SMART SENSE
innovations

School of Engineering Science • Burnaby, BC • V5A 1S6
http://ssi.cjb.net • ssi-ensc@sfu.ca

January 19, 1999

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

Re: ENSC 370 Project Proposal for a Mobile Paging Car Security System

Dear Dr. Rawicz:

The attached document, *Proposal for a Mobile Paging Car Security System*, outlines our project for ENSC 370 (Transducers and Embedded Systems). Our goal is to design and implement a programmable unit that will alert a car owner, through a mobile page, when the car alarm has been activated.

The purpose of this proposal is to provide an overview of our proposed product, an outline of the design considerations, our sources of information and funding, a tentative projected budget, and information on project scheduling and organization. This document also explores alternative forms of car security and this system's market potential.

Smart Sense Innovations consists of four motivated, innovative, and talented third-year engineering students: May Huang, Shirley Wong, Caroline Dayyani, and Frederick Ghahramani. If you have any questions or concerns about our proposal, please feel free to contact me by phone at (604) 123-4567 or by e-mail at ssi-ensc@sfu.ca.

Sincerely,

Shirley Wong

Shirley Wong
President and CEO
Smart Sense Innovations

Enclosure: *Proposal for a Mobile Paging Car Security System*

SMART SENSE
innovations

Proposal for a

Mobile Paging Car Security System

Project Team: Caroline Dayyani
Frederick Ghahramani
May Huang
Shirley Wong

Contact Person: Frederick Ghahramani
ssi-ensc@sfu.ca

Submitted to: Dr. Andrew Rawicz – ENSC 370
Steve Whitmore – ENSC 305
School of Engineering Science
Simon Fraser University

Issued date: January 19, 1999
Revision: 1.1

EXECUTIVE SUMMARY

Jane has had the most stressful workday of her life. Her clients had her running all day, constantly paging her for support, all demanding immediate answers and attention. Finally, her workday comes to a close, and she longs to leave for a hot bath. Car keys in hand, Jane experiences the biggest shock of her life in the parking lot: some time in the last 14 hours, her car has been stolen and her day just got worse . . . .

Jane's story is all too familiar these days. It seems we all know of someone who has been a victim of auto crime. Provincial statistics highlight a large increase in auto theft, and according to the Insurance Corporation of British Columbia (ICBC), more than 60,000 vehicles were stolen or vandalized in British Columbia in 1997 alone. This figure has increased more than 750% since 1989 and costs tax payers nearly $130 million every year.

Many preventative devices have been developed to deter, and even stop, potential auto thieves from stealing a car. Physical restraint systems have been designed to impede the movement of the steering wheel or to disable the forcefully entered vehicle. Alarm driven deterrent systems are popular, and in theory, alert passersby of illegal activity. However, false alarms have begun to annoy the public. A recent study suggests 68% of car drivers pay little or no attention to car alarms, and instead assume they are false alarms (RCMP, Burnaby Detachment sources). Moreover, these devices provide little information as to the exact timing of the theft or vandalism.

This document proposes developing a device that will interface with an already existing car security system. The device sends an alphanumeric mobile page to the car owner when the car is being vandalized or stolen. Such a device can be designed to interface with both existing preventative and deterrent systems. Using this device, the car owner will be provided with immediate feedback as to the state of their car's security, thereby empowering the car owner to take action instead of expecting passersby to be alerted by these alarms.

Smart Sense Innovations (SSI) consists of four third-year engineering science students with experience in analog/digital circuit design, telephony, and signal processing. SSI members are also well trained in a wide range of software design, from real time operating systems to microprocessor assembler programming.

We propose the engineering cycle for this project will encompass research, design, and construction. This cycle will span a 13-week period with April 1, 1999 as the scheduled completion date for an operational prototype. The entire project is tentatively budgeted at $800.00, which we expect to obtain from a variety of sources.

Table of Contents

1. INTRODUCTION

"Where there is wealth, there is crime" – This ancient Assyrian proverb couldn't be more true today. Car theft and vandalism is on the rise in British Columbia, costing tax payers upwards of $130 million every year, which is greater than the 1997 provincial deficit.

