September 21, 2009
Dr. John Bird
School of Engineering Science
Simon Fraser University
Burnaby, British Columbia
V5A 1S6

Re: ENSC 440 Capstone Project Proposal – CheckList™, Assistive Memory System by Mnemosyne Innovations Incorporated.

Dear Dr. Bird:

Please find attached the Capstone Project Proposal for the product CheckList™ by our company Mnemosyne Innovations Inc. Mnemosyne Innovations is comprised of four highly motivated and talented individuals: Priyanka Deshmukh, Rachel Cheng, Ana Namburete and Surbhi Seru.

Forgetting items is something all of us have experienced at some point or another. The product CheckList™ is precisely aimed at alleviating this problem. CheckList™ is a convenient portable memory aid device that enables users to confirm that all relevant items are being taken with them when they leave their surroundings.

The proposal introduces the technology being used to create such a device, and in addition, information regarding market research, company structure, budget, funding and schedule – all of which aim to support the fact that a product like CheckList™ definitely has a significant need in the market, and therefore is a highly profitable opportunity.

If there are any questions regarding the proposal, please feel free to contact me by phone (778-995-0832) or email (pmd1@sfu.ca).

Thank you very much for your consideration.

Sincerely,

Priyanka M. Deshmukh

Priyanka Deshmukh
Chief Executive Officer
Mnemosyne Innovations Incorporated

Enclosure: *Proposal for Mnemosyne Innovations' CheckList™ - Assistive Memory System*

CheckList™

Assistive Memory System

Project Proposal

Project team:	**Priyanka Deshmukh** **Rachel Cheng** **Ana Namburete** **Surbhi Seru**
Team Contact:	**Priyanka Deshmukh** **pmd1@sfu.ca**

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Executive Summary

At Mnemosyne Innovations, we know what it is like to lead busy lives. During the course of a day, there are so many areas that warrant our attention that sometimes we leave behind the items most important to us. There are countless of times where cellphones, wallets, or keys have been forgotten at home, in the office or on public transit. Our solution to this problem is the CheckList™. With this handy device, anyone will be able to tag an item and add it onto the CheckList™. Before walking out of any place, the CheckList™ will detect whether or not you have everything you need. Simply press the handy 'Check' button, and the CheckList™ will inform the user if anything is missing. Forgetting will be a thing of the past. Just remember the CheckList™.

The current market does not present a tough competition for Mnemosyne Innovation's CheckList™. While technology has significantly advanced over the last decade, and inventions such as the smarphone have proven to be highly successful, none of the devices fulfill the same purpose as the CheckList™. Mnemosyne Innovations prides itself on the originality, creativity and the overall ingenuity that went into developing the idea of the CheckList™. We strongly believe that there is a definite niche in the market for a product of this nature and we are passionately committed to deliver positive results.

Mnemosyne Innovations Incorporated, named after the personification of memory in Greek mythology, is comprised of four undergraduate female Engineering students at Simon Fraser University. Throughout the course of the semester, the team will put in their 100% into the successful completion of the project and strive to deliver the best results to the market. The cost of the prototype is projected to be in the vicinity of $800. However, the retail price of the product will be in the range of $15-$20, and hence affordable to the general public.

The following document is a proposal intended to provide an overview of our product, review possible design solutions and details of the proposed product design. It also contains a financial projection and an estimate of the budget, as well as a Gantt chart to illustrate the duration for each stage. Lastly it provides an outline of our team organization and company profile.

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List of Acronyms

GUI	Graphical User Interface
LCD	Liquid Crystal Display
PDA	Personal Digital Assistant
RFID	Radio-Frequency Identification
USB	Universal Serial Bus

CheckList™: Project Proposal

Introduction

To forget is human…

In today's busy lifestyle, with the interaction of many complex systems constantly on our minds, we often forget the simplest things that are vital to our ability to get through the day. Oftentimes we will leave our homes or offices thinking that we have certain items inside our bags only to realize, to our dismay, that we have in fact forgotten something. This forces us to have to retrace our steps in order to retrieve the forgotten item, which costs us time and adds to our stress. Perhaps, if we had been informed that the items were missing from our bags before our departure, we would not have forgotten them.

