Vantek

September 22, 2014

Dr. Andrew Rawicz
School of Engineering Science
Simon Fraser University
8888 University Drive
Burnaby, B.C.
V5A 1S6

RE: ENSC 440 Capstone Project Proposal for the Robison Detector

Dear Dr. Rawicz,

Please find the attached document for the proposal of the *Robison Detector*. This is an installable car device that receives emergency vehicle sirens, then reduces the car stereo volume and safely alerts the driver so they can properly yield.

This proposal will provide all of the necessary information such as a brief introduction, the project plan, risks/benefits, market competition including any relevant research, our company's details, design elements, a timeline, costs involved, and anything else relevant.

Vantek's cutting edge technologies and rich history of research are the right mix to create the *Robison Detector*. The company consists of six senior engineering students: Shayan Ebrahimi, Kartick Verma, Raj Wardhan, Siheng (Shane) Wu, Siavash Seyfollahi, and Gurinder Singh.

If you have any questions or comments, please do not hesitate to reach me at 604.817.7588 or shayane@sfu.ca.

Sincerely,

Shayan Ebrahimi

Shayan Ebrahimi
Chief Executive Officer
Vantek

Enclosed: A Proposal for the Robison Detector

Proposal for the Robison Detector

Shayan Ebrahimi, **Chief Executive Officer**
Siavash Seyfollahi, **Chief Operating Officer**
Raj Wardhan, **Chief Financial Officer**
Gurinder Singh, **Chief Technology Officer**
Siheng (Shane) Wu, **Chief Marketing Officer**
Kartick Verma, **Chief Information Officer**

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Issued Date: September 22, 2014
Revision 1.2

Executive Summary

Jim and his crew are working in the firehall when all of a sudden the alarm goes off and they need to handle an emergency. They quickly hop into the firetruck, turn on their siren and hit the road. To their frustration, many of the other drivers are oblivious to the blaring siren and won't yield to them. It turns out the drivers have their car stereos on too loudly, which drowned out the siren's noise thus preventing them from hearing the emergency siren. Jim and his crew are helplessly delayed by this as lives are potentially on the line.

Jim's story is a reality that all emergency vehicle drivers face. In cities with numerous loud noises and modern car construction which essentially sound-proofs the vehicle, it's easy to see why an emergency siren isn't audible to the driver [1] [2]. This problem isn't specific to firefighters, emergency personnel such as the police and paramedics also experience this issue. In some cases, lives are on the line and time is of the essence.

There have been a few proposed solutions to this problem. One of them is a low-frequency emitter installed within the emergency vehicle that sends a rumbling sound to alert the surrounding drivers in the case of an emergency. However this may startle people when they feel the shake of the low-frequency rumble and also cause unpredictable behaviour in the surrounding environment.

The following proposal introduces the Robison Detector, a device that can pick up an emergency vehicle siren and alert the driver to yield their vehicle by lowering their car stereo volume and giving an efficient alert. The unit will be small enough so that it can be installed within a consumer vehicle and robust enough so that it fully integrates with the car's electrical features, such as the stereo. With this device, the driver will be safely alerted of an emergency vehicle's demand of the road, especially in situations when the stereo is too loud.

Vantek consists of six fourth year engineering students with experience in analogue/digital circuits, MATLAB, AM/FM receivers, various computer languages and other skills. The members also have experience with configuring microcontrollers/processors and have worked in industry.

There are 3 basic steps in completing this project: design/research, implementation, and testing/bug-removal. The timeline will be about 14 weeks beginning September 2, 2014 and its completion is tentatively set for December 15, 2014. For now the budget is $684, which is expected to come from the ESSS and other 3rd parties.

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Figures & Tables

1. Glossary

EMV	Emergency vehicle (police car, ambulance, firetruck, etc.)
Embedded System	A computing device within a larger system that performs a dedicated task

2. Introduction

With a rapid increase in the number of motor vehicles over the last few decades, road safety has never been more important. One of the key aspects is allowing emergency vehicles (EMVs) to safely pass during an emergency when time is limited and lives are in danger. However, recently drivers have become less aware of events on the road due to cellular phones, loud stereos, or even the sound-proof design of some cars [3]. So they unknowingly don't give way to emergency vehicles. A scenario like this can be seen in Figure 1 below.

