January 22nd, 2007

Mr. Lakshman One
School of Engineering Science
Simon Fraser University
Burnaby, British Columbia
V5A 1S6

Re: ENSC 440/305 Project Proposal for Theater Ushering System

Dear Mr. One,

Please accept and critique the attached document, specifically named *Theater Ushering System* for ENSC 440/305. The attached document will discuss our approach and design for a system targeted at movie theatres. Our system will significantly improve and provide unique movie theater experience by offering convenience with interactions to the audience. By raising movie theater standards, audiences will be more compelled to return to make second purchases thus increasing revenues. Majority of the details have been discussed with Cineplex Entertainment and endorsement is currently in discussion.

In our proposal, we provide details such as high-level system overview, possible solutions and our targeted design solutions. Along with some technical information, we also discuss the feasibility of the project in terms of budget, funding, schedule, project milestones and company profiles.

U-Nexus Inc currently consists of four SFU undergraduate engineering students with expertise vary from student to student. Each team member has its specialized field that contributes greatly to the project. Aside from technical skills, many team members have exceptional management skills along with great industrial experiences. Team members consists of, Eric Wang, Gordon Lee, Bo Wang and Danny Chan. All of us are looking forward to work under your guidance. Should you have any questions, please feel free to contact me at 604-721-6226 or by email at ensc-unexus@sfu.ca.

Best Regards,

Eric Wang

Eric Wang
CEO
U-Nexus Inc

Enclosure: *Proposal for Theater Ushering System*

ENSC 305/440 Proposal:

Theater Ushering System

Project Team:	Danny Chan Gordon Lee Bo Wang Eric Wang
Contact Person:	Eric Wang ensc-unexus@sfu.ca
Submitted to:	Mr. Lakshman One – ENSC 440 Mr. Steve Whitmore – ENSC 305
Issued date:	January 22nd, 2007
Revision:	2.0

Executive Summary

"Factors are hurting theater attendance includes social factors eroding theater environment (talking, cell phones, babies crying, etc.)…"

Movie experiences have always been much more enjoyable than watching movies on a home theater system. In fact, many tend to choose movie theaters because of its unique experiences. By providing a unique, memorable experience, users will tend to return and make repeated purchases [3].

With the ever large movie population slowly decreasing and the availability of DVD or movie download services, movie theaters are losing their appeals. The only competition edge that theaters have is the fact that brand new movies are showing. One can argue that this is all the industry needs to survive, however, in reality, casual moviegoers are at risks. One thing we know about the casual moviegoers are that they attend movies as a form of relaxation and recreation, they do not go simply to see a certain movie and that usually their preferences are open to what's available. In short, casual moviegoers go for the experience, not for the movie itself.

In order to bring back the appeals of movie theaters, new experiences will need to be offered. For starter, theaters must improve customer convenience and customer interaction. For example, by using non-reserved seating structures, problems arise for many moviegoers. We often find ourselves catching movies late, and trapped in the dark looking for seats. To make things worse, we are often required to ask others if the seats are available or that if we can get by. This form of distraction is very irritating and can be avoided easily with a seating monitoring system. Although not very often, but chances of injuries do increase dramatically when navigating and looking for seats in the dark. Lastly, to improve customer interactions and to implement marketing promotions, the theater will need some form of communication with the customers.

To address these issues, we propose our Theater Ushering System, which monitors the empty seats of a theater screen and displays the seating availability on the entrance to the theater, thus providing a sense direction to the late moviegoer. By knowing the location of the empty seats, one can eliminate the tasks of searching and quickly make way towards the seat to reduce distractions to others. By eliminating the need for searching, moviegoers can now focus on navigation to the seat thus reducing the chance of accidents. During other times, the display panels can be used for other purposes such as information display or advertisements. To promote interaction between customers, we can execute trivia games before the movie starts. We can then use the theater ushering system to keep high scores, where winner can receive prizes. With increased interaction amongst audiences, movie experiences will never be the same again. In conclusion, the intention of the system is to aid movie industry by providing a different unique experience to moviegoers.

U-Nexus Inc has four members and each member brings their unique strength to contribute to the team, either academic or past industry experiences. We have members specializes in project management, hardware, software, research and testing.