This situation is a particularly interesting topic of research in the field of cognitive psychology. The theory of *Cue-Dependent Forgetting* proposes an explanation for this phenomenon. This theory states that an item is forgotten when the memory of it cannot be retrieved, however when an appropriate cue is provided, the person is able to recall it [1]. Based on this theory, we can understand why people might forget even the items that they deem to be important. This could explain why items of importance such as house keys or reading glasses tend to be left behind or misplaced, and why we might not even be aware of their absence until the item is needed.

To solve this problem, we need to figure out a way to aid in retrieval of the memory of the item. A device that could aid in this and thus prevent the disappointment and frustration of forgetting an item would be ideal for most people, regardless of age, gender and lifestyle. Ideally, the device would be portable so that we could be reminded before leaving not only our homes but our places of employment or recreation, where we might forget items of importance.

An ideal device would scan us and perform a check of whether or not items of importance are present. The device would remove the need for a self-generated cue for retrieval. Also, it would be useful if the missing item were displayed, so that we would know which items are missing and thus determine the level of necessity. It would also be practical to have a

portability component which would allow us to check if we have all our items with us at any given time and location. This device is the CheckList™.

The CheckList™ will reduce the number of self generated retrieval cues for items of importance as we would only need to remember to check the device to ensure all items are on us. Therefore, instead of having to check for the presence of many items of importance, we would only need to check for the presence of the device and let it do the rest of the work. It would not only enable people to ensure that they have certain items but would act as a reminder by displaying the missing items to the user. It will help in personal organization, and may even serve as an insurer of personal safety as it would ensure that items used for self defense such as pepper spray, are not forgotten. This device will be intended for users of all ages, not solely for older adults that may have problems with memory retrieval.

System Overview

As shown in Figure 1, the CheckList™ system requires five main components: a USB key, a LCD display, a transmitter-receiver, RFID tags and a GUI.

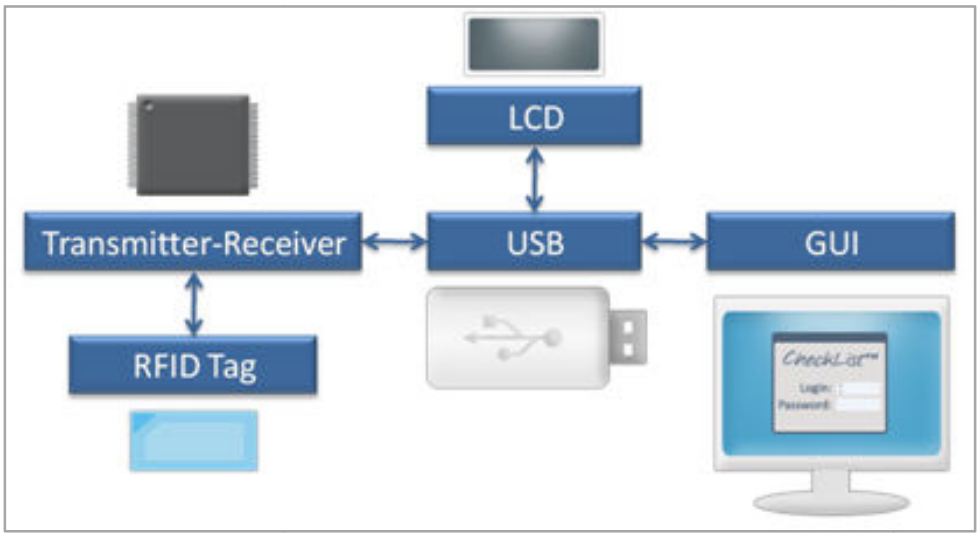

Figure 1: Overall System Components

The LCD screen and the transmitter-receiver are mounted onto the USB key forming the device that is to be kept with the user, either on a keychain or attached to a lanyard. Each item needed by the user is tagged with its own unique RFID sticker and the list of items can be added by using the program found on the USB. Once the list is saved, the user can then check at any time whether all the necessary items are with him/her. To do this, the user simply presses the 'Check' button found on the USB key and then follows the steps outlined in Figure 2.

