December 10, 2010

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

Re: ENSC 440 Post Mortem for the Remote Diagnostic System

Dear Dr. Rawicz:

Enclosed is the functional specification provided by MediCare Solutions for the Remote Diagnostic System. The system is composed by three components – the remote diagnosis software, a central server and an embedded handheld tablet. Our system is designed to allow paramedics to transmit patient information and their vital signs data electronically to the hospital in real time. The goals are to improve communication efficiency and accuracy between paramedics in an ambulance and the personnel at the hospital. Thus, it will result in shorter waiting time and better preparation at the emergency room (ER).

In the attached document, we will address the current state of our prototype Remote Diagnostic System (RDS) and the current functionality as well as a few slight deviations we have made from our original design. Furthermore, possible future improvements of our system will also be discussed. Moreover, MediCare Solutions' finances and each member's testimonial of their development process will be stated.

MediCare Solutions consist of five members of senior engineering students with different engineering concentration: Da Zhou, Danny Chieh-Yao Cheng, Eric Chow, Jeffrey Tam, and Sean Yu-Hsiang Fang. If you have any questions or concerns about our proposal, please feel free to contact me by e-mail at cca16@sfu.ca.

Sincerely,

Danny Chieh-Yao Cheng
President and CEO
MediCare Solutions

Enclosure: *Post Mortem for a Remote Diagnostic System*

MediCare Solutions

Post Mortem for a

Remote Diagnostic System

Project Team: Danny Cheng
Jeffery Tam
Da Zhou
Eric Chow
Sean Fang

Contact Person: Danny Cheng
cca16@sfu.ca

Submitted to: Dr. Andrew - ENSC 440
Michael Sjoerdsma - ENSC 305
School of Engineering Science
Simon Fraser University

Issued data: December 10th, 2010

Revision: 1.1

Table of Contents

List of Figures

List of Tables

Glossary

ER	Emergency Room
EMS	Emergency Medical Service
GUI	Graphical User Interface
UI	User Interface
Handheld Tablet	A portable touch screen computer
Server	A computer **Server** that stores all information about patients and hospitals
RDBMS	Relational Database Management System
ER	Emergency Room
WiFi	Wireless Fidelity

1. Introduction

Patients getting treatment in a timely manner is a crucial component affecting a patient's recovery rate. Unfortunately, the wait time for the Canadian emergency rooms (ER) have been increasing every year. The goal of our product is to improve the efficiency of the ER with the introduction of MediCare Solutions' Remote Diagnostic System (RDS). Our system will provide timely and reliable information to medical personnel in all situations alike.

1.1 Scope

The intention of this document is to provide the most current update of MediCare Solutions' RDS prototype and documents any deviations from our original intended course of action stated in our previous document such as the proposal and functional specifications. Furthermore, future development will be discussed as additional functionality could be implemented to further enhance the overall system. Actual prototype spending and timeline as well as each member's experience during the developmental process will also be addressed.

2. Current State of the System

As illustrated from the project proposal, the current state of MediCare Solution RDS fulfills the requirements described by the following system flow chart in Figure 1. The RDS prototype will consist of two main functional systems; handheld tablet that will be used by paramedics to gather information and a hospital component that will that will be used to transmit and retrieve necessary information from the hospital's central server unit.