Car owners have some options in attempting to counter this rise in auto theft and vandalism. Many third-party after-market systems have been developed and marketed. These products range from physical preventative devices that lock the steering wheel or disable the car, to alarm driven deterrent systems that sound a siren alerting passersby of illegal activity.

The objective of our project is to develop a stand-alone module that will interface with an already existing car security system. The device will receive as input, the output from the car security system. The module will ultimately send a mobile alphanumeric page to a preprogrammed commercial pager number. The paging will be executed through the use of DTMF code generation and an embedded mobile telephone. Depending on the quality of the existing security system, our system will also be able to differentiate between the class of alarms (a "you are too close to the vehicle" alarm versus a "the window has been broken" alarm), subsequently sending 2 different types of pages.

A mobile paging car security system will give the car owner and law enforcement officials immediate warning when an auto theft or vandalism is occurring. This immediate surveillance feedback is promising, considering the statistics of the timing of auto theft and vandalism. According to ICBC, nearly 54% of auto thefts occur between 8 pm and 5 am, presumably after cars have been parked for the night. Another 28% occur between the hours of 9 am and 4 pm, presumably when commuters have parked for the day. Both time frames share the characteristic that the report of the theft or vandalism will occur several hours after the criminal act.

This delay between the realization of a crime and the occurrence of the crime, places law enforcement officials in a very difficult situation when attempting to investigate the theft. According to the Burnaby detachment of the RCMP "auto crime and property crime are recorded, but [are] rarely investigated unless we catch the thieves red handed, or have a special project to target a series of crimes." A device that alerts the car owner when a theft is occurring could aid law enforcement and finally catch all such thieves red handed.

This document is a proposal providing an overview of our product, outlining design considerations, sources of information and funding, and project scheduling. Alternate solutions and existing forms of this system are discussed and critiqued. Projected financial requirements and sources of funding are provided, as are project, Gantt, and milestone charts.

2. SYSTEM OVERVIEW

Figures 1 and 2 show the basic function of the mobile paging car security system. The sensing stage of the module is attached to the existing car security system. The state of the alarm system is monitored, and analyzed until it is determined that the alarm system is activated. At that point, the system utilizes the embedded mobile telephone to generate and output the alphanumeric page to the pre-programmed number.