Our design makes use of RFID tags due to their low cost, and the fact that they are thin and flexible allows them to be affixed to a variety of objects. The chips on RFID tags are also equipped with "*multi-read*" functionality, which will enable multiple tags to be read simultaneously. Another benefit that is particularly relevant to our product is that RFID tags do not need batteries because they collect the energy for operation from radio signals, and they do not need to be in any particular position in order to be identified by the reader [2].

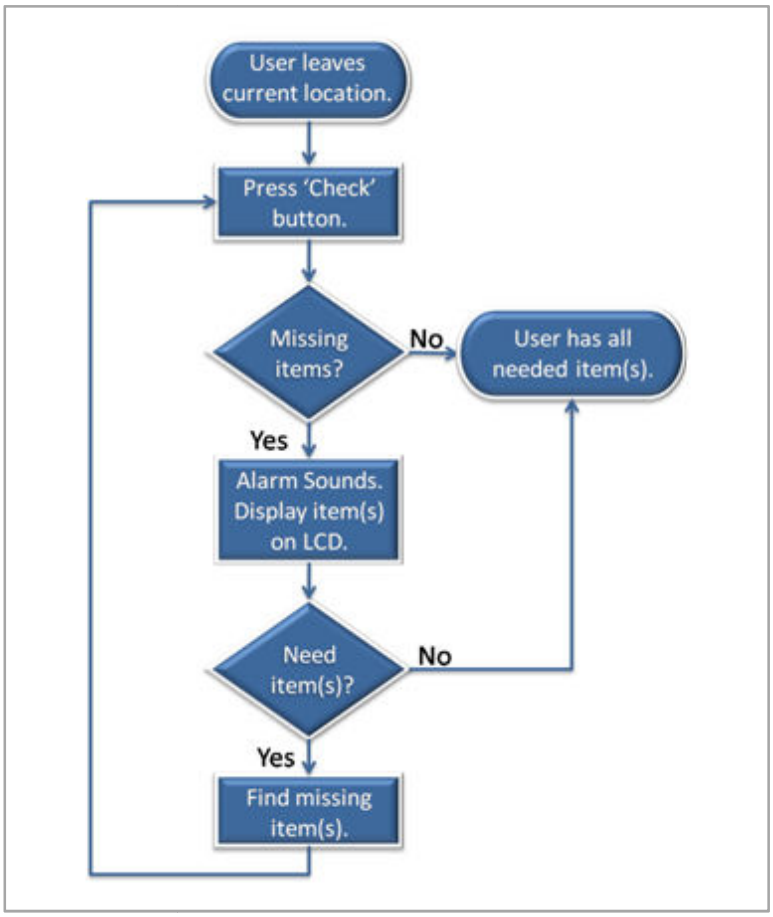

Figure 2: Overall System User Flowchart

The USB will contain an executable file so that once the user inserts it into a computer the GUI will open and allow the user to update which RFID tag will correspond to a specific item. There will be an empty field next to each of the RFID tag numbers, and the name of the object that the user enters into the field will be the name that will be displayed in the LCD screen if that particular item is missing. This type of functionality provides flexibility as it will allow the user to update which items are tagged anywhere at any time, because the executable module is able to run on any computer.

One of the main constraints of this project is time. We have a total of thirteen weeks in which to complete the project, so we decided to keep the product as simple as possible, whilst solving the problem of a person forgetting important items. With more time, we would be inclined to develop an additional module that would also help in theft alert. For this option, the user would have to press a pushbutton that would activate a "continuous check" module that would trigger intermittent signals to be sent from the emitter to the

RFID tags, and these tags would also intermittently return a signal. This option would be useful when a person is walking through a crowd and would like to be alerted if he/she has been pick-pocketed, or has simply dropped something on the way. It would also be ideal if we could incorporate an audio alert that would be activated if any of the tagged items were missing.