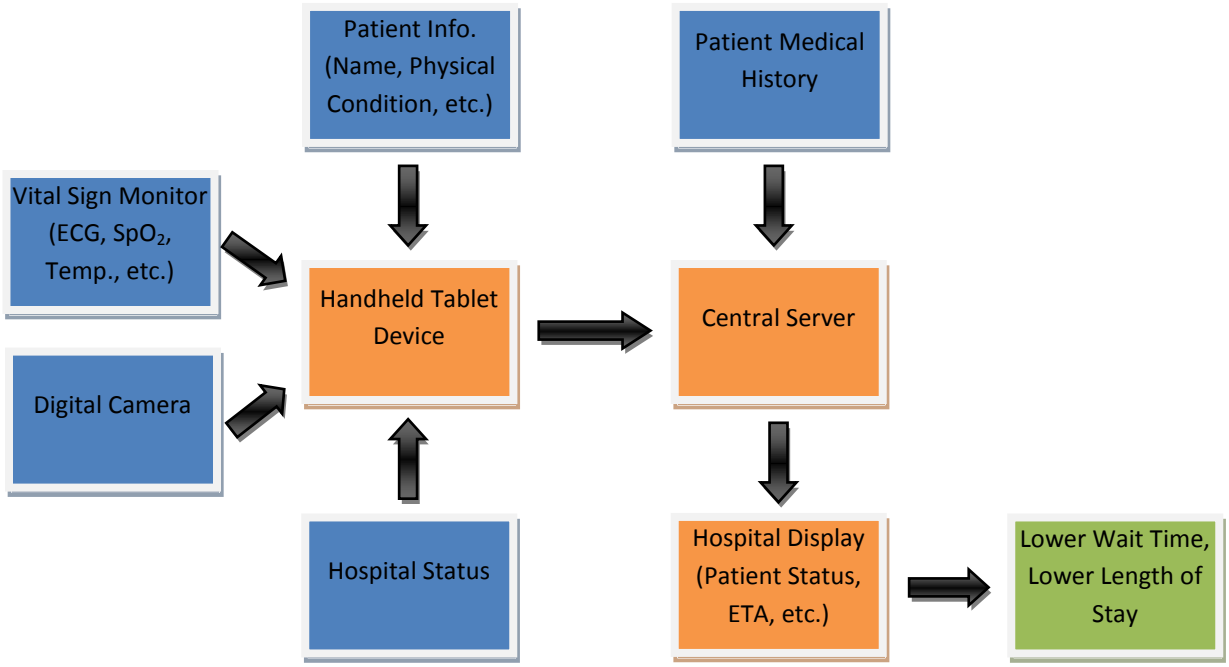


Figure 1 - System Overview Flow Chart

2.1.1 Handheld Tablet – Devkit 8000 Evaluation Board

In the current state, the RDS handheld tablet utilizes the DevKit8000 Evaluation board with digital camera and WiFi modules. This prototype system will utilizes WiFi as the main source of communication with the hospital server component. The digital camera module as shown in Figure 2 will allow paramedics to take high quality 3.2 megapixels images of patients' conditions or wounds to be transmitted back to the hospital in order for a pre-assessment to take place by the triage nurses.

Figure 2 - 3.2 MP Digital Camera Module

In addition, we have built-in a feature that would permit the connection of vital sign devices such as the pulse oximeter with our tablet device to transmit real time vital sign information back to the hospital server as illustrated in Figure 3. Live vital signs information will allow triage nurses and doctors to have a much better idea of the incoming patient's medical condition. It results in better prioritization of patient based on the level of severity of their injuries or conditions.