The tentatively budget for this project is estimated to be approximately $1500 for working prototype only. We are currently seeking funding via school associations and industry companies such as Cineplex. Additionally, we will be utilizing school's technological resources as much as possible, including components and microcontroller rental. We are also working with technology companies hoping to acquire development kits in evaluation or sponsorship to further ease our funding difficulties. By the end of April 2007, we hope to have a prototyped machine available for demonstration. After prototype, we hope to improve the system by using embedded system thus significantly reduces the size of the system. Lastly, we hope to deploy our system and prepare for production during the first quarter of 2008.

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1. Introduction

With the ever busy society racing towards higher productivity of the working hours, it is no doubt that the members of the working society will try to maximize their free time to reduce stress. To enjoy their free time, people often seek out recreational activities such as movies, concerts and sporting events. Movie revenues from casual moviegoers are significant and cannot be ignored. However, with decreasing movie attendance for the past four years, the industry is concerned and unsure of their destiny [6]. One solution to improve attendance is to revamp the traditional image that people perceive of a movie theater by incorporating current technologies to raise convenience and customer interactions. The emphasis will be placed more on experiences offered to the moviegoers rather than just offering them new movies.

In large events, often hundreds of seats need to be arranged and managed. Specifically, events such as movie theaters are interesting, due to its first-come-first-served seating style. This kind of seating style is effective and quick at the point-of-sale; however, introduces problems for moviegoers when attendance is high and for those who arrived late [1], [2]. Late moviegoers are then often faced with the problem of finding empty seats in the dark and loud surrounding. The first problem immediately arise is the distractions introduced to other moviegoers. Second problem is the potential injury that can occur due to misstep, tripping over furniture or other seated moviegoers.

In recent events in the city of Richmond, VA, an audience received $20,000 after breaking her ankle due to lighting issues in the theater [4]. This example shows a much more severe case of injury, and as we all know, many of the lighter injury usually goes undocumented. According to data by Statistic Canada in July 2006, Canadian movie attendance is about 103 millions [5], while in the USA, attendance is at about 1.4 billions [6]. As the number of moviegoers increase, crowd control and seating management becomes much more apparent.

To address these issues, we propose our system called Theater Ushering System. The system is specifically suited for movie theaters, and the goals of the system are to provide a new movie experience. We offer new experiences such as convenience and interaction to the moviegoers. The system can help late moviegoers to find seats quickly thus reduces the amount of distractions to other audiences. Alternatively, late moviegoers can also make decision whether to refund or continue to attend this movie based on the fact that if no preferred seats are left over. Lastly, the system reduces possible chance of injury in theater during the quest of seat finding.

To successfully convey the seating information, a large display panel is then placed at the hallway to the entrance of each screen. Interestingly, by having a large display panels, more promotional schemes can be adapted by the theaters. After discussion with one of the largest movie theater company, Cineplex, we discussed the possibility of running movie trailers and advertisements for additional revenue generation. Also, trivia games or contests can easily be incorporated using controls on each seat which may allows moviegoers to win prizes such as snacks. By having such rewarding scheme, additional side purchases can be expected as well. Another promotion discussed is the ability to vote after the movie has ended. By having such data shown on the screen and display panel at the hallway, it can generate interest to other

moviegoers. But most importantly, no matter what promotion schemes used, it will be used for fun and to promote a different atmosphere in the movie theaters.

By having such systems available, convenience for the user and unique atmosphere will create a wave of new movie theaters that is fun to attend, and brings exciting experiences to not just the hardcore movie fans, but also casual fans.

Currently no such system exists due to many issues aside from costs. However, entertainment industry has always thrived on providing best experiences, thus with our proposed implementation, movie experiences will be much smoother and much more enjoyable. The convenience introduced by the system, will also attract casual moviegoers because of its niche design and conveniences [10].

2. System Overview

In this section, we discuss the key components required. Figure 2.1 shows the system block diagram with simple description. The Seating Status Transmitter (SST) is responsible for data acquisition, regarding the current status of seats around the theater. After acquisition, information is transmitted to the Seating Status Monitor (SSM). After processing, SSM will present seating information to the audience via large screen display. So the general flow of the system is data acquisition, data processing and lastly output of the data [9].