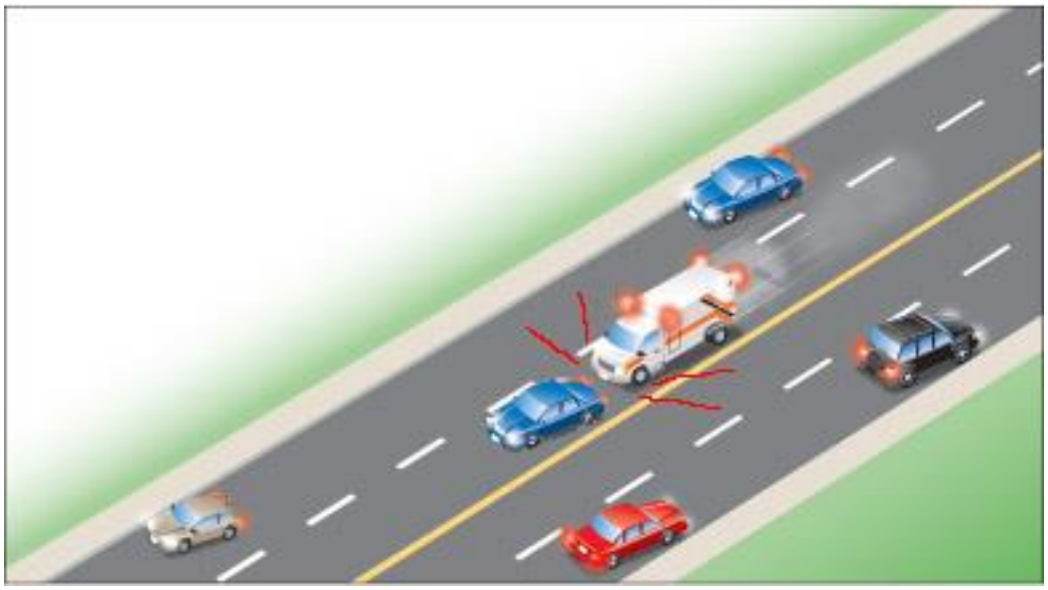

Figure 1 - The EMV is blocked and delayed by the blue car in front of it [4]

For this reason, there needs to be a system built into the car that safely alerts the driver of an emergency vehicle's need to pass. Otherwise, there is a serious risk of drivers not allowing emergency vehicles to pass, simply because they are not aware of it. This could lead to increased wait-times for emergencies and the results could be fatal. Also, dialing 911 is widely considered the best option in the case of an emergency. Within North America, it is culturally known that dialing 911 will get an immediate response. In order to maintain this standard of 911's response time, an alert system like the Robison Detector can be used.

The proposed solution of the Robison Detector is an embedded device that will automatically detect the siren of an emergency vehicle. Upon detection, it will safely alert the driver by lowering their car stereo (if it is too loud) and providing them with a non-intrusive LED alert. With this, the driver will become aware of the emergency in time and allow it to pass.

3. Scope, Risks, & Benefits

3.1. Scope

Vantek's solutions, the Robison Detector, will not only safely alert drivers of surrounding EMVs, but can be installed within consumer vehicles during or after production. The essential hardware used for the device includes a microphone/input device to receive the emergency siren, an electronic board which will process the sound and determine if it is a siren or not, and an external signal – something that will alert the driver. And so the scope can be shown as the Figure 2 below.