Market Research

Prior to the commencement of the project, Mnemosyne Innovations believes it is pertinent to assess the need for such a memory device and explore the market for the variety of related products currently available. This will provides Mnemosyne Innovations with a general understanding of the need for a device like the CheckList™. The various methods used by the public to aid with memory and recollection are categorized and discussed below, starting with the very basic, to those that are more technologically advanced.

Post-It Notes™ are perhaps the most convenient method of remembering items. Not only are they easily accessible to the general public, they are low cost and highly effective for short periods of time. However their biggest drawback involves the fact that they cannot be used continuously as their adhesiveness decreases over time.

Another form of remembering items is to form a to-do list. This technique has also been in use for a long time, and as technology has evolved, to-do lists have transformed from those on paper to those made on the computer – more will be discussed on this topic later on. To-do lists are best for providing an individual of the general overview of all the items that need to be performed – in some instances, an individual may also choose to number their list in order of priority.

Many individuals also find it convenient to be reminded by members of their family, friends or office staff for example about items that they need or appointments they need to fulfill. However, this system is not reliable, as the problem of remembering is simply shifted from one person to another.

Computer applications such as planners and email alarms can definitely be used as a memory aid. There exists an array of programs that a person is able to install on their desktop or laptop computers, and that would enable them to organize their day in an efficient manner (i.e. by keeping track of purchases, sending reminders for appointments etc). In addition, online applications have gained popularity because the user is able to have remote access to the necessary information.

More advanced forms of memory aids that are currently available can be blanketed under the term of a Personal Digital Assistant (PDA), which is essentially a handheld computer. PDAs in the early days only contained basic functionality such as address books etc. However, as technology advances, PDAs have been installed with new capabilities such as a

color screen and audio indicators, and thus are used as smartphones, portable media players and web browsers. Cellphone and smartphone applications such as timers/alarms, calendar alarms and electronic to-do lists are those that are relevant to our investigation. This approach is a significant improvement over the post-it notes and paper based to-do lists because it is firstly electronic and secondly is portable. Being electronic is an advantage because the probability of losing the information significantly decreases and portability is definitely a plus since the person is able to be mobile and still have access to the necessary information [3].

Aside from the uses of PDA and similar products mentioned above, memory devices can also be used in the form of assistive technology to aid individuals suffering from dementia and Alzheimer's disease. This type of technology is mainly used to support independent living, and includes simple items such as calendar clocks to more complex devices such as automatic lighting and pill dispensers. An important distinction between the assistive devices used for individuals suffering from cognitive disorders and the CheckList™ is that most of the assistive technologies are passive, i.e. the person does not need to activate the system in any way. In the case of the CheckList™, the user is required to press the 'Check' button at the time of leaving their current environment, making it an active system.

Thus far, through an extensive search, a portable memory device such as the CheckList™ has not yet been introduced. The CheckList™ has a very distinct purpose i.e. to help individuals take with them important items when they leave their current environment. The CheckList™ is different from the post-it note concept for example, because it relies on checking the distance between the person and the object – thus not only can it be used to check if the individual has all the items with them, but to also potentially *locate* an object in a user's surroundings. None of the devices in the current market achieve this purpose.

The CheckList™ is an automated system, and hence is far more reliable than say a reminder from another individual. Furthermore, the CheckList™ reminds the user only about tangible items and not appointments or to-do items. Currently there are several devices, especially those mentioned above that remind the user of appointments and such quite efficiently. Mnemosyne Innovations does not wish to duplicate this technology, but rather tap into a subset of the market that is currently unexplored.

Sources of Information

Mnemosyne Innovations plans to utilize a wide variety of sources when gathering the necessary information and knowledge required to develop a marketable product. The possible sources of information will be the internet, peer-reviewed journals, engineering textbooks, research papers prepared by the academic community and professors at Simon Fraser University.

We recognize the importance of reliable sources of information and thus, one of the main sources for our project will be the journals and magazines published by the Institute of Electrical and Electronics Engineers (IEEE). In addition to that, in terms of the technical design aspect, SFU professor Patrick Leung (P. Eng) has been approached to assist Mnemosyne Innovations by sharing his technical expertise. Professor Rodney Vaughan, who specializes in wireless communication technology, has also been approached to provide insight into the CheckList™ design idea.