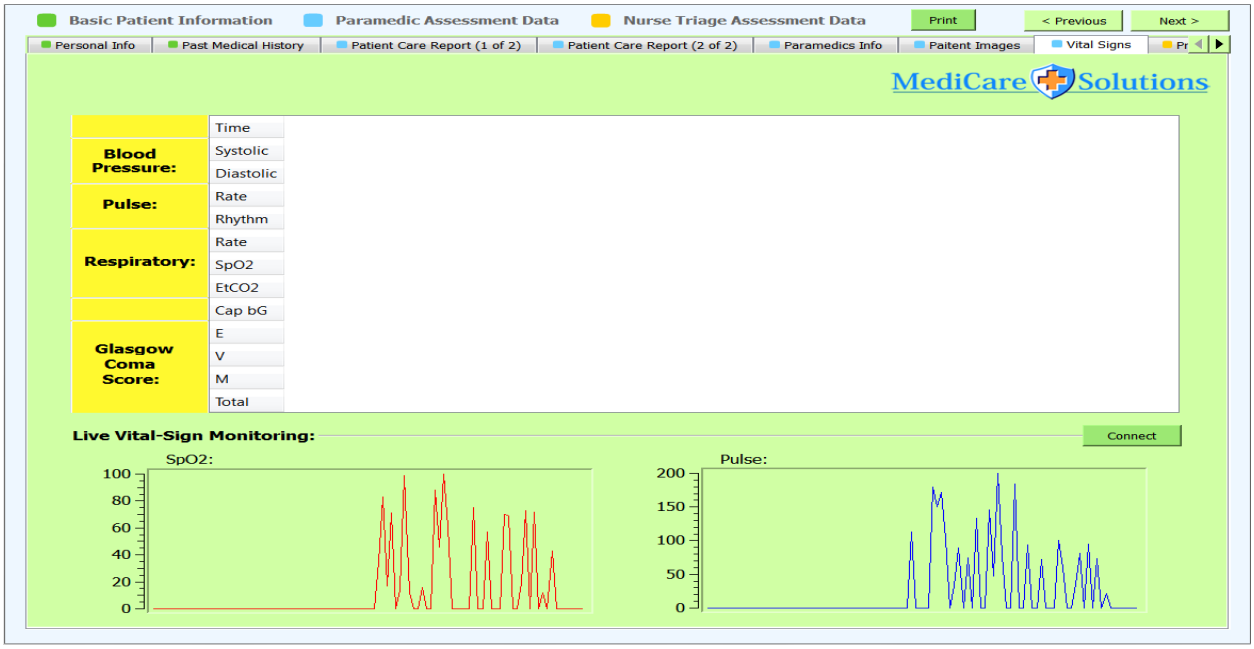


Figure 3 - Plotted Live Vital Sign (SpO2 and Pulse) Update

We have also tailor-made a case to store the evaluation board out of plexi-glass as shown in Figure 4. It will increase the durability of the tablet device. The casing will increase the system's overall shock as well as water resistance which are essential as paramedics will have to work under all situations and weather.

Figure 4 - Plexi-glass Protective Casing

2.1.2 Handheld Tablet – Patient Care Report GUI

A graphical user interface software has been developed that follows closely with the Patient Care Report that is currently used by British Columbia Ambulance Service (BCAS). Usability was a main factor that was considered in the overall intuitive design that is meant to require minimal amount of learning utilizing our new device. User will be able to produce a new patient care report with ease, and updating pre-existing report information are also in placed to provide versatility. Proper fail-proof warnings are also implemented into the GUI design to ensure mandatory information is inputted prior to transmission to hospital server as shown in Figure 5.

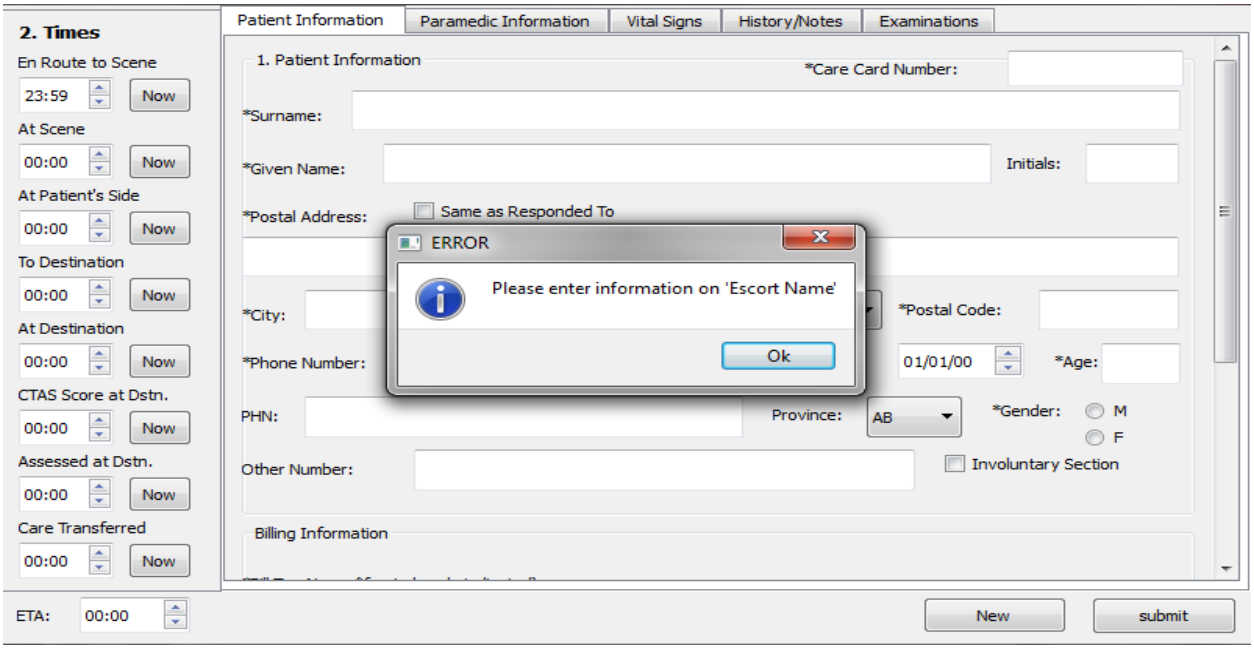


Figure 5 - Error warning system to alert user of incomplete fields

2.2.1 Hospital Component – Database Server

For demonstrative purposes, MediCare Solution decided to utilize the Microsoft SQL Server 2008 as the hospital's central database server. All relevant patient information including the paramedics' Patient Care Report and Triage Nurse Assessment form information will be stored and/or retrieved from this database unit. Due to the complexity of the information, multiple tables have been assigned to store respected information. Relationships between these tables are also pre-determined accordingly in order to improve retrieval time of such information whenever necessary.