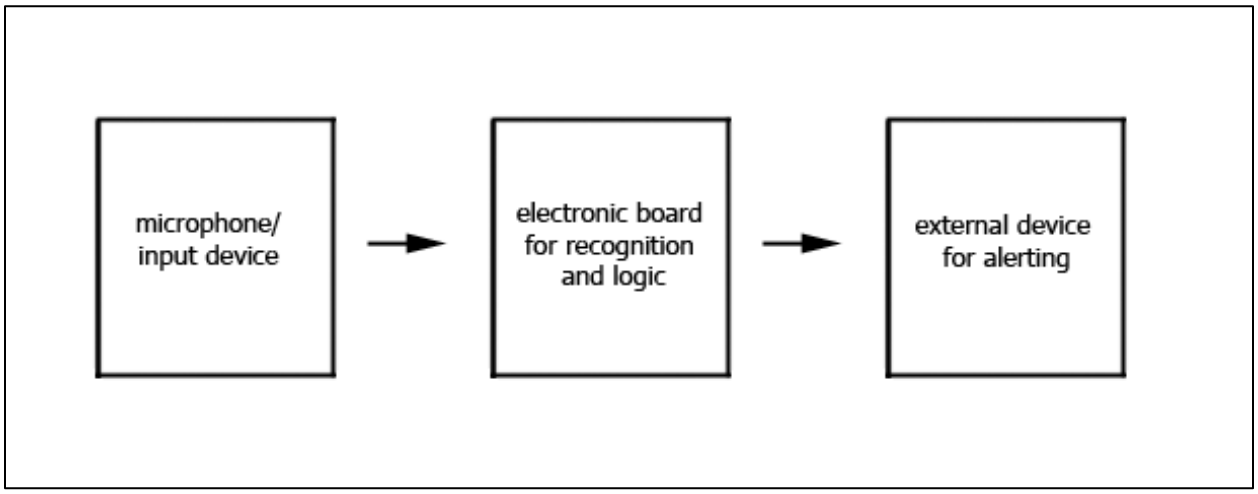

Figure 2 - The project's scope in 3 steps

3.2. Risks

There are several risks and challenges for a project like this. Firstly, it will be important for the detection system to isolate the siren from any external sounds so that it can be properly recognized. For example, if the siren were to be enabled while an airplane is flying above, the detection system should be able to pick up only the siren; otherwise the system will not alert the driver of an EMV.

Secondly, there can also be cases of a false alarm. For instance, if a vehicle's Robison Detector receives a nearby siren, but the EMV doesn't need the driver to yield because it's driving on a completely different street. In this case, the detector would unnecessarily be enabled. If this were to happen often enough, it could annoy the driver. The proper measures would have to be considered during designing and testing so that this can be avoided.

Finally, there will be some challenges integrating the detector with a car stereo, whether it is an older analogue or a modern digital one. It's likely that there are many different kinds of stereo systems built into cars and so at least one of these will have to be considered during the testing process. If the Robison Detector were to become successful and take the next step in

production, additional car stereo systems would also have to be considered during the integration process.

3.3. Benefits

The primary beneficiary of a successful Robison Detector is society as a whole. Emergency authorities will find it much easier to navigate through heavy traffic since all surrounding vehicles will be alerted. Thus, the public will get the benefit of reduced emergency response times. In addition, drivers on the road won't have to worry about whether they can hear an emergency siren or not; the Robison detector will simply alert them.

4. Market & Competition

The market for a product like the Robison Detector is primarily for those that drive road vehicles. This can include cars and motorcycles, particularly for vehicles that may inhibit the driver's ability to hear an EMV siren. Thus, the market is a global one and is vast in prospective buyers. If a person owns a road vehicle, they are a potential consumer for this product.

The Robison Detector can also be sold to car manufacturers too. Figure 3 on the next page shows the various companies and their shares, all of which are potential buyers for this product. This would be a different approach than selling directly to the consumer. However, it could be just as effective if not more because car manufacturers are likely to buy the detector in bulk and sell it as a feature in their vehicles.

Figure 3 - Vehicle market share [5]

Figure 3 also shows that a good fraction of vehicle production takes place in North America. Thus, it would be best to focus our efforts in North America first since this is where the product will be developed and it will be easier to launch. Also, it would be quicker to recruit potential buyers locally, rather than internationally. However, if the product were to be successful in the local market, exploring international opportunities would be looked into.

5. Research Rationale & Other Solutions

Eric Froese, from Vancouver, B.C.'s fire services states that "there have been complaints… that people can't hear us" [1]. As cities like Vancouver become more and more dense in population, the increased activity can lead to EMV sirens being less audible. A device like the Robison Detector can alleviate such a problem.

Vantek has also spoken with local authorities about this issue, and they have shown interest in such a product. In particular, Burnaby firefighters have voiced concern over drivers not being able to hear sirens during an emergency. They would welcome such a device being used on the roads.

For research purposes, the following markets would be interested in a product like the Robison Detector:

- Car manufacturers
- Emergency services (police, ambulance, etc.)
- Car stereo designers
- Bluetooth designers

Table 1 shows the other solutions to this problem and their respective descriptions

Name of product	Description
Rumbling siren [1]	An EMV is equipped with a rumbling siren that emits a low-frequency siren to alert surrounding drivers. Because of the low-frequency, the drivers "feel" the siren rather than hear it. A potential problem with this is that it may unpleasantly surprise people, leading to unpredictable behavior on the road. Also, not enough testing has taken place to ensure the safety of buildings impacted by this low frequency siren.
Emergency vehicle pre-emption [6]	Using a GPS system, a green traffic light is activated when an EMV is travelling with its siren on. This will allow it to pass the intersections freely, while all other traffic is stopped at a red traffic light. But, this still doesn't guarantee that nearby vehicle will pull over to yield for the EMV. This solution only alleviates traffic at an intersection.