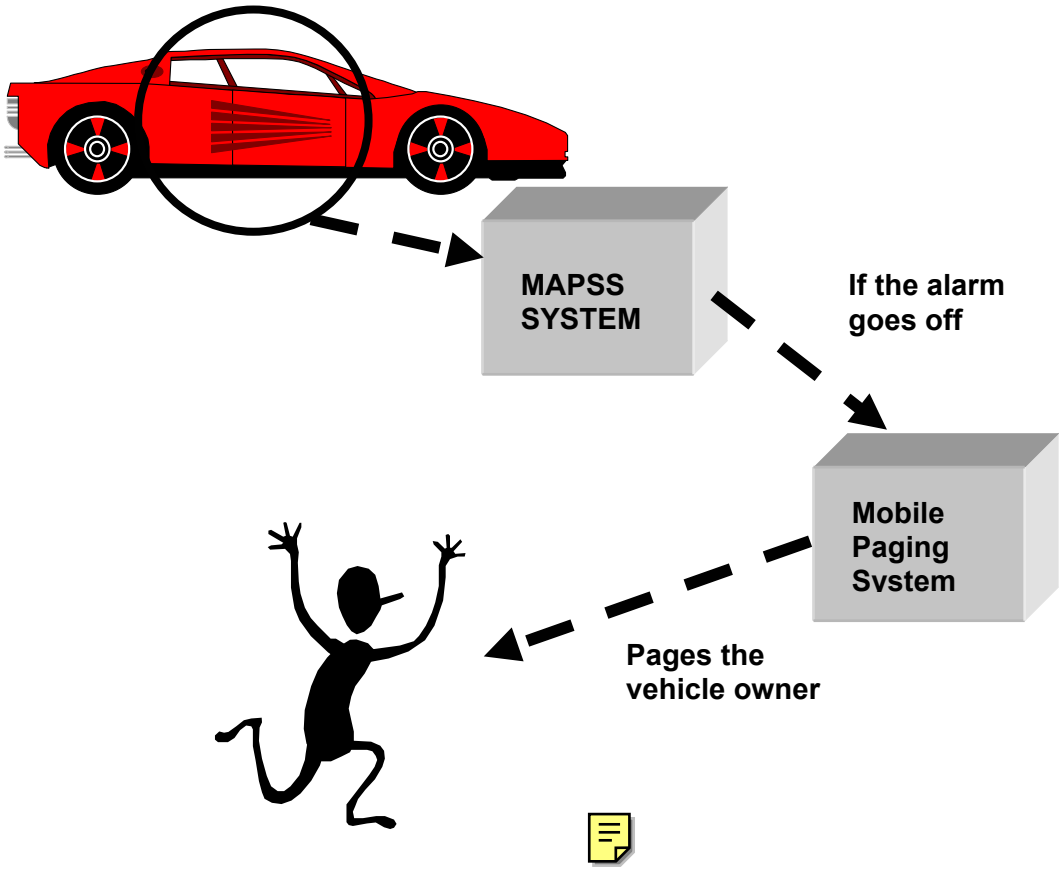


Figure 1: Conceptual Overview

A simple programmable user interface is provided to allow pre-programming of the mobile pager number. Inside the processing unit, the output from the car security system is sampled on a consistent clock cycle frequency to detect an activation.

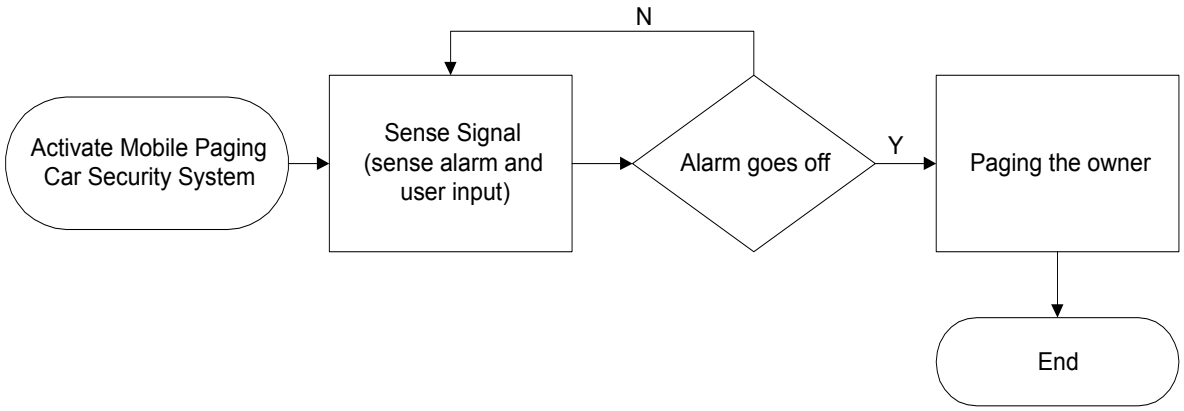


Figure 2: System Block Diagram

3. POSSIBLE DESIGN SOLUTIONS

Currently, with the help of new technology, there are many different ways to catch car burglars. Although current deterrent and restraining devices minimize car crime rates, these systems still have many disadvantages. One of the biggest problems in preventing crime is a need for a system which can be activated quickly in order to determine the actual time and place the crime occurred. Some of the devices currently used are listed below.

3.1. Car Alarm Systems

One of the problems with recent car alarms is that once activated, they send out an annoying sound which in most cases disturb other people until the owner of the car is informed. Moreover, we lack a fast way to inform the car owner about his/her car burglary. Also, in many cases people have difficulty determining whether their car alarm system has been activated or someone else's. Another problem is that even with new and expensive car alarms, the rate of auto thefts is still so high that some people do not trust car alarms at all.