2.2.2 Hospital Component – Whiteboard

A graphical user interface has been designed to be treated as the whiteboard for displaying arriving patient information as well as patient waiting to be processed at the hospital. The whiteboard will be utilized by the triage department to better prioritize and prepare for patients based on their level of severity of their injuries. The bottom table in Figure 6 illustrates patient in transit to the hospital while the top table illustrates patients who are waiting to be treated or are already being treated.

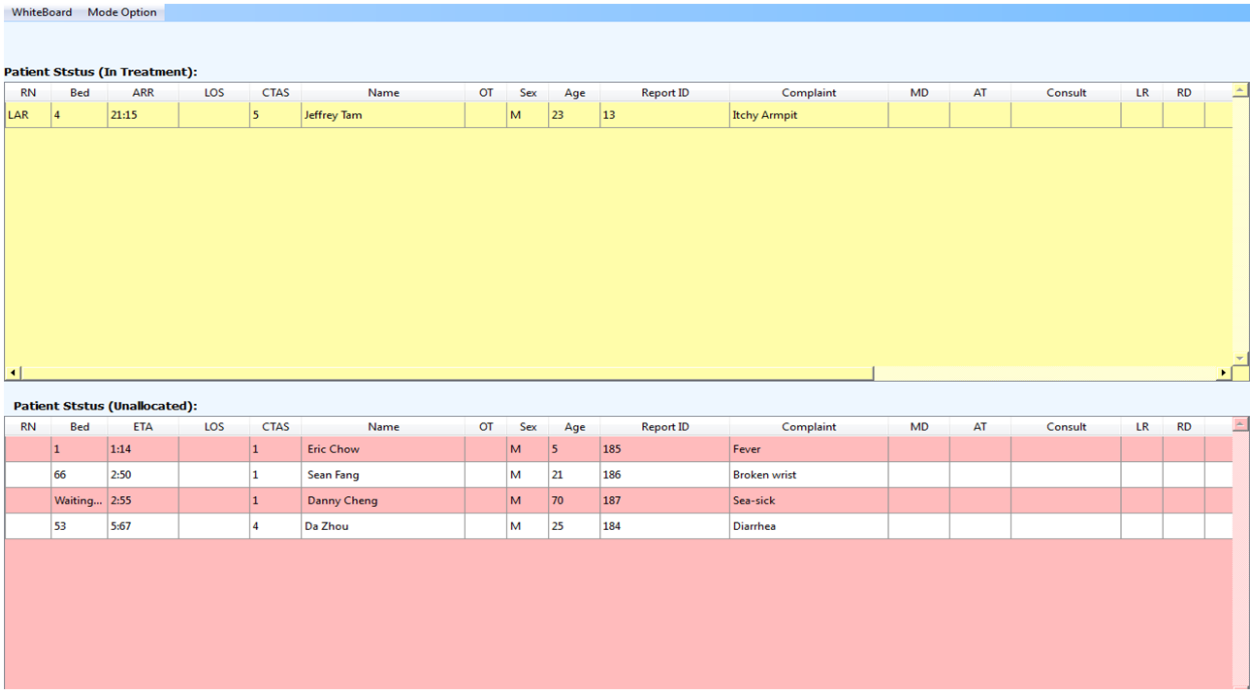


Figure 6 - Whiteboard GUI

A function to edit patient information is also implemented into the interface by selecting “Mode Option > Edit Mode”. For security purposes, a login box will appear where the medical personnel have to enter their Employee ID and Password before gaining access to modify any information as shown in Figure 7.

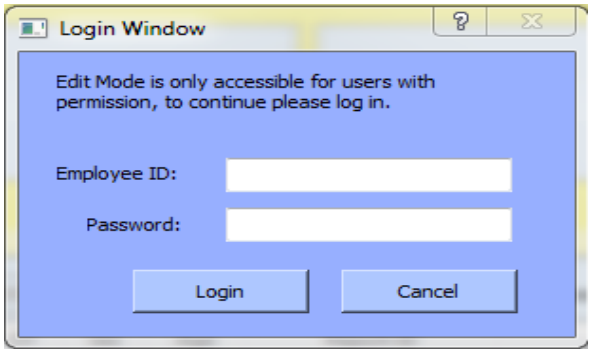


Figure 7 - Security Feature: Login Feature to the Database

2.2.3 Hospital Component – Triage Nursing Assessment GUI

After the patient is admitted into the hospital, the triage nurses have to do a thorough assessment of the patient’s injury. This injury report is known as the Triage Nursing Assessment. Without a doubt, Medicare Solutions have also included this functionality into the GUI design as shown in Figure 8 below.

