

January 25th, 2005

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Re: ENSC 440 Project Proposal for a Wireless Home Security System

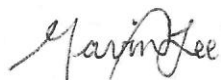
Dear Mr. One,

The enclosed document, Proposal for a Wireless Home Security System, outlines our capstone project for ENSC 440. Our goal is to design a wireless home security solution that notifies the home owners through their computer or a cell phone, in case of fire, flood, or break-ins.

The purpose of the proposal is to provide an overview for our product. It outlines the system overview, sources of information, budget and funding, project schedule, and team organization. This document also compares how our proposed product is better than traditional home security systems.

Our company, WInnovations, is comprised of four 5th year SFU engineering students: Jason Fong, Alex Hsiao, Gavin Lee, and Gaurav Magoon. If you have any questions please feel free to contact us at ensc440-security@sfu.ca.

Sincerely,



Gavin Lee
CEO
WInnovations

Enclosure: Proposal for a Wireless Home Security System



Proposal for a
Wireless Home Security System

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Issued date:

January 25th, 2005

Executive Summary

Security and communication are two of the most important issues to today's consumers. With the increase in media coverage about property crimes and terrorism, few things would calm a person's mind more than a sense of safety. In this age of the Internet and wireless telephony, instant communication has become a mainstream in the Canadian lifestyle.

WInnovations, a newly formed company comprised of four creative fifth-year Simon Fraser University engineering students, aims to deliver an enhanced wireless security solution to the consumer market. Each student has experience and skills in separate concentrated areas, and together they constitute a team of balanced hardware and software capabilities.

The product WInnovations plans to create is a wireless home security system that notifies the owner via the screen, cellular telephone, telephone or email when there is a natural disaster or a security breach is detected. In this way the homeowner is immediately notified, and it is his or her decision to notify the authorities. This is different from the traditional systems where the authorities are immediately contacted through a contracted home security service company such as ADT Security or Brinks Security. Some other traditional systems are not handled by a dedicated home security company and generally trigger a siren as a means of a warning.

This system will consist of a number of sensors located in the home and an attached transmitter which will send data from the sensors wirelessly to a receiver connected to a PC. When a natural hazard or a security breach is detected, the PC will relay the information from the receiver to the user. The goal of this product is to improve the notification of any incidents at home to the homeowner as soon as possible, increasing the integrity of emergency calls to authorities while reducing the number of unnecessary dispatches.

With a project start date of January 2005, we expect to complete this project by April 2005. Three demonstrations will be presented during this time frame: an oral presentation in mid-February outlining our project, a preliminary demo in mid-March showing working progress, and a final group presentation in mid-April exhibiting our finished product. Since we had previously arranged to obtain a wireless transceiver kit, the total cost of the project is expected to be kept under \$390. We will attempt to have at least part of this covered by awards from the Engineering Science Student Endowment Fund (ESSEF) and Wighton funds, both administered by the SFU Engineering department.

We hope you will find our product idea to be interesting and helpful to society, as well as being profitable for all parties involved.

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1. Introduction

According to Statistics Canada, in British Columbia in 2003, there was a total of 52,949 break and enters reported to police, 26,356 which occurred were residential [1]. In Canada, between 2002 and 2003, the number of break and enters increased 2.4% from the previous year [2]. The increase in the number of break and enters is an indication that home owners need to focus on improving home security.

Many preventative measures have been developed to deter theft which includes the conventional house alarm with a siren to house alarms monitored by security companies where the owner will be called in the case of an emergency. The ubiquity of home security systems has proven to be somewhat effective in deterring theft although the passive nature of most security systems can only trigger a siren in the event of a break-in, which people often ignore.

Not only is security a concern within the household, but safety needs to be a consideration as well. For example, house fires, gas leakages and flooding are some of the possible considerations for home safety. According to British Columbia residential fire statistics, the two leading causes of residential fires are cooking and heating which contribute 24% and 12%, respectively [5]. Moreover, the two leading causes of residential fires have resulted in an annual property loss of \$17 million [5].