Furthermore, for the user interface and usability aspect of the product, Mnemosyne Innovations will be approaching members of the target market for ideas, opinions and suggestions regarding the external appearance, on-screen interface, and functionality of the product. This research will be performed in the form of a series of surveys/interviews, and is necessary to make the product as user-friendly as possible.

Budget and Finances

Mnemosyne Innovations has researched the various components required for the design and development of the product and a tentative price list of all the materials are included in Table 1, below. All the estimated prices include taxes, shipping, as well as an additional 13% contingency.

Table 1: Estimated Budget for Production of the CheckList™

COMPONENT	COST
LCD Display	$40.00
RFID Transmitter/Receiver	$300.00
RFID Tags	$40.00
Controller/Processor	$250.00
USB Interface	$30.00
Power Supply	$40.00
PCB	$50.00
Contingency	$100.00
TOTAL COST	$850.00

It is essential for the final manufactured device to be very low cost in order to be marketable. However, the initial prototype will cost far more because of the design, testing and development involved. For this reason, sources of funding are vital to the success of the product. We have already been offered $800.00 from the Engineering Science Student Endowment Fund (ESSEF) and are actively pursuing funding from the Wighton Engineering Development Fund. Furthermore, we will attempt to borrow as much equipment as possible to use for building the prototype by making use of the ESSEF Equipment Loan program as well as approaching SFU professors.

We realize that it might not be possible to generate sufficient capital to fund the project entirely. In these circumstances, company executives are willing to share the remaining financial costs of the project equally. A detailed account of all financial transactions will be kept to ensure that all members are reimbursed.

Project Timeline

The following figures provide an estimate of the timetable our group aims to follow in order to successfully complete the project. The Gantt chart, shown in Figure 3, illustrates the duration taken by each stage of the project. The Milestones chart, shown in Figure 4, presents a timeline for when our group plans to achieve our project milestones.