Table 1 - Competition that includes other products

Vantek's solution accounts for more scenarios than the ones listed in Table 1 and deals with the central problem of drivers unable to hear an EMV's siren.

6. Project Planning

The following two figures will be used as a guideline for the project's planning.

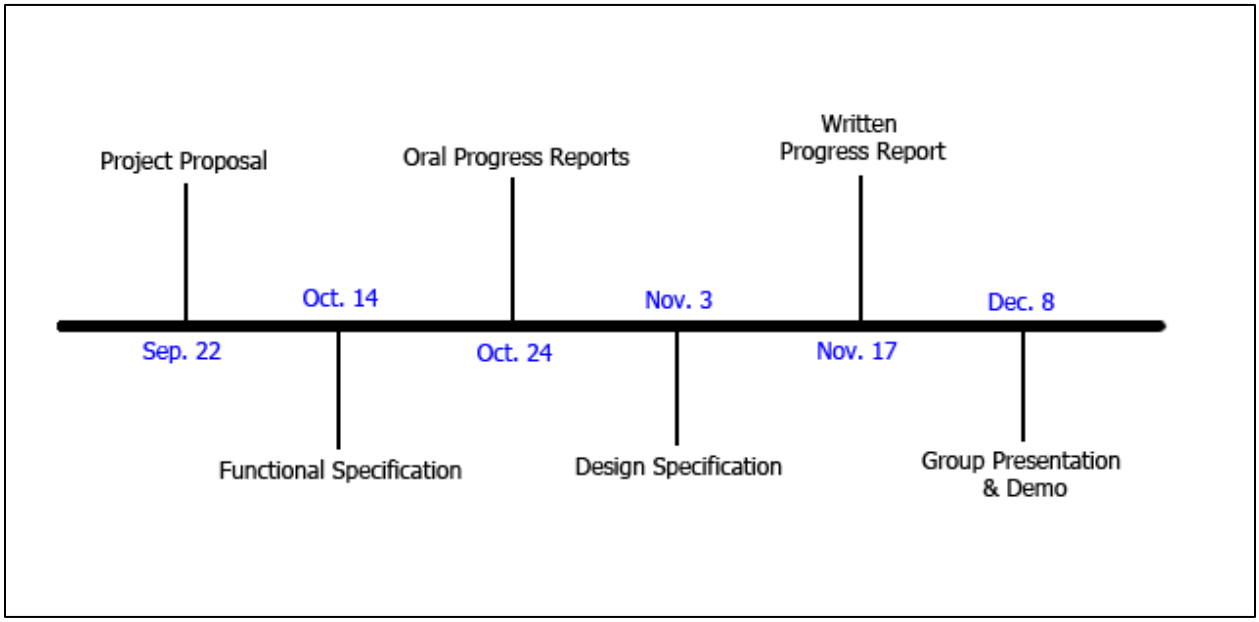

Figure 4 - Major milestones for the project

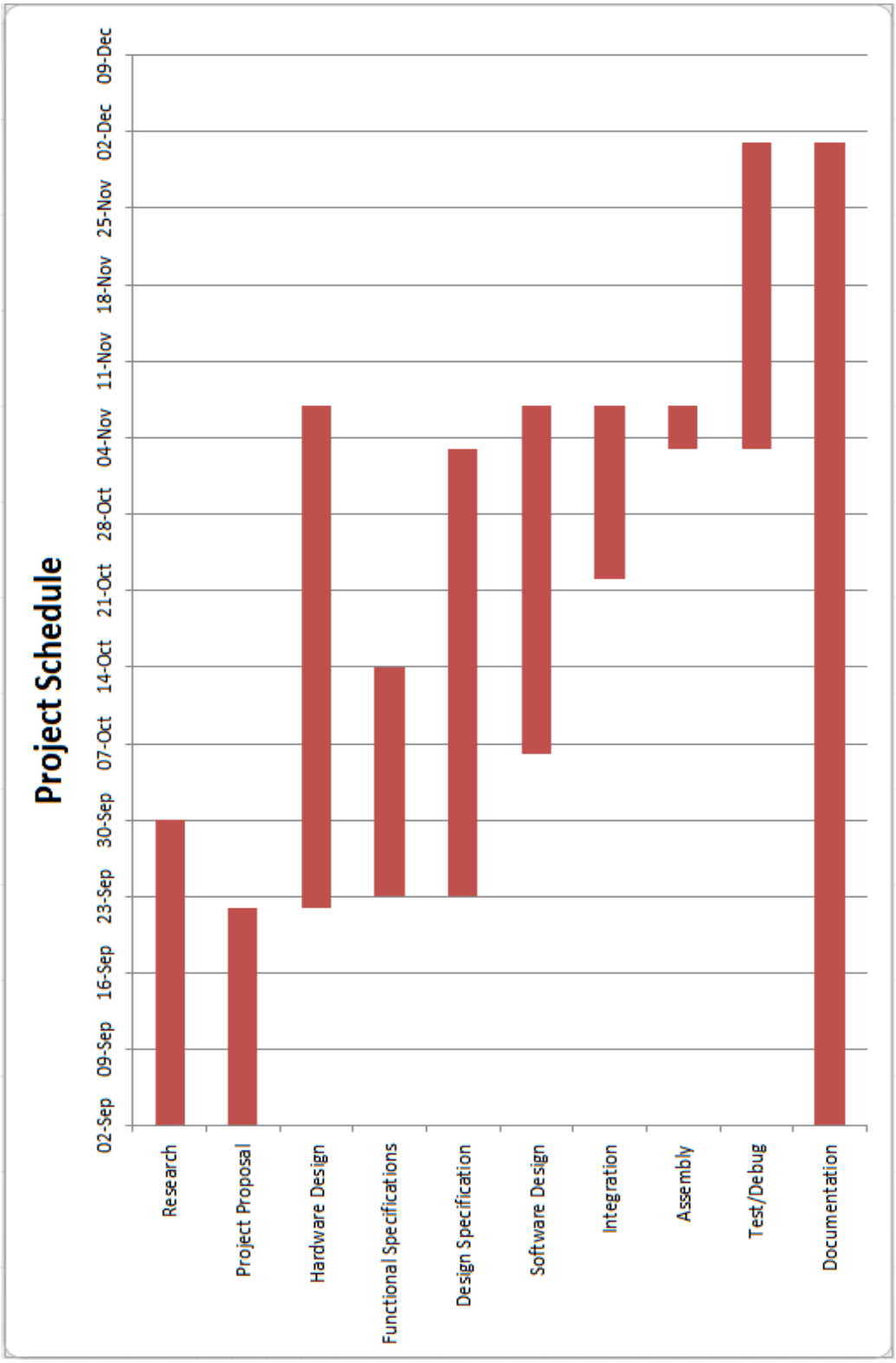

Figure 5 - A Gantt chart for the project

7. Cost Considerations

The costs for the project are a rough estimate and are subject to change throughout development process. Table 2 below lists these costs in Canadian dollars, and are rounded up to the nearest dollar.

Item Description	Cost ($)
MSP430 LaunchPad Value Line Development kit (microcontroller)	33
MSP430 LaunchPad 2nd kit (microcontroller)	10
Kit Eval Aud Booster Pack C5000 (electronic board)	60
The BluPack Booster Pack (Bluetooth)	7
BT Boosterpack	20
HC05 Bluetooth Module	10
Hazardous Light	20
Manual Push Buttons	5
Speakers	100
LCD displays	50
Microphone sensor	30
Car enclosure (for integration)	100
Shipping costs	150
Total Cost + 15% contingency: 684	

Table 2 - Estimated costs for the project

Vantek is looking to the Engineering Student Society Endowment Fund (ESSEF) for covering most of the costs. Additional expenses will likely be covered by the Wighton Fund, which will occur during the later stages of development. Any remaining procurements will be handled directly by Vantek.

8. Company Details

Shayan Ebrahimi, CEO

Shayan is a SFU fourth year Electronics Engineering student and Power Electrical Engineering graduate of Azad University. He practiced his Power Electrical degree in an Engineering department of an oil and gas company to represent his self with a well-founded electrical and electronics knowledge. He has gained exceptional communication and marketing skills during his Tour Guide position in Malaysia. Shayan was the Network Administrator of a "Network Protector" company and expanded his networking skills after doing his Co-op as a Network Lab Administrator in BlackBerry Canada. With a combination of his passion in electronics and marketing he is willing to contribute new and creative ideas to Vantek.