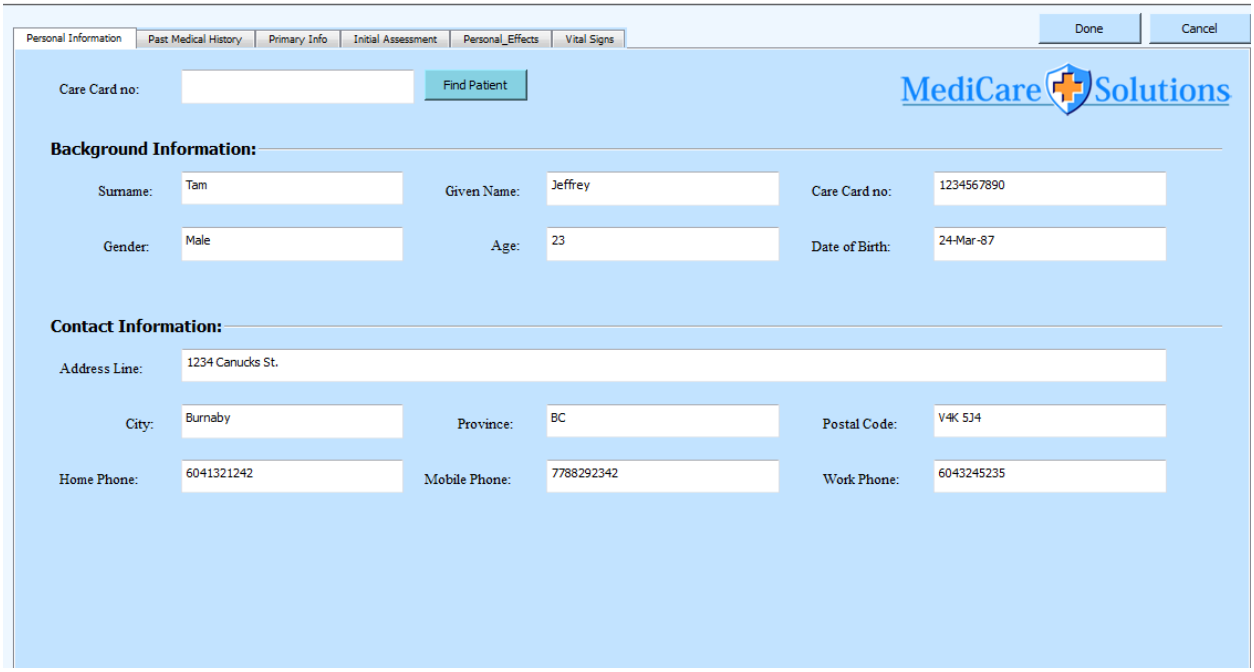


Figure 8 – Triage Nursing Assessment GUI

The feature to search for a patient's personal information and past medical history is included as well. All that is required is an existing patient care card number to perform the query. Moreover, features such as real-time vital signs update is also implemented into this GUI design. This will allow remote monitoring of multiple patients at the same time by medical personnel.

3. Deviation of the System

The final product is about 90% of what we originally set out except for two features. We didn't implement the hospital resource availability feature on the tablet because of two reasons. Since the hospital will receive the data from the tablets, they will know what is incoming and if they don't have the capacity to receive the patient, a radio communication would suffice. Also, sometimes the choices are limited due to different hospital equipment and specialty. Even if the beds are full, the patient may still need to be admitted to that hospital anyway. As we analyze the possibilities of different situations, we felt it was unnecessary to include that feature. The second feature that wasn't included was the digital thermometer readings on the tablet GUI. This was mainly due to our misunderstanding of the available medical device when we first proposed the project. The equipment we used from the Biomedical lab doesn't actually read temperatures, and thus we had to abandon that feature in our product. However, if we could read vital signs, we can definitely read temperature so it wasn't a big deviation from original project.

As section 6 will later show, our project had some delays in a few milestones. Most of the delay was due to unforeseen integration complications that arose. However, it was actually in our expectation to have

issues during integration so our schedule wasn't affected too much because we had already left soft delay tolerance in our original timeline.

4. Future Development

The current state of this product allows a proof of concept design to be tested in the laboratory environment. To improve the system functionality and allow field testing, we could like to make following suggestions for future development of the remote diagnostic system.