3.2. Steering Wheel Locking Systems

Although using a steering wheel locking system (also known as the *car club*) is a less expensive way of preventing car thefts, it can easily be bypassed once the car door is broken. Another disadvantage is that the owner will not be informed, in any way, of when the crime took place. Since these devices are physically obstructive, they do slow down crime rates – but they don't stop the crime. For this reason, many people distrust using car clubs.

3.3. Existing Custom Pager Systems

Another option for car owners is to use custom pagers that will alert them when their car has been broken into. But these pagers don't have the range of commercial pagers. Moreover, the car owner has to buy another device on top of his/her existing pager. This system requires a person not only to pay more, but also to carry an extra device.

4. PROPOSED DESIGN SOLUTION

Our proposed solution is to build a module that interfaces with an existing car alarm system and delivers a distress mobile page to the car owner once the alarm has been activated. Such a device would be very useful to law enforcement officials who would be given a chance to catch auto thieves or vandals *red handed*. This device would also be beneficial to the general public on two accounts. First, the financial burden that the crown insurance corporation (ICBC) must pass on to tax payers every year would be decreased. Second, this device would immediately alert the car owner of an alarm, thus eliminating the annoying phenomena of the neighbor who left his alarm on for 30 minutes.

A mobile paging car security system is not a novel idea. Already several car alarm developers have designed such a solution. Unfortunately, these solutions involve the purchase of a system-specific pager and do not offer as large a coverage (2 miles at best) as conventional paging networks. The simplification offered by our design is that any commercially available pager can be used as the alert device. As such, we are proposing an inexpensive and simple way of providing peace of mind to car owners who are at an increasing risk of being the victims of auto-theft and vandalism.

The main constraints in completing this project are the limited timeline and funding. We have only been allotted thirteen weeks to complete the project, and we must seek funding on our own initiative in that same time frame. Within these constraints, we will be able to build a simple module that will be customized only for a specific type of car security system and will send a distress mobile page to the car owner when the car alarm has been activated.

With more time and money, we would develop a more robust mobile interface unit. Such a unit could interface with any given security system or we could even develop our own security system. As well, a module that delivers a mobile page upon sensing a certain action could have a variety of other applications, such as implementations for home security or for the hearing impaired (in this last case, the device could be adapted to differentiate between the door bell, a phone ring, a fire alarm, etc.)

The number of applications for a robust mobile page interface unit is considerable. For our ENSC 370 project, however, we have decided to design the module specifically to combat auto theft.

5. SOURCES OF INFORMATION

In researching and analyzing our problem, we will obtain information from a variety of sources: course textbooks, electronics periodicals, telecommunication publications, and manufacturers' component specification sheets for mobile phone and security systems.

The Internet will likely be a valuable resource for locating sources of funding, industrial contacts with similar projects, and other technical information. For example, the Statistics Canada website led us to the RCMP website, where we managed to find the phone number of a contact person who informed us of several grants that we could apply for. He also connected us with the ICBC information resources coordinator.

In addition, several faculty at SFU are currently involved in telecommunications research and will no doubt be invaluable resources for our project. As well, some undergraduate students in Engineering Science have previously worked on related projects and can be contacted for technical information. For example, Matt Stewart and Tim Norman conducted some student-level wireless research for their wireless fencing sensor.

Finally, perhaps the most intriguing and eccentric individual source of information is a team member's colleague from industry. At the age of 16, this individual was prosecuted for *hacking* several private corporation PBXs for long distance usage (a practice that earned the now reformed individual an instrumental design position at a telecommunications company two years later).

6. BUDGET AND FUNDING

6.1. Budget

Table 1 outlines a tentative budget for the mobile paging car security system. Many of the sub-components have been grouped with their functional equivalents. For example, a microphone will most probably be used and has been grouped with the "Mobile Phone and Accessories". Also, a pager must be activated for testing and has been grouped with the costs of the mobile phone. Most components have been overestimated by at least 15% to provide for contingencies.