In 2002, 17% of residential break and enters were solved by police in Canada [3]. Therefore, the need to be concerned with home safety and security has resulted in programs such as BlockWatch, where neighbourhoods work together to monitor the neighbourhood. However, an effective means to provide home security around the clock is needed more than ever.

The primary objective of WINnovations is to develop a wireless security system that takes into consideration home safety and security without the hefty monthly costs associated with home security monitoring services or high installation fees. The security system will contain various sensor modules which interface with a main transceiver module to send signals wirelessly to another transceiver connected via serial port to a household computer. The user can monitor safety and security activity on a custom interface on the computer or receive notification via e-mail or text messages through SMS (Short Message Service).

This proposal outlines the system overview of our product, the design approach we have chosen to take and our budgeting and funding for undertaking this project.

2. System Overview

In the wireless home security system, sensors will be placed in various settings in a home. Their status will be constantly monitored and if the sensor goes off or has detected a state of danger (such as smoke detector, flood detector, home security, etc), a wireless signal will be sent to a PC that is located in a different location for urgent notification. Figure 1 illustrates this idea [7].

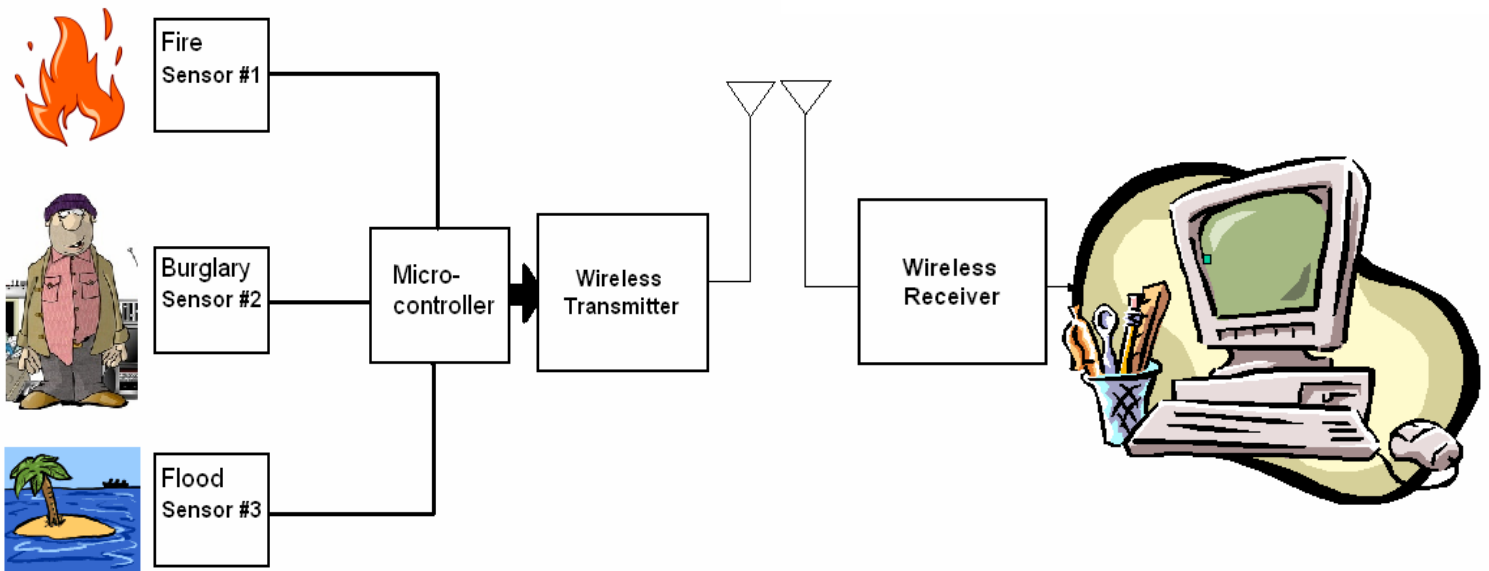


Figure 1: Conceptual Overview

Initially only a few sensory devices are going to be included in the system but as more features become necessary, more sensors can be added. The wireless transmitter will send text messages to the PC. The interface on the PC will be notified if there is a message just received including which sensor sent the message. Figure 2 shows a flow chart of the behaviour of the system setup as in Figure 1 but at a slightly more detailed level.