4.1 System Design

Current prototype uses WIFI as the transmission medium; however 3G networks with its greater coverage and accessibility is the ideal choice for RDS. The 3G transmission module should be adapted and co-exist with the WIFI modules to provide transmission support to ensure communication between the tablet and server system is viable. Multiple tablet devices communication should be supported by the RDS in the future for field testing as well.

4.2 Tablet Design

4.2.1 Hardware

Device Case: The current case does not provide enough protections for the internal board of the product. A well ergonomically designed case should be provided for field test.

Touch Screen: Current system uses a resistive touch screen which has de-bouncing error using the existing I2C bus. It is also hard to be used with human fingers due to the nature of the resistive based design. The human interface and usability will be greatly improved if a capacitive touch screen is used. The I2C bus driver should be reworked to provide a fast responding time and more accurate touching spot detection. The size of the touch screen should be increased to 11”-15” to reduce number of tabs that paramedics needs to flip back and forth for data entering.

Serial Port: Vital sign monitoring is also an important feature in the RDS. However, the Linux driver for RS323 port of the current prototype has several reading errors. Those errors should be removed before the device is carried out for field testing. We suspect a customized driver will solve this reading problem.

Camera Resolution: Currently a 3.2M pixel digital camera is used for imaging purpose, and it supports 640x480 image resolution. The image provides the most intuitive understanding to the injuries. It will be beneficial for the emergency service personnel if a higher resolution and sensitivity camera can be used.

Battery Management Component: As of existing prototype, tablet is directly power through an AC adaptor, which will not be accessible when performing field testing. A battery and corresponding management component should be added to provide portability to the device.

4.2.2 Software

Tablet GUI: An intuitive user interface to allow paramedics to use the tablet is most critical step of the product. The GUI design should be re-designed to match more closely to what paramedics will need to go through and the feedbacks from paramedics.

Device Driver: The current device uses an old Linux Kernel and several generic hardware drivers. They will need to be upgraded to provide easy maintenance and better device functionality.

4.2 Server Design

4.2.1 Software

Server GUI: This interface provides the nurses the understanding of the paramedics' treatment to injured people. A re-design of the interface based on the nurses' feedback is desired.

Multiple Tablet Tracking: Current server will only be able to communicate with only one tablet at the time. However this will not be the real scenario in the field, multiple tablets will attempt to setup transmission channels with the server, thus a parallel handling of all tablets' incoming data should be supported by the server.

RDS is designed to assist paramedics to provide emergency services in a more efficient way. Further research on how to improve efficiency will also be needed to improve the system performance. Before the system can be carried to the field testing stage, we estimate it will take another half-year of dedicated work from the entire team to complete the laboratory testing and redesign process.

5. Project Finances

In the original estimate in September, MediCare Solutions team has estimated total spending to be $645 CAD. The major purchase for the prototype system is solely an evaluation board with a LED touchscreen with digital camera and WiFi modules. A significant portion of this prototype can be done on desktops or laptops which are accessible to all five team members, thus reducing the overall development cost.

5.1 Budget and Spending

The following table illustrates a comparison of the estimated spending and actual spending as of December 9, 2010.

Purchases :	Source:	Estimated Cost: CAD	Actual Cost: RMB	Actual Cost: CAD	Date of Purchase
Devkit8000 w/ camera, VGA, WiFi module	Embest	$645	2800¥	$424.73	21-Sep-10
Fedex - Devkit8000 w/ camera, VGA, WiFi module	Fedex	-	337.86¥	$51.25	21-Sep-10
Digital Camera Module	Embest	-	500¥	$75.84	29-Nov-10

Fedex - Digital Camera Module	Fedex	-	200¥	$30.34	29-Nov-10
Plexi-glass	Home Depot	-	-	$29.92	1-Dec-10
Gender Changer + Lithium Battery	The Source	-	-	$15.66	2-Dec-10
Mounting Material	Lee's Electronics	-	-	$10.14	3-Dec-10
10 ft Modem Cable + DB9/10Pin-Header Slotplate	Memory Express	-	-	$24.62	7-Dec-10
Total Spending		**$645**		**$662.50**	
Obtained Funding:					
ESSEF Funding		**-**		($**250)**	
Total Cost		**$645**		**$412.50**	
CAD to RMB Exchange Rate Dec 10th,2010	**6.5924**				