Figure 2. 1: System Block Diagram

3. Possible Design Solutions

Currently there are many technologies capable of performing such seat availability check, yet there is no product of such sort on the market. After extensive research, some possible solutions are listed below.

3.1 Microcontroller Design

The quickest design is to use a microcontroller which monitors the status of a set of switches attached to each seat. As moviegoers occupy the empty seats, movie seats are first pushed down. By taking advantage of such action, a switch can detect of the seat is taken or not. The microcontroller then processes the data for output on display. One immediate problem arise are the changes required to the existing infrastructure, for example, additional power outlets and wires will need to be laid for microcontroller and data transmission from seats to microcontroller, thus making deployment much harder.

3.2 Wireless Transceiver/Receive Design

To avoid the infrastructure problems of microcontroller design, we can adapt wireless devices to transmit the information between each seat to a central processing location and outputs the relevant data for display. However, the number of units required by each theater is large, which increases the number of wireless nodes dramatically making possible communication errors and data collision [7]. Also, additional power outlets will still need to be available to the wireless switches on the seat.

4. Proposed Design Solutions

After examining the disadvantages of the two possible solutions, we wanted to find a solution that was capable to address the following [8],

- Introduce minimal infrastructure changes to increase chance of deployment
- Minimal maintenance costs and effort

The proposed solutions is then to combine the two solutions discussed above, by using microcontroller to monitor seats while transmitting information using wireless devices. The system composes the following,

- Set of switches attached to seats and triggers when seat is occupied
- Switches are hardwired to a microcontroller nearby
- Microcontroller processes information and uses wireless device to transmit data to display located at entrance
- Display unit receives the data wirelessly and outputs on screen

Figure 4.1 shows the general model of the proposed design, where we have many sets of SSTs communicating wirelessly with single SSM at timed interval. The single SSM will then display seating information to the audiences at the entrance.

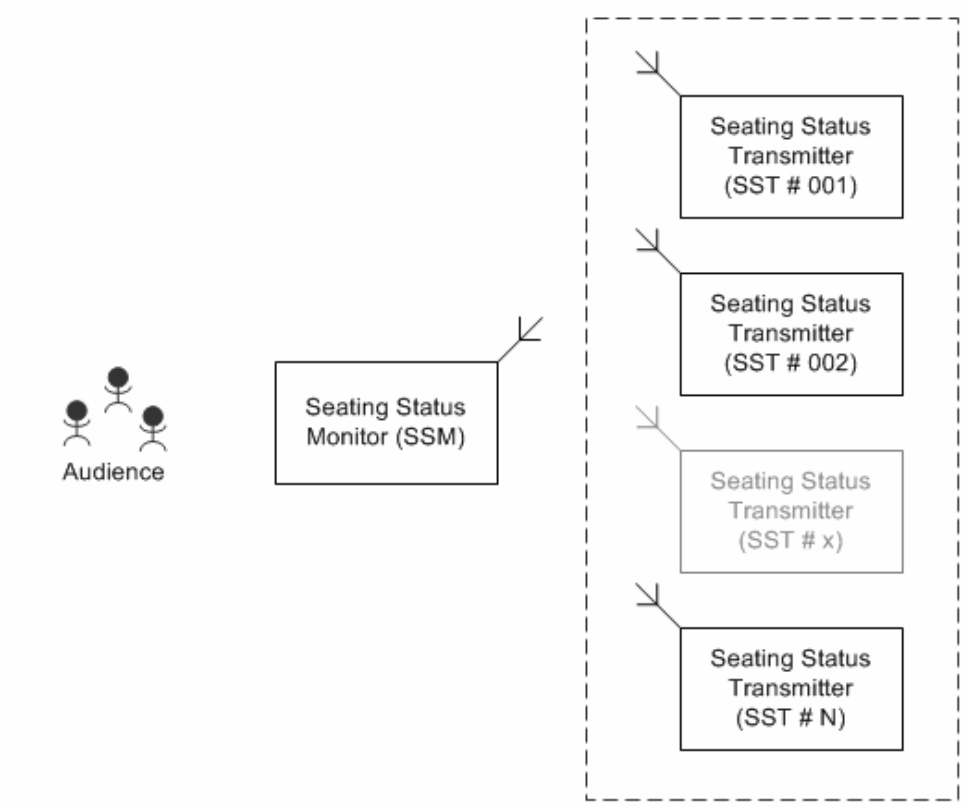


Figure 4. 1: Proposed Design Model

By adopting such design, we introduce minimum amount of wires required, only between the seats and microcontroller. Also, since this is a low data rate application, this means the system requires low power to operate. By adopting low power wireless design, we can actually power the entire unit on battery, thus eliminating the need for additional power. The only required infrastructure change would then be the placement of display, which is much simpler and are located near the entrance of the theater. Figure 4.1 shows the general usage of the system, where SSM receives information regarding each seat from SST and displays data to the audiences.