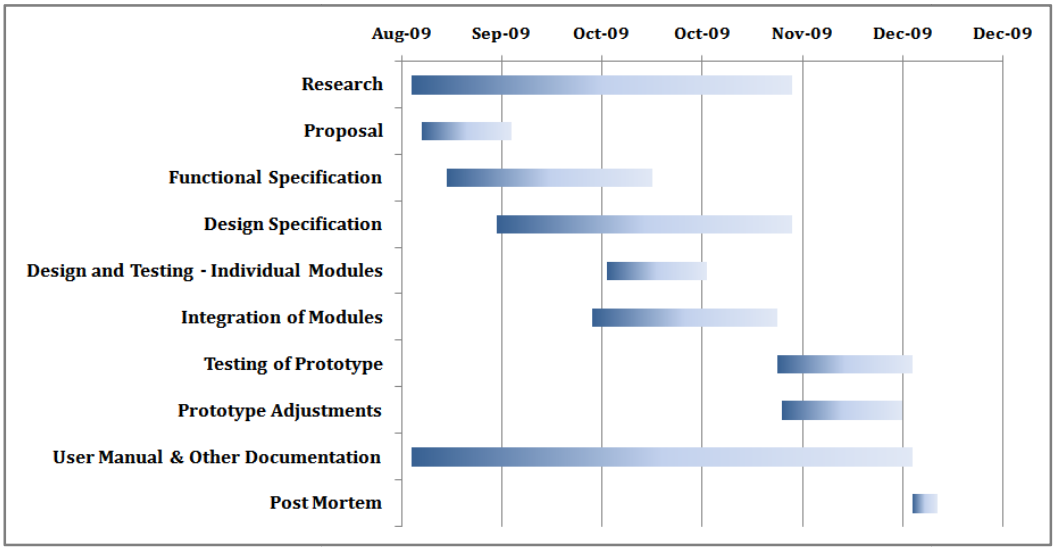

Figure 3: Gantt chart

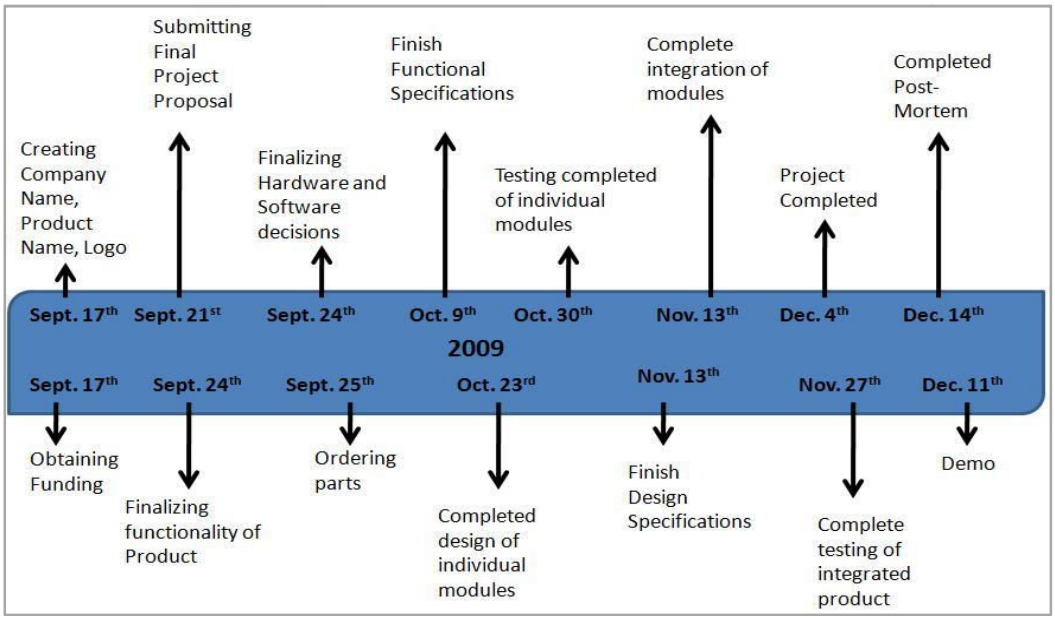

Figure 4: Milestones chart

Company Profiles

Priyanka Deshmukh – Chief Executive Officer (CEO)

Ms. Deshmukh is a fifth year Engineering student specializing in the area of rehabilitation and assistive devices in the Biomedical Engineering (Hon.) program at Simon Fraser University. Through coursework and having completed two co-op terms at Top Producer Systems, Ms. Deshmukh has experience with C++ programming, quality assurance testing and digital device interfacing. Furthermore, Ms. Deshmukh demonstrates expertise implementing and debugging electric circuits as well as experimenting with digital waveforms. In addition to the technical abilities, Ms. Deshmukh is an effective communicator and displays good teamwork, leadership and organizational abilities, all of which are key characteristics a CEO must possess to lead the company on a successful path.

Rachel Cheng – Chief Operations Officer (COO)

Ms. Cheng is an nth year Systems Engineering major and Communications minor at Simon Fraser University. While completing her degree, she has developed strong technical writing skills as well as gained experience programming in C++ and MATLAB. After completing an eight month work term as a quality assurance tester for Safeway, she has become familiar with the process of releasing a product from both the technical and commercial aspects. With these skills, she is taking on the portfolio of software development and testing for Mnemosyne Innovations in addition to overseeing administrative duties for executive meetings.

Ana Namburete – Chief Technical Officer (CTO)

Ms. Namburete is a fourth year Biomedical Engineering student specializing in biomedical imaging at Simon Fraser University. In a previous co-op term at Radisys Innovations, she worked as a Software Engineer where she familiarized herself with an array of programming languages including Java, C++, Assembly language, Python, and with database management, defect tracking and source code repositories. She has also worked as a research assistant in both the Microinstrumentation Lab and the Neuromuscular Instrumentation Lab at SFU where she became proficient in Computer Aided Design (CAD) and digital image processing. Due to her extensive experience in software engineering and programming, she will be responsible for the software component of the company, and the liaising and integration of software and hardware.