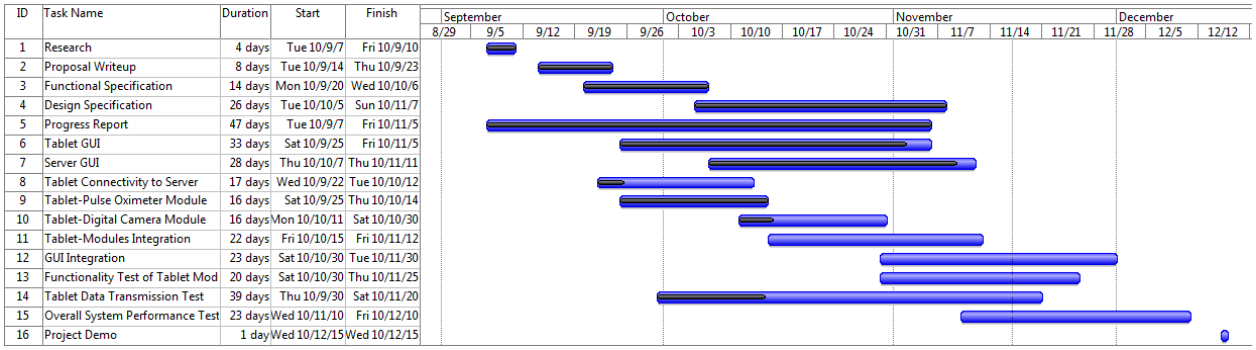
Table 1 – MediCare Solutions Estimated and Actual Spending

As shown by the above table, the cost of the evaluation board with the necessary modules is significantly lower than predicted. This is due to the fact that a group member utilizes his connection to obtain lower prices for the evaluation board with its respected modules from the overseas dealer. Additional purchases were required as we initially did not account for the cost of the materials for casing and other accessories.

From the Engineering Science Student Endowment Fund (ESSEF), $250 was granted to MediCare Soltuions at the beginning of the semester. As originally planned, the team will apply for the Wighton Engineering Development Fund to obtain further reimbursement. Currently, the actual outstanding amount is $412.50 CAD, which is be equally split between five MediCare Solutions members if no further funding can be obtained.

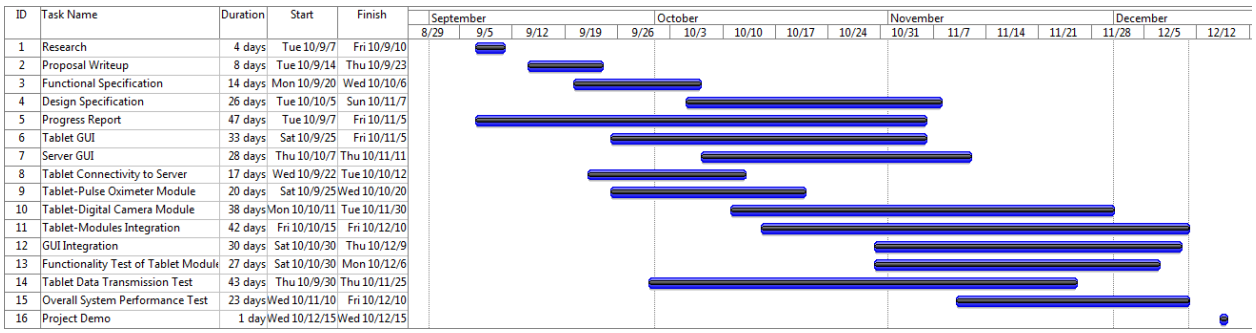
6. Project Timeline

The project in general followed the timeline quite well except for a few milestones. Figure 9 is what the original schedule represented, and Figure 10 is what the project timeline actually looks like.



ID	Task Name	Duration	Start	Finish
1	Research	4 days	Tue 10/9/7	Fri 10/9/10
2	Proposal Writeup	8 days	Tue 10/9/14	Thu 10/9/23
3	Functional Specification	14 days	Mon 10/9/20	Wed 10/10/6
4	Design Specification	26 days	Tue 10/10/5	Sun 10/11/7
5	Progress Report	47 days	Tue 10/9/7	Fri 10/11/5
6	Tablet GUI	33 days	Sat 10/9/25	Fri 10/11/5
7	Server GUI	28 days	Thu 10/10/7	Thu 10/11/11
8	Tablet Connectivity to Server	17 days	Wed 10/9/22	Tue 10/10/12
9	Tablet-Pulse Oximeter Module	16 days	Sat 10/9/25	Thu 10/10/14
10	Tablet-Digital Camera Module	16 days	Mon 10/10/11	Sat 10/10/30
11	Tablet-Modules Integration	22 days	Fri 10/10/15	Fri 10/11/12
12	GUI Integration	23 days	Sat 10/10/30	Tue 10/11/30
13	Functionality Test of Tablet Mod	20 days	Sat 10/10/30	Thu 10/11/25
14	Tablet Data Transmission Test	39 days	Thu 10/9/30	Sat 10/11/20
15	Overall System Performance Test	23 days	Wed 10/11/10	Fri 10/12/10
16	Project Demo	1 day	Wed 10/12/15	Wed 10/12/15