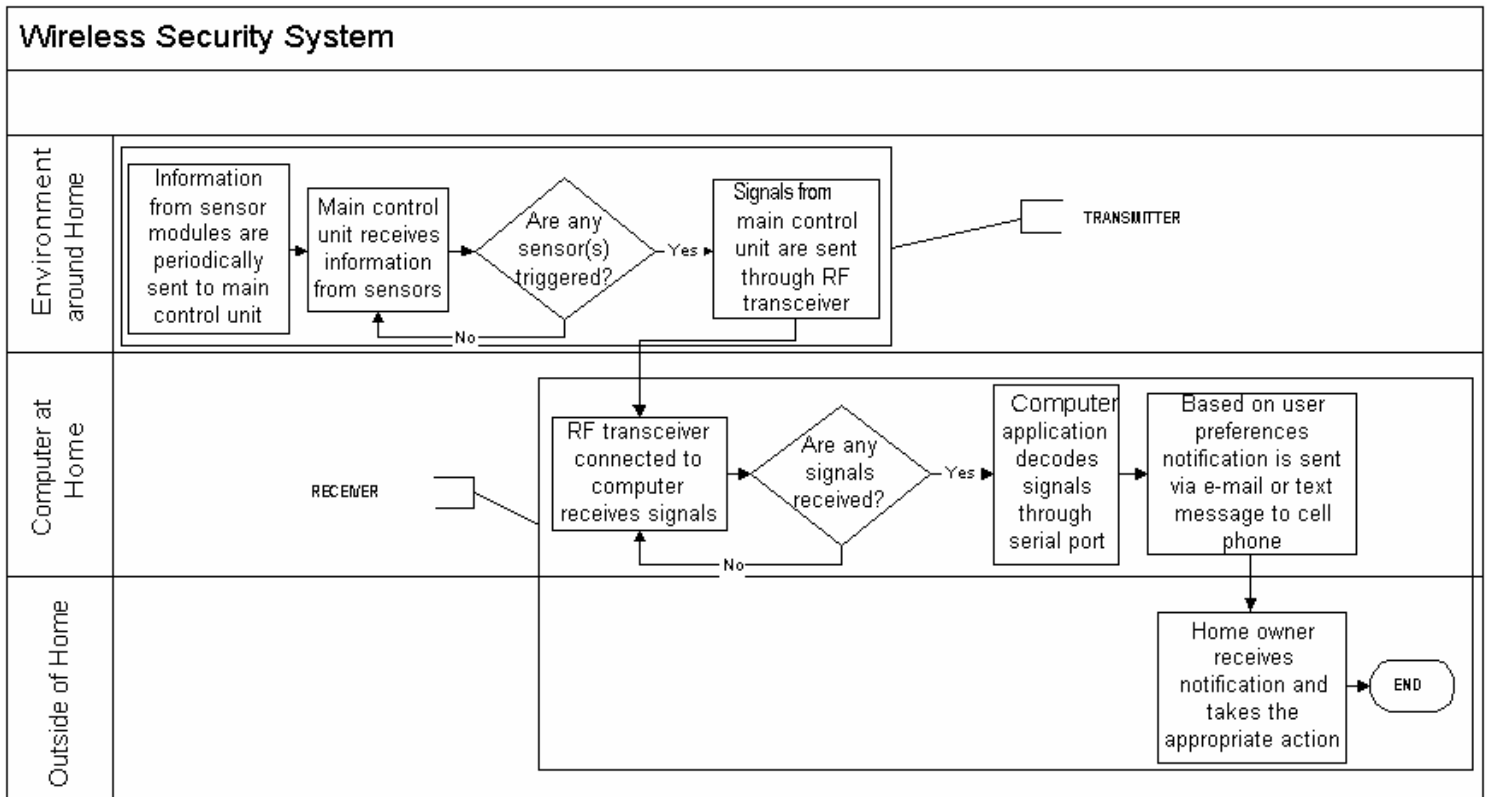


Figure 2: System Overview Flowchart

Figure 2 illustrates the process overview on the receiver and transmitter side of the home security system. This flowchart illustrates the process flow of the transmitter and receiver behaviour.

3. Possible Design Solutions

Currently there are many other security systems present on the market that aim towards total home security for the user such as ADT home security [4] or Brinks home security as well as individual security devices.

3.1 ADT / Brinks Home Security Systems

One of the drawbacks of home security systems for consumers is companies that charge the home owner a monthly fee for home security. Another problem with such systems is how the home owner has no flexibility on changing the location of the home security system as they are usually hardwired. Monthly charges do not allow the user to have their own portable home security device; the home owner is tied down by a contract. Several of these companies have control over the home security, which means that if these companies are breached, the home is breached. These companies also have full access to your privacy and that puts you at a personal risk. Intruders could possibly tap into the security systems of such companies and gain access to one's home security codes. This can be discouraging in the long run. These security companies may also claim higher prices and monthly service charges for your home security, which you have no control over.

3.2 Alternate Home Security Solutions

There are several other home security solutions on the market. Most of these systems are stand-alone devices for smoke detection, flooding, home-security, carbon monoxide detection, etc. For example, one device that is offered by a security company is called XCam2 wireless security camera which transmits live TV to any wireless recording device [8]. Another device is an all-in-one security device offered by T-Quest called The Private Detective which calls 6 designated numbers upon a fire breakout [9]. The user can expand the system with another sensor, a wired door sensor. Thus, this system has a limitation of only two security sensors. Several other companies promote similar types of devices for security purposes. By limiting the number of security features on the devices to at most a few, the device offers less security and safety for the home user.