One additional note is that, we assume the moviegoers are capable of enjoying a movie without additional equipments support. By having this definition, we assume moviegoers possess normal vision and require a seating provided by the theater. Thus, the theater ushering system will not provide useful information to those who does not meet the requirement (e.g. system will not monitor wheel-chair spots). The reason for such limitation is that we require moviegoers to be able to view the information on screen, thus somebody who has potential vision problem will not find the system useful (despite questioning their presence in the theater).

5. Source of Information

In development, we will perform researches from wide variety of resources provided by SFU library such as textbooks, scientific journals, and previous thesis by other students. Alternatively, we will often use internet for quick researches and or data sheet gathering. Most importantly, IEEE journals will be our primary interests due to large amount of technical researches available.

Another excellent source we will use is the faculty and teaching staff from SFU. Their past experience in both academia and industrial will provide valuable suggestions to our design process.

6. Financial Information and Risk Factors

6.1 Budget

Table 6.1.1 outlines an estimated budget for the Theater Ushering System. The budget shows costs to each component required to have a working prototype. Note that this is a cost to the prototype for development; the estimated cost does not reflect the cost of manufacturing the unit. For estimate of sale price, see Break Even Analysis in the reference section [5]. Also, an extra miscellaneous cost has been added to account for charges such as shipping, and for extra components that we might need and have not considered at this moment.

Equipment	Estimated Cost
Data Acquisition Microcontroller	$10.00
Sensors for Seat Monitor (set of 8)	$20.00
Wireless Transmitter/Receiver Kit	$500.00
PC Desktop System/ Flat Panel Display (19 inch)	$750.00
Miscellaneous	$220.00
Total	$1500.00

Table 6.1. 1: Tentative Budget

Due to ongoing negotiation for parts and sponsorship, some of the components listed above might be free of charge, thus the estimated budget can vary greatly as the project progress.

6.2 Funding

Sufficient funding will be a great problem and can potential halt our project. Currently we plan to pursuit funding from ESSEF and other universities associations. We are looking at the possibilities of borrowing programmable microcontrollers from SFU Surrey Library, and we are still in negotiation with movie companies such as Cineplex for funding. We are also in discussion with many of the parts vendor for a lowered price, evaluation unit or sponsorship. Currently, there is a very high probability that we will get sponsorship for a low powered wireless device for use (potentially $500 development kit). Lastly, our PC desktop system with display is at lowest priority, if we cannot gather sufficient funding, we shall use an existing system from members of the team for development and demonstration.

6.3 Risk Factors

The proposed design was concluded after extensive research and we believe that the project has a somewhat heavy workload. One of the primary risk factors introduced is the amount of time available for this project. Engineering science 440 is a four months project course, which after the planning stage, may not leave enough time for development. We are of course, prepared for the unforeseen problems due ahead, however, equipment problems, design difficult ties, funding problems can all lead to an incomplete project.

7. Schedule

Figure 7.1 shows the overview of the proposed project schedule. We are targeting to finish the working prototype on the April 20 for demonstration and presentation. We also include target date for engineering prototype and the manufacturing prototype. We hope to have an manufacturing prototype ready by first quarter of 2008 and begin production shortly after.