Raj Wardhan, CFO

Raj Wardhan is a fourth year Electronics Engineering student at Simon Fraser University. He is currently working for IT services, SFU which provides him with a broad knowledge in networking, troubleshooting SFU NET-SECURE issues, and setting up video-conferences for staff. Moreover, he has worked for Icron Technologies as a Test Engineer, thus providing him with a diverse experience with various hardware. During his tenure at SFU, he has worked on several projects which include a FPGA matrix inversion accelerator, medical image processing device, and many embedded systems. Additionally, he was involved in compiling a budget for Icron Technologies and their purchase of testing equipment. This establishes his credibility to uphold his position as CFO at Vantek.

Siavash Seyfollahi, COO

Siavash Seyfollahi is a fourth year Computer Engineering student at Simon Fraser University with a co-op experience of 8 months at Broadcom as a Software Developer. He has programming skills in C/C++, Java, and MATLAB, as well as scripting languages such as Tcl/Perl/Python. Siavash has circuit design and analysis skills using LTSPICE, PSPICE and HSPICE. He has also led and managed several group projects throughout his courses and has been the lead programmer/developer for majority of them. Siavash's exceptional communication and inter-personal skills also make him a valuable asset to Vantek.

Gurinder Singh, CTO

Gurinder Singh is a fifth year Computer Engineering student at Simon Fraser University. He has 8 months of co-op experience at Sierra Wireless as a Firmware Designer. While working at Sierra Wireless, he gained skills in the field of embedded software development, wireless data communication, and network programming. During his time at SFU, he has worked on several projects like the streamline grading system using QT(cross-platform application and UI framework), database applications, and a FPGA puzzle game board using the VHDL language. His skills and technical experience will help him uphold his position at Vantek.

Siheng Wu, CMO

As a fourth year Electronics Engineering student at SFU, Siheng has gained solid proficiency in various fields of engineering. The Co-op experience at Xiamen Intretech Inc enhanced her knowledge in hardware design, particularly in PCB design and troubleshooting of circuit schematics. Furthermore, her experience with foreign markets has given her strong ties to the international engineering community. She obtained superior communication skills working with Xiamen Intretech Inc partners, which resulted in many industrial connections in China and North America. During the stay at SFU, she has worked on many projects including control system analysis, active filter design, digital system design on a FPGA board, and video coding. Her strong marketing skills and various professional connections will be a welcome addition to Vantek.

Kartick Verma, CIO

Kartick is a fourth year Simon Fraser University Electronics and Computers Engineering student. He has 8 months of work experience with Westport Innovation where he configured servers/workstations, repaired computers, and networked machines. Kartick is also experienced with the scripting languages C/C++ and Shell. He has lead a group of 7 members in building an automated grading system for distribution in school systems, a project that included GUI designing and database integration. Also, he is experienced with audio filters and manipulators using open-source software. Kartick's strong communication skills and various technical abilities will be a strong addition to the rest of the team.

9. Conclusion

Vantek is excited at the opportunity of developing the Robison Detector. Once installed in vehicles, it will act as a secondary set of eyes and ears for EMV sirens. Any driver with a Robison Detector installed can be assured that they will not be interfering with any emergency services. Furthermore, authorities can take comfort in knowing that they will reach their emergency as quickly as possible without any traffic delays.

This proposal details all of the required information to get started. Once a functioning prototype is built, additional marketing can take place to gauge the product's viability in the market. Vantek has confidence in its team and is prepared to deliver the Robison Detector within its timeline and budget.

10. References

[1] J. Giovannetti. (2014, Jun. 6). *Vancouver police equipped with new rumbling siren.* [Online]. Available: http:// http://www.theglobeandmail.com/news/british-columbia/vancouver-police-cars-to-be-equipped-with-new-rumbling-siren/article19032505/

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[3] W. Vermaak. (2014, May 5). *Safe Driving when Hearing the Emergency Siren.* [Online]. Available: https://www.arrivealive.co.za/Safe-Driving-when-Hearing-the-Emergency-Siren

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[6] B. Baillie. (2011, Sept 2). *Emergency Vehicle Pre-emption (EVP).* [Online]. Available: http://www.trafco.ca/emergency-vehicle-pre-emption