4. Proposed Design Solution

In our design solution, we provide a solution to the problem of a single device that can provide features to monitor home security, fire, floods, etc. Furthermore, our device will transmit the data to any computer remotely via wireless communications. This method of notification is very efficient because the user has full control over the status of the device without having to continuously check on its battery life. Our goal is to create a smart system that allows the user at the PC to be able to continuously receive full status of the remote security device and of each of the sensors, in addition to a log of any abnormal activity.

We plan to design a very user-friendly user interface such that any authorized PC user may be able to check on home security. Our user interface is not strictly limited to a user sitting at home, but also for a user that may be outside of the home. By including the phone line and the Internet (broadband) in the software, if a problem occurs and nobody is at the PC then a signal will be sent out of the house for urgent warning.

Thus, our system combines an in-home security system and an outside home security system that is not provided by other home security systems such as ADT. ADT has full control whether one is inside the house or outside other than allowing the user to disable/enable home security. At the same time we include flexibilities that will allow the user to be able to add on additional sensors.

There are a few possible constraints that might be encountered for this project. These constraints may be time and equipment. Since we intend on using an existing RF kit that is used for wireless communications, we need to find a way to interface it with these units without modifying the kit. It may be difficult because sometimes one has to modify their equipment or devices to work towards a certain goal. Currently, we intend on starting off with only three sensors, and hope to soon design the system to accommodate more sensors. We will also attempt to expand the user interface software to include several other software-oriented features, such as an audible sound alert.