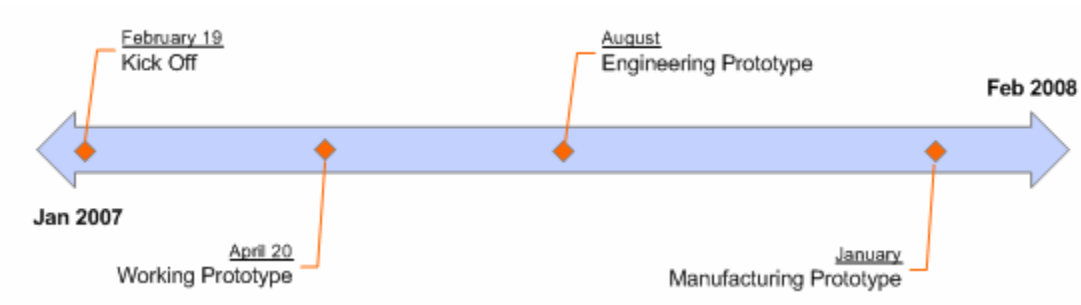


Figure 7. 1: Overview of the Proposed Project Schedule

For our working prototype, our target is to have a system with display capabilities while monitoring small numbers of seats. With our current hardware limitation, we are capable of monitoring at least three stations due to the fact that we are using evaluation development kit. However, each station is expected to manage 8 seats, thus simulating a small movie theater environment. The display unit will show our seating arrangements and which seats are taken. With other features available, we are expected to be able to run advertisements such as still images or short clips.

Table 7.1 outlines project's Gantt chart and milestones for the proposed project. We are targeting for a demonstration on April 20th and finish the whole deliverable documents by April 27th of 2007. Note that the estimated dates are calculated by first estimating the amount of time required for each tasks, then we impose an approximately 50% overhead into the tasks to account for unforeseen difficulties, details can be found in [11].