Table 1: Tentative Budget

Equipment	Estimated Cost
Mobile Phone and Accessories	$400.00
Dialer	$200.00
Back up Power System	$100.00
User Interface	$50.00
Signal Splitter	$20.00
Cables	$15.00
Case	$15.00
Total Cost	**$800.00**

6.2. Funding

As with the design of any prototype, the initial engineering cycle will require more capital than the actual cost of the finalized product, especially given economies of scale once the original cycle has produced a prototype.

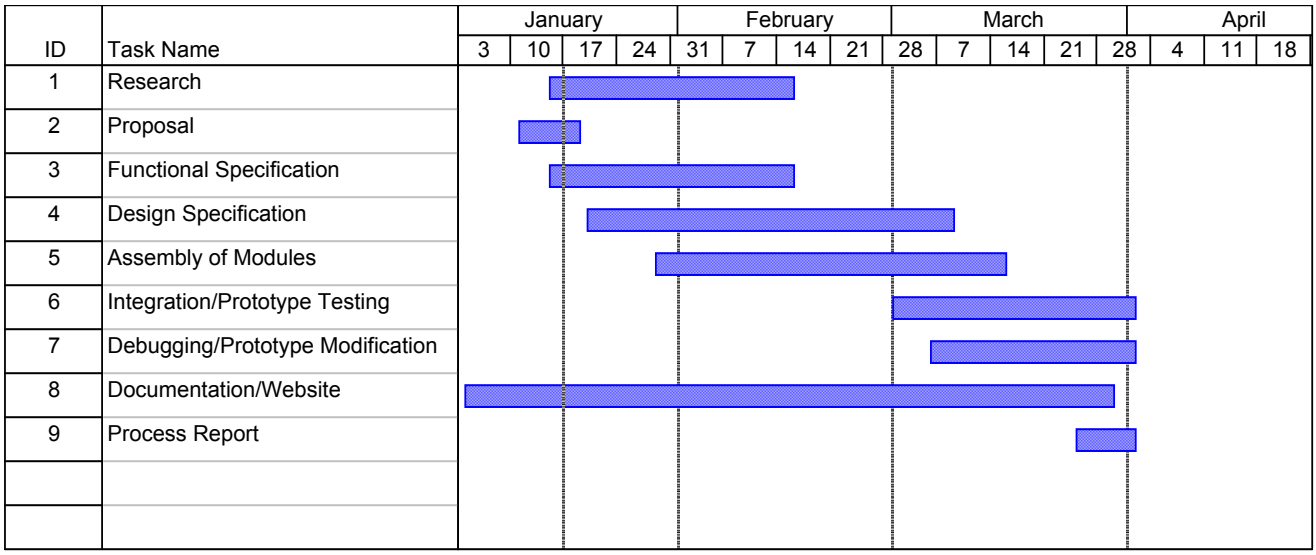
Due to the high cost of this project, many sources of funding are being considered. SSI is in the process of applying for the Engineering Science Student Endowment Fund, the Wighton Development Fund, and the ICBC Auto Crime Prevention Grant. As well, the Burnaby detachment of the RCMP has shown interest in contributing used equipment. We are also currently involved in lobbying two local government officials for nominal financial donations (the Burnaby MP and MLA), and a Burnaby consulting firm (AGF Robertson Inc.) has pledged to contribute financially to our project.

Our team members are willing to accept that we may not be able to generate enough original capital to sufficiently fund the entire project. If such circumstances arise, our team members are willing to share the remaining financial costs of the project equally. An accurate account of all financial transactions will be kept to ensure proper reimbursement to members. We also plan on entering our design in several competitions in the future, such as WECC (Western Engineering Conference and Competition) in January 2000 and miscellaneous other engineering competitions in hopes of reimbursing our members.

7. SCHEDULE

Table 2 shows the Gantt chart of the expected time to be spent on the various tasks involved with our project. Figure 3 shows the corresponding expected completion dates for the various tasks mentioned in Table 2.