5. Sources of Information

In pursuing the completion of our project, we intend on referring to several sources of information. They include electronics engineering journals, electronics magazines (UK), radio frequency kit documentation/manuals, datasheets, and course textbooks. The Internet will prove to be an effective resource that will provide a source for datasheets and electronic journals obtained through the SFU library databases. We also intend on utilising online electronic resources such as search web sites for electronic journals.

We also intend on relying on some of the team members who have completed work terms in various industries learning invaluable hardware and software skills that we believe will help tremendously. In addition, previous courses taken by team members in the areas of network communications, embedded system design, and microelectronics circuit design will be of additional benefit for this project.

Furthermore, several engineering faculty members specialize in the communications field, which will be beneficial to us.

6. Funding and Budget

We have received permission from Mr. Sarkis Teghararian from VTech Engineering Canada to use his RF Evaluation Kit for the duration of the semester. In total, this will save about \$700, at least for the development of the project.

There is still the issue of how to fund the remaining parts. One possibility is acquiring funding through the Engineering Science Student Endowment Fund (ESSEF), and the John Wighton fund (the contact for that is Andrew Rawicz). The company is currently completing an application form. The four company founders will equally cover any remaining deficits. A preliminary budget is shown in Table 1.

Table 1: Estimated Budget for the Project

Equipment and Parts	Estimated Cost
Wireless Transceiver Evaluation Kit (includes receiver and transmitter)	\$0
Sensors <ul style="list-style-type: none">• Fire (temperature/smoke detector can be accomplished with a DIP chip)• Burglary (motion detector)• Flood (level sensor)	\$300 (~\$10 – may order samples, ~\$10 for shipping) [6]
PIC chip	\$20
Other lab tools & misc. (e.g. DMM, tweezers, prototype board)	\$70
Total	\$390

7. Schedule and Milestones

Figure 3 shows the Gantt chart of the estimated time that will be spent on each task during the project period. The figure also shows the expected completion dates as milestones for each of the major tasks.