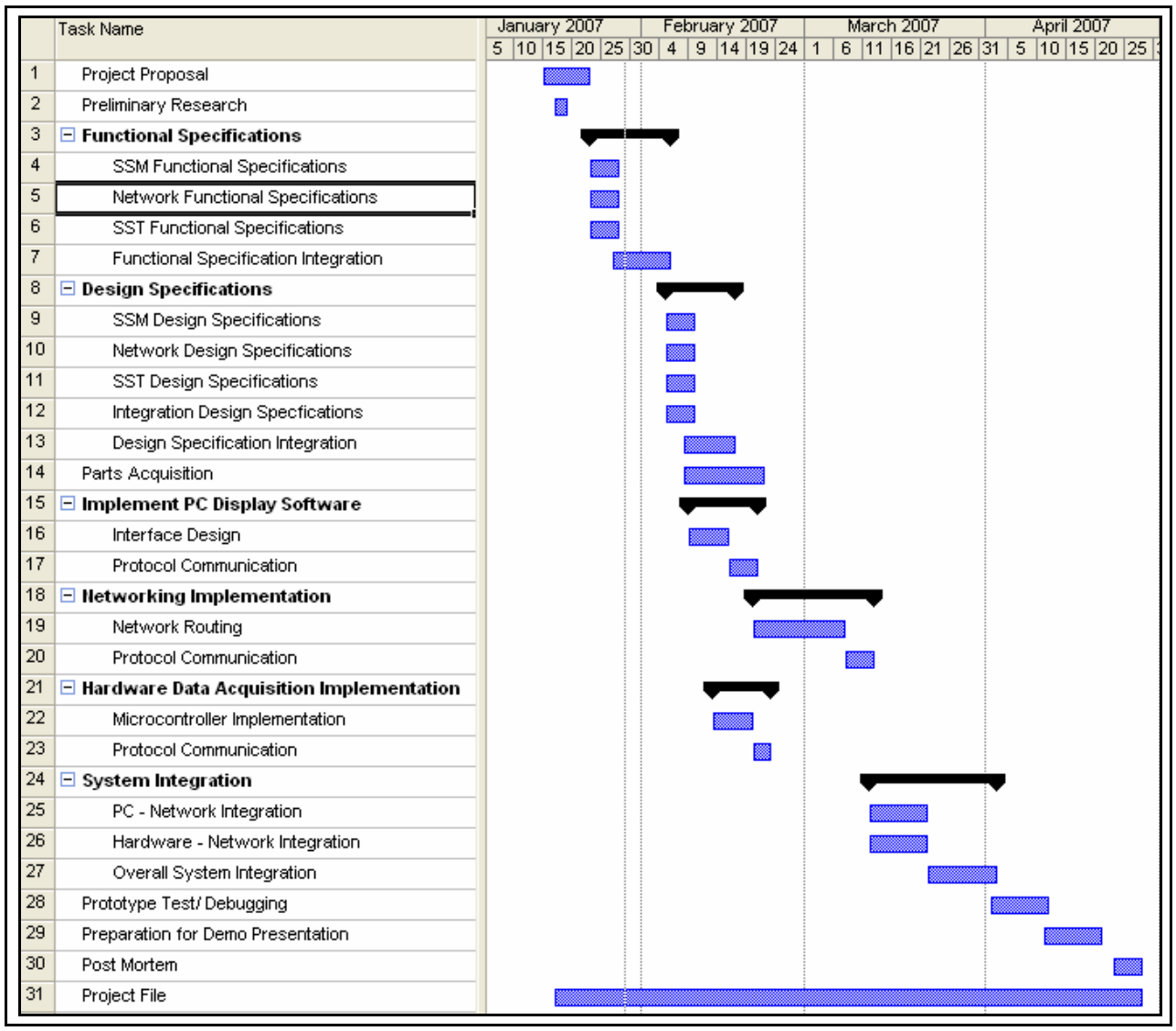


Table 7. 1: Gantt Chart of the Proposed Project

Figure 7.2 shows an alternative view of the milestones we are preparing for. Milestone items include project deliverables and other items that we feel are essential to the project.

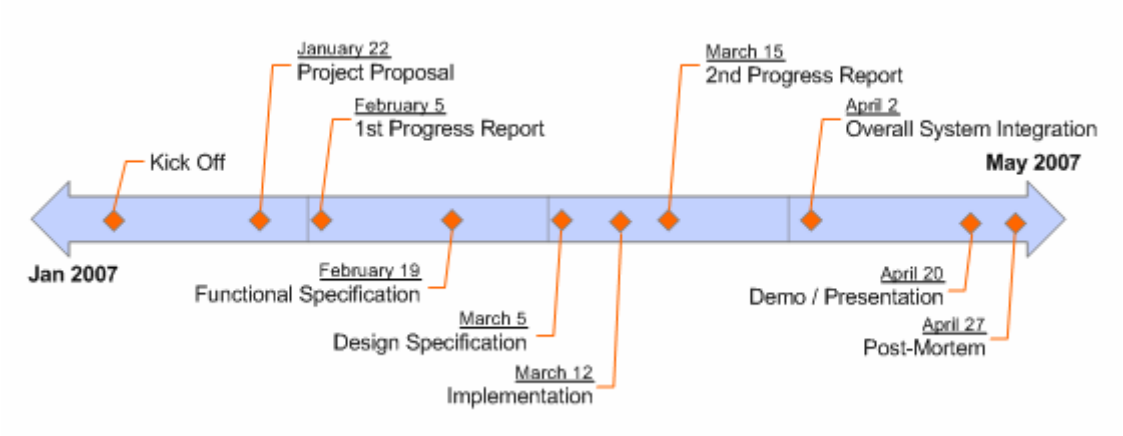


Figure 7. 2: Alternative View of Milestones

8. Team Organization

U-Nexus Inc consists of four students from the undergraduate program of Simon Fraser Universities. The students are Danny Chan, Gordon Lee, Bo Wang and Eric Wang. Even though the four students all study under the electronics engineering options, they each bring diverse experiences to the team. Each member all have some specific areas where they can contribute to project and these specific skills are outlined in the following section.

Due to small team size, it is our best interest to clearly divide the tasks to each individual to promote efficiency and reduce overlap. Yet at the same time, we must maintain a level of organization and professionalism. Thus we will adopt a simple two level interactive organization model led by CEO, who foresees the entire project, while CTO, CFO and COO reports directly to him. By adopting this model, CEO has the ability to make decisions when needed to, while does not necessarily have to conform to the rigid hierarchy in top-down management. At a same time, we embrace the advantages of bottom-up organization such as its democratic environment and the ability to maintain a level of personal relationship between each team members.