Surbhi Seru – Chief Marketing Officer (CMO)

Ms. Seru is a fifth year Biomedical Engineering student at Simon Fraser University. She has previously worked for KPMG LLP, specializing in hardware and mechanical engineering clients. Ms. Seru is also currently working at the Neurokinesiology Laboratory at Simon Fraser University where she is responsible for specification, testing, data acquisition, and data analysis. In addition to developing her technical knowledge base at KPMG, she was also able to improve her business development skills and expand her professional network. Furthermore, Ms. Seru has been extensively involved with AIESEC, the world's largest student-run organization. She has held multiple roles which have helped her develop her marketing, negotiation, and problem solving skills. These skills, along with her sound technical background, makes Ms. Seru ideal for the position of Chief Marketing Officer of Mnemosyne Innovations.

Team Organization

Mnemosyne Innovations is comprised of four talented SFU Engineering students: Priyanka Deshmukh, Rachel Cheng, Ana Namburete and Surbhi Seru. Each of these individuals is an asset to the company due to their very specific area of expertise, with the previous section clearly illustrating each team member's strength. We recognize that working in a team environment is a key component of a successful business, and therefore we are committed to be adaptable, welcome each individual's working styles and overcome any challenges we may face during the course of the semester in order to deliver a high-quality final product.

Each individual is responsible for a certain aspect of the project, and is therefore assigned a title accordingly. Ms. Deshmukh is the Chief Executive Officer (CEO) of Mnemosyne Innovations and is responsible for ensuring good time management, facilitating discussions in a respectful manner and ensuring the team remains on track to achieve the goals set at the beginning of the semester. Ms. Cheng is the Chief Operations Officer (COO), and is responsible for managing the daily operations of the business. This includes organizing meetings, and maintaining sound documentation of the progress made. Ms. Namburete is the Chief Technical Officer (CTO), responsible for coordinating the technical efforts of the group. This includes being aware of the latest design and technology and facilitating technical problem solving within the group. Ms. Seru is the Chief Marketing Officer (CMO) of Mnemosyne Innovations and will oversee sales management, product development and distribution, and develop strategies for successful introduction of Mnemosyne Innovations' CheckList™ into the technology market.

We recognize that in order to successfully complete this project, the planning and execution stages are of key importance, and hence the following demonstrates how we will achieve successful completion. Weekly meetings will be held in order to discuss the progress of the project and to assign the remaining tasks to team members. Twenty four hours prior to the meeting, Ms. Deshmukh will be sending out an agenda to ensure that the meeting is carried out in an organized and effective manner. During the minutes, Ms. Cheng will be documenting the contents discussed in the form of meeting minutes, which will be sent out to the team members within the next twenty four hours. In addition to the above, each group member will maintain a journal, in which they may include any thoughts and ideas from the planning, execution and testing stages of the project, serving as a means of more formal documentation.

Lastly, we recognize the importance of effective communication, collaboration by all team members and the ability to be involved in the decision making process. To achieve the above, Mnemosyne Innovations has decided to create an online team forum, in the form of Google Documents that will be accessible to all group members. Each of us will be able to upload our work onto this platform and other members will be able to view and edit the same. This will achieve successful learning on all parts by each individual and will give Mnemosyne Innovations a degree of flexibility when working on the project.

Conclusion

There is no need for anyone to lose their valuables wherever they go and we believe the CheckList™ can be a solution to that dilemma. As outlined in our proposal, Mnemosyne Innovations has a strong team, each lending their strengths to this project. We will work hard to complete our prototype in a timely fashion and within budget.

Whether it's used at home, work or on vacation, the CheckList™ is the simple way to keep track of all important items. It will help anyone remember what they need, anywhere with just the click of a button.

All you need to remember is your CheckList™.

References

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Photo References

All images were created by Rachel Cheng, using Adobe Photoshop CS2 and Microsoft PowerPoint 2007.

Charts and graphs were created by Priyanka Deshmukh using Microsoft Excel 2007.