Table 2: Gantt Chart



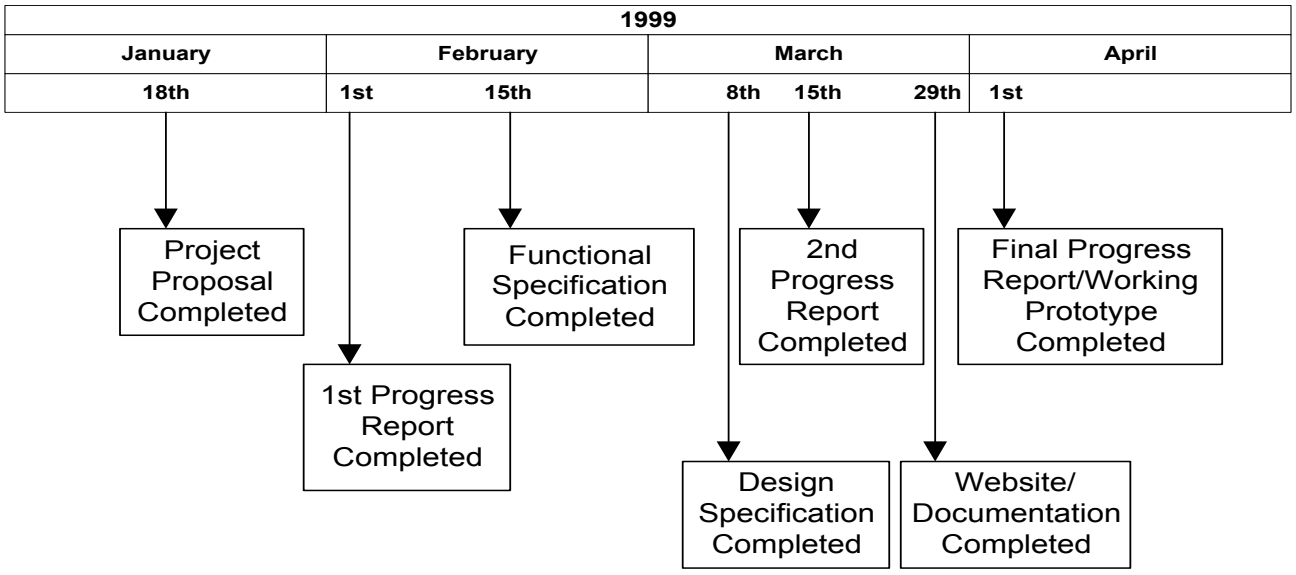


Figure 3: Milestone Chart

8. TEAM ORGANIZATION

Smart Sense Innovations consists of four talented and creative engineers: May Huang, Caroline Dayyani, Shirley Wong, and Frederick Ghahramani. All members are third-year engineering undergrad students, with differing program specialization interests. Our diversity of interests is important to note, for each member will contribute his/her specific expertise to achieve a common goal for this project. The members' specific skills are highlighted in the next section, Company Profile.

SSI's corporate structure is loosely organized in the following manner: each member is responsible for a specific field of operation in the corporation. But with a project this large, a great deal of the work will be shared and delegated among team members. Shirley Wong, President and Chief Executive Officer (CEO), is in charge of the overall progress of the project and is also responsible for resolving organizational conflicts. Caroline Dayyani, Chief Financial Officer (CFO), will manage the budget and resolve financial issues. May Huang, Vice President of Operations, is in charge of the technical operations of the project and is also responsible for acting as the "design elder" in suggesting alternative solutions to technical issues. Frederick Ghahramani, Vice President of Marketing, is responsible for generating capital through product marketing, shareholder recruitment, and web page design.

To ensure proper group dynamics and concise communication, the team has designated a meeting time once every week to discuss the progress of individual tasks. Instead of permanently appointing a member to be a scribe or chairperson for meetings, we have instead decided to have an open forum meeting structure with the only rule being "respect the opinions of others." At the beginning of the meeting, the team sets a timeline for the end of the meeting to guarantee that the dialogue remains on topic. Members who miss, or are late to meetings, will end up missing the doughnuts provided that week, so we don't foresee anyone missing a meeting too often.

The task assignment will be allotted based upon member's strengths and weaknesses. Upon functionally decomposing our solution into smaller modules, we plan on pairing up into groups of two to complete specific tasks. At this time, we foresee the need for three groups of two operating every week. This leads us to the structure where one person each week will be involved in two projects. The member performing a "double duty shift" will be alternated weekly to ensure that each member of the team receives a proper rest period and sufficient preparation time for other courses.