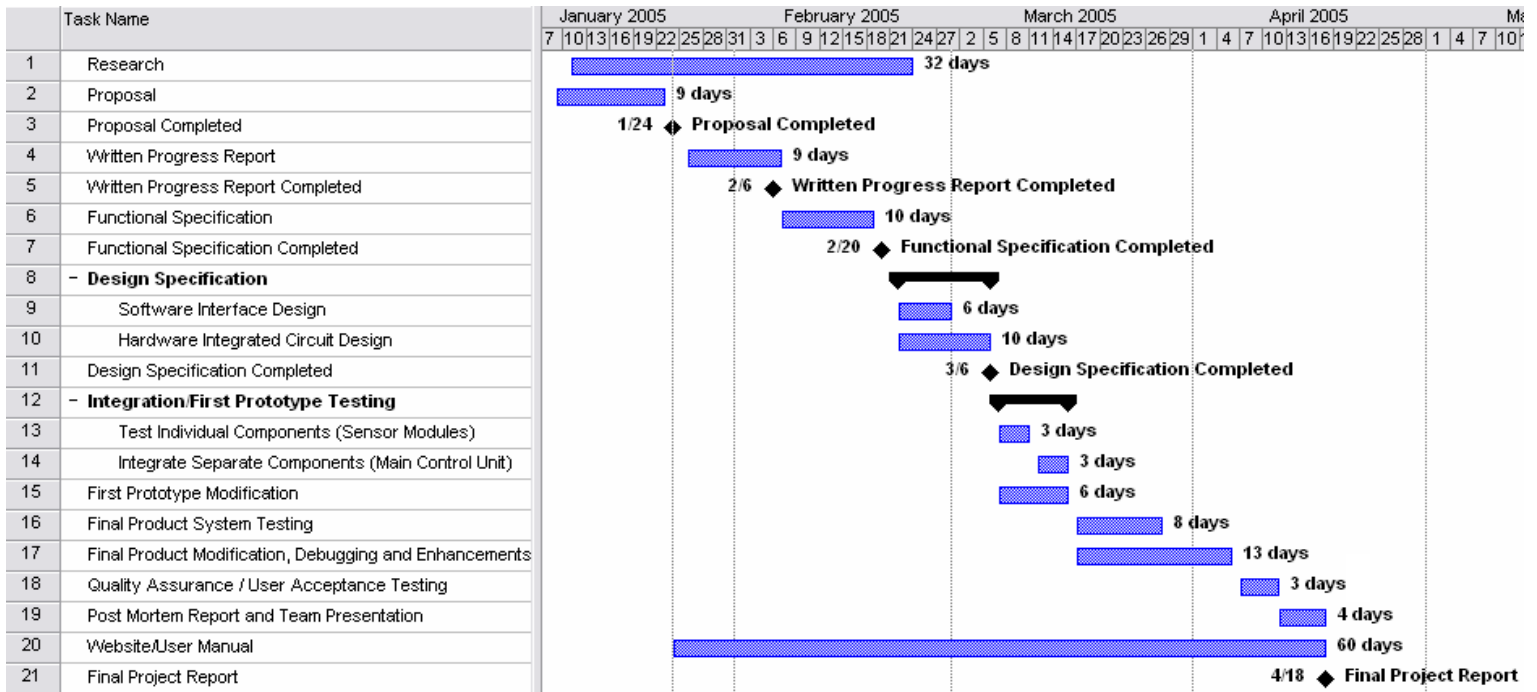


Figure 3: Gantt and Milestone Chart

As evident in the Gantt and milestone chart shown in the figure, we set the milestones for the completion of the documentation to be before the actual due date to allow time for revision. We have organized the planning for the project so that it incorporates tasks that benefit from teamwork and those that can be done more efficiently on an individual basis. In doing so, it allows the team to complete tasks more efficiently by working on an individual basis on separate components, but also contribute to the team by integrating those components as a system to meet the proposed schedule.

8. Team Organization

The team at WINnovations has diverse skills in a variety of areas including Electronics and Computer Engineering. Since this project requires a combination of software and hardware skills, the expertise of this team meets these requirements. The team members at WINnovations include Gavin Lee, Gaurav Magoon, Jason Fong and Alex Hsiao. The team members are dedicated to completing the project in a cost effective and timely manner.

The company structure of WINnovations is organized in a way that all members of the team are treated equally regardless of title or primary roles. In order to provide an effective means of completing the project, Gavin Lee (CEO) will be primarily responsible for ensuring that the team works effectively in achieving a unified goal. Gaurav Magoon (CTO) will be primarily responsible for ensuring the technological aspects of project are satisfied. Budget, funding and finances will be organized by Jason Fong (CFO). Product marketing will be organized by Alex Hsiao (COO).

To ensure each team member understands his or her responsibilities and duties for the project, team meetings will be conducted twice a week. Usually an hour in duration, these meetings will focus on updates from each individual as well as the progress as a team in achieving the next milestone. Before each team meeting, the agenda for the meeting will be updated via e-mail so that any topics that need to be addressed are known before the actual meeting. Each group member, on a weekly basis, will update his or her progress in Microsoft Project (project file) so that any updates on the project are visible by all members in a centralized location.

Assignment of tasks will be based on the abilities of each team member and his area of expertise. The task list will be compiled as a team by analysing the project and breaking down the various parts of the project into independent components. In this way, a delay in one component would not cause a propagation delay through the entire project. Task delegation will be discussed and assigned as a group to ensure that the recipients of the tasks are comfortable and confident in undertaking it.

Document management is vital to the success of completing the project and organization of the team. It ensures that all members have a central repository to store or access important documentation. Each team member will have a bound notebook for recording all design prototypes or possible design solutions. In addition, a project folder will be kept which includes all documentation such as meeting minutes, component specifications and data sheets. Organization of documents ensures that all members of the team achieve a unified goal.