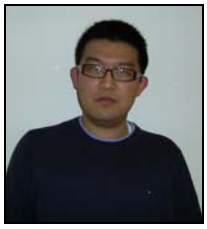
CEO will be Eric Wang, who manages the entire project and lead discussion whenever necessary. CFO will be Danny Chan due to his experiences and academic studies related to financial management. Gordon Lee will be designed the role of CTO since he has good knowledge of current market and has hands on experiences on many types of hardware from microcontrollers to chip level components. Lastly, Bo will be the COO, responsible for maintaining the project file, documentation revision and web site maintenance.

Even though we adopt a management styles similar to that of typical corporation, we still need to resolve issues via majority votes, thus a CEO will never have the final decision and will always need to consult other members during conflict resolution or any form of major decision-making. At U-Nexus Inc, we want work to be fun and enjoyable, even though each member is dictated by a title, this does not mean that they are isolated to the tasks described by that title. We always encourage exploration, alternative thinking and discussion. The only way we can grow is by

having opinions that leads innovative ideas, thus no subject is ever an irrelevant subject amongst the team.

Our team will meet on weekly basis to discuss our progress formally. During other times, we shall report all relevant information and discussion to our own simple web service host under SFU ACS department. We will also be using popular VoIP software, Skype, for discussion and host conferences via internet whenever necessary.

9. Company Profile

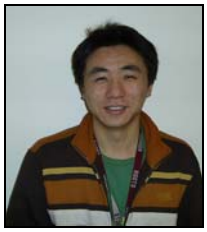


Chief Financial Officer

Danny Chan is a fifth year electronic engineering student at Simon Fraser University. Danny has profound knowledge in C++, Java, and Visual Basic as well as in hardware testing. He had worked as a product engineer in Texas Instrument Taiwan Ltd, where he was responsible for retest analysis as well as maintenance and debugging of device interface board. In Addition, he's also responsible for implementing the two-camera computer vision system for the SFU MIROHOT Hockey Robot Project.

Chief Technology Officer

Gordon Lee is a fifth year electronic engineering student at Simon Fraser University. He has extensive experienced in developing RF application. Specifically, he has spent his coop terms working with a senior RF developer to develop a wireless private area network on IEEE 802.15.4 protocol. Gordon is also well familiar with programming language such as C/C++, Java and circuit layout design and debug. Lastly, he had a coop term working as a webpage developer at Simon Fraser University, where he used php and MySQL to develop a web application to assist coop management.



Chief Operation Officer

Bo Wang is a fifth year electronics engineering student with keen interests in real-time embedded design and implementations. He has experiences with various microcontrollers such as PIC16F877 and NiosII development kit (CycloneII FPGA). Bo is currently employed at VTECH, involved with audio signal sampling, tone generation, data acquisition and FFT analyzing. Bo is also experienced with C/C++ and assembly language under various IDE. He is currently at his last semester at Simon Fraser University, and he will dedicate his career to developing embedded systems upon graduation.

Chief Executive Officer

Eric has extensive work experience within the technology industry. He has experiences from small startup company to the mega size corporation environment. Specifically he has worked in the development department of a security company called Armorlink Corp in California on their digital video recording equipments. Currently, he is employed by Redback Networks and is responsible for testing their network software. Academically, Eric is in his fifth year, currently in his last semester in the electronics engineering program in Simon Fraser University. Eric's area of interest focuses on firmware and hardware design, however, he is well familiar with many software languages such as C/C++.

10. Conclusion

Today, the movie theaters open once again filled with audiences. To provide the best experiences possible and most enjoyable time, we know that Theater Ushering System can be a use to them. We hope to demonstrate the usefulness of the system in a theater setting, making audiences think that how they ever did without it. By adopting current wireless technology with simple low budget microcontrollers, we can develop a low-cost effective solution ready for use. However the final price will depend on configuration of the display panel whether is a gigantic multi-screen setup or simply a mounted LCD panel. Nevertheless, problems mentioned previously will be addressed, and we will not let the project be a technological-driven project, but always remain a problem-driven project. Of course, once the foundation of the project is set, other applications are possible as well, potentially opening up other market opportunities.

Our source of funding will mainly be from the Engineering Science Student Endowment Fund (ESSEF) and third party sponsorship from the industry. We plan to have the project completed by beginning of April and present our prototype during the mid April time frame. Our vision is to adapt this project to other markets and not just limit ourselves to one scope in the future [10]. We hope to be able to market the production model in first quarter of 2008.

11. References

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