student. It deviates from the usual technical and knowledge based courses in the engineering science department. These 2 courses really made us engage in individual studies, research and many other non-technical work like marketing issues, understanding market demands and very importantly the various systematic phases in a product manufacturing and documentation process. I believe that the knowledge I gain in the whole process of producing our own prototype would be very beneficial to me in my future work place.

Besides the knowledge gained on manufacturing our product and technical knowledge involved in our prototype, we also learnt other vital skills that are applicable to many other aspects of life. These include good time management, good communication skills, managing limited funds and very importantly also how to be an effective team player whether you are a team leader or a team member.

After these 2 courses, I somewhat have an idea on the key points that make a successful group effort. First of these is the necessity to be a good team player and be able to switch between roles of being a leader and also a member. I realise it is as important to be a listener as it is to be the speaker/advocator and to have a healthy balance between these 2 in order to avoid unconstructive internal conflict while also not being overly agreeable and be subjected to what is known as group think and other psychological defence measures. I also learnt the importance of not being too egocentric but to instead be open to and respect the views and opinions of others in the group although you might never get to see their rationale behind those. Probably one of the more

important of the few remaining key points to a successful group effort is earning the respect of your team mates. I believe this respect has to be earned from many different aspects, namely good communication, being timely, equitable share of workload, making sure to best achieve group consensus and most importantly to be able to deliver what you claimed to be able to.

Overall, ENSC 305 and ENSC 440 were very practical and enriching courses and should definitely be taken by all engineering students.

Peter Chen:

The Ensc 305 and Ensc 440 courses provide great experiences towards my experience as an engineer. These courses not only provide technical experiences, but inter-person experiences as well. This course is very different from our usual courses in ways that teaches us how the real world works.

In the technical department, I learned that research is very important for a project to be completed on time. Insufficient research will lead to huge amount of time wasted.

In the inter-person department, I learned that it is sometimes very hard to communicate and work with others. This is especially true when working with people you never knew before. This is why I suggest future Ensc 440 students to form group with people you know well and work well with. Otherwise, you may pay dearly in this project.

Overall, I think the Ensc 305/440 is a great project. It is probably the most useful course in the whole Engineering education.