Many engineering students who have taken ENSC 370 in the past have noted the importance of team work and group dynamics in successfully completing their projects. With this in mind, we believe that SSI – with its open-minded yet focused teamwork ethic – will be successfully complete its project Moreover, SSI's members may still be friends after four months.

9. COMPANY PROFILE

Shirley Wong – Chief Executive Officer (CEO)

I am a third year Systems Engineering student at Simon Fraser University with a previous co-op term placement at PMC-Sierra. My skill set encompasses both software and hardware. Through course work and work experiences, I have programmed in C++ and 8086 assembler. I have implemented and designed test schemes for custom designed integrated circuits, designed TTL to PECL converters using MC10ELT20 translators, configured FPGAs as well as various other digital hardware. However, more important than my technical experience is my ability to communicate and work well with others.

Caroline Dayyani – Chief Finance Officer (CFO)

I am a third year Systems Engineering student at Simon Fraser University with previous co-op term experiences in the Opto-electronics Lab of Nortel Networks and Biomedical Departments of Vancouver General Hospital. I have programming experience in object-oriented design (C++) and Assembly language. I am familiar with the operations of most electronics equipment used in the lab such as oscilloscopes, power supplies, function generators, digital multi-meters, and FFT spectrum analyzers. I have experience with the design of PCB layout using PSpice and assembly of PCB boards by hand. As well, I am able to design and implement circuits at the logical switch and transistor levels. Further, I am familiar with the operation of different kinds of sensors, actuators, motors, generators, and feedback systems. Above all, I have good communication and team-work skills.

May Huang – Vice President of Operations (VP Operations)

I am a third year Electronics Engineering student at Simon Fraser University with experience in a variety of fields. In past years, I have taken courses in semi-conductor devices, analog and digital communications, and real-time and embedded systems. Some of the projects completed relating to these courses include a Plate Sorting System using pneumatic sensors and PLC, games implemented on the 68HC11 and displayed on an analog oscilloscope, and a Train Simulator and Emulator programmed using C and QNX.

Frederick Ghahramani – Vice President of Marketing (VP Marketing)

I am a third year Computer Engineering student at Simon Fraser University with two co-op work term experiences (Ballard and Nortel wireless). My strengths lie predominantly in software and digital processor design. More specifically, I have extensive experience with low level assembly and machine code debugging on a variety of processors (8086, HC11, PowerPC 604e). I've undertaken several self-initiated telephony projects in the past and have experience with fundraising and marketing in general.

10. CONCLUSION

Smart Sense Innovations is dedicated to applying technology to help reduce auto thefts and vandalism. The result of our goal is financially beneficial to car owners as well as tax payers. Along with the financial savings, comes the peace of mind in knowing that a reduction in auto crime can mean an increase in the number of safe neighborhoods.

Our proposed security system module would empower law enforcement officials in their pursuit of car thieves and provide car owners with instant feedback as to the state of their cars. Our approach is more cost effective than similarly existent systems through the use of already existing commercial paging networks. Our system is functionally superior to conventional car alarms due to the instant remote feedback.

The Gantt and milestone charts in the schedule section demonstrate that this project can and will be completed in the time frame allotted. We have highlighted our sources of information and research material. We have presented our potential financial sources, and have clearly defined our solution and proposed a strategy to achieve this objective.

We are confident that by April 1999, no matter how long Jane decides to stay in the office, she can rest assured that she'll never again have to face an empty car stall at the end of the day.

11. SOURCES AND REFERENCES

1) Apex Electronics (Kingsway, Burnaby)

2) BCTEL Mobility (Metrotown, Burnaby)

3) Radio Shack (Metrotown, Burnaby)

4) RP Electronics (Richmond)

5) Sergeant Cooke, Burnaby Detachment of the RCMP

6) Constable Scott Sheppard, Burnaby Detachment of the RCMP

7) Janice Knapp, ICBC Information Resources Coordinator, ICBC Public Affairs