9. Company Profile

Chief Executive Officer (CEO)

Gavin Lee is a fifth-year Electronics Engineering student at Simon Fraser University who has experience in a variety of programming languages including C#, SQL and Visual Basic. He has taken courses in different areas of engineering which include communication networks, reliability engineering, computer aided design and microelectronic circuits. His past and current experience in developing Windows applications with database access through ActiveX Data Objects (ADO) and his experience with business analysis and the business process will be helpful for this project.

Chief Technology Officer (CTO)

Gaurav Magoon is a fifth-year Electronics Engineering student at Simon Fraser University who has a variety of experience in the communications sector as well as experience in several programming languages such as C++ and Visual Basic. He has undertaken a variety of courses as electives to gain knowledge in the different areas of communications including communication networks, digital communications, multimedia communications and communication systems. His experience from working as an RF coop at VTech Engineering Canada has provided him with further experience and knowledge in the areas of RF communications. This experience along with solid hardware knowledge will be helpful for this project.

Chief Financial Officer (CFO)

Jason Fong is a fifth-year Computer Engineering student at Simon Fraser University. He has considerable programming experience, ranging from Java in SFU courses and projects, to C/C++ in an engineering research lab, to Delphi in a software company in China. His main accomplishment in hardware was building a circuit with enough power to run a fairly large DC motor. He has also used VHDL and Cadence to simulate various digital circuits. In addition, he has a passion for public speaking, serving as President of a Toastmasters club focusing on developing oral communication skills.

Chief Operating Officer (COO)

Alex Hsiao is a fifth-year Computer Engineering student at Simon Fraser University. He is experienced with Omron and Allen-Bradley PLC programming, Java, C, C++, MySQL, and PHP programming languages. He is also familiar with CAD tools such as AutoCAD and Solidworks. Outside of school, he has strong passion for playing Go (WeiQi), and he is currently 5-Dan in Canada and is the president of the SFU Go Club.

10. Conclusion

Providing feasible, user-friendly solutions in the effort to improve peace of mind is the primary objective of WINnovations. With the wireless home security system from WINnovations, homeowners can leave home knowing that their home is safe from natural disasters and burglaries.

The wireless home security system will notify the homeowner via e-mail or text messaging any security or safety issues that may arise so that the homeowner can take the appropriate action. Other security systems are passive by triggering a siren, require high installation costs to run wiring or require a third party to monitor the system at a monthly cost.

In preparation for undertaking this project as shown in the proposed schedule of milestones, the Gantt chart indicates that WINnovations strives to stay organized and dedicated to the tasks at hand. The dedication by WINnovations in finding cost effective means to obtain parts and funding is an indication of our priorities in completing the project on time and on budget.

Through the whole timeline of this project, we hope to apply all our accumulated knowledge gained from previous co-ops into it. Keeping in mind that we all have different backgrounds in engineering (software/hardware), we hope that through this project, all members of the group can gain further skills in the other area where they wish to learn more about. We hope to produce a product which can be marketable to the general public as an alternative to current home security solutions. We also hope to learn how to work together in a group environment with times of success and failure, while simulating a real-world company.

11. References

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- [2] Burglary Statistics, <http://www.rcmp-bcmedia.ca/pressrelease.jspvRelease=6032>
- [3] Canadian Centre for Justice Statistics, Break-ins in Canada 2002, Catalogue No. 85-002-XPE
- [4] ADT home security, <http://www.adt.com/adt/>
- [5] BC Fire Statistics, <http://www.city.port-coquitlam.bc.ca/Page819.aspx>
- [6] Allegro Semiconductor, AC Smoke Detector, <http://www.allegromicro.com/sf/5349/>
- [7] Microsoft Clip Art
- [8] Wireless Security Camera, http://www.x10.com/key_products/security-device.htm
- [9] T-Quest Optical, Private Detective, <http://tquestoptical.com/security.php>