Figure 9 - Original Timeline



ID	Task Name	Duration	Start	Finish
1	Research	4 days	Tue 10/9/7	Fri 10/9/10
2	Proposal Writeup	8 days	Tue 10/9/14	Thu 10/9/23
3	Functional Specification	14 days	Mon 10/9/20	Wed 10/10/6
4	Design Specification	26 days	Tue 10/10/5	Sun 10/11/7
5	Progress Report	47 days	Tue 10/9/7	Fri 10/11/5
6	Tablet GUI	33 days	Sat 10/9/25	Fri 10/11/5
7	Server GUI	28 days	Thu 10/10/7	Thu 10/11/11
8	Tablet Connectivity to Server	17 days	Wed 10/9/22	Tue 10/10/12
9	Tablet-Pulse Oximeter Module	20 days	Sat 10/9/25	Wed 10/10/20
10	Tablet-Digital Camera Module	38 days	Mon 10/10/11	Tue 10/11/30
11	Tablet-Modules Integration	42 days	Fri 10/10/15	Fri 10/12/10
12	GUI Integration	30 days	Sat 10/10/30	Thu 10/12/9
13	Functionality Test of Tablet Module	27 days	Sat 10/10/30	Mon 10/12/6
14	Tablet Data Transmission Test	43 days	Thu 10/9/30	Thu 10/11/25
15	Overall System Performance Test	23 days	Wed 10/11/10	Fri 10/12/10
16	Project Demo	1 day	Wed 10/12/15	Wed 10/12/15

Figure 10 - Actual Timeline

As the figures represent, the milestones most affected were the modules and GUI integration, and ultimately the entire system testing process. When the individual parts were done and ready to integrate, we encountered problems that were not expected during the development stage of the project. Most of the problem occurred because of the different architecture and environment that we were transferring our system onto. For example, local machine versus local LAN network for our data transmission, and moving from Intel CPU to ARM CPU architecture. The delay however didn't affect us too much because when we planned out the original schedule, we gave ourselves some room for error in case delay occurs.

7. Group Dynamics and Experiences

As expected, the dynamic of the group was healthy from start to finish as each member has known each other for years. Many of us have worked with one another in other projects and labs prior to this project. Together, we have formed a well-balanced group as the team consisted of engineers from biomedical, electronics, computer and systems option. More importantly, we have delegated our roles to suit each of our strengths and interest to ensure we work efficiently.

7.1 Jeffrey Tam

In this project, I have undertaken the role of Chief Financial Officer (CFO) in MediCare Solutions team. I was directly responsible for all of the overseas purchases as well as keeping track of MediCare Solutions' budget and finances. Moreover, I assumed the role of a database server administrator as well as the graphical user interface developer dedicated to programming tailor-made interfaces suited for medical personnel.

As the database server administrator, I have created and maintained a fully functional relational database management system using various tables to represent different sets of data that are needed to demonstrate the full functionality of MediCare Solutions' RDS. Originally, MySQL Server Database was used. However, due to incompatibility with the user interface development software, Microsoft SQL Server Express 2008 was chosen. Proper constraints and user account privileges were set up to simulate the degree of accessibility that is given to various medical personnel (ie. paramedics, nurses, doctors).

I also spent a majority of the time in GUI development in Nokia Qt, which is a popular cross-platform application framework that is used for GUI design. A large portion of GUI development involved developing forms that will be accessible by medical personnel to display and retrieve relevant information to the database.

For the duration of the project, I have encountered new software technologies that I otherwise would not have been come into contact with. One of which was developing a database using SQL. In a short 4 months, I have developed adequate knowledge in developing a database system using SQL. Moreover, it is also the first time I have encountered with GUI development which is a valuable experience and asset to have. Furthermore, I have used C++ to program the interfaces, which allowed me to renew and further developed my programming techniques.

The project, unlike any other, is rewarding and provided me with a sense of accomplishment due to the fact that we were successfully able to build something useful from scratch with minimal amount of guidance. Whether it is during debugging or integration stages, each member has their moments of frustration in the process, but what matter is that we have overcome each obstacles that stood in the way. I am proud of the group and each team member as we successfully put together a fully functional system that addresses a public concern that we or someone we know may benefit from in the near future.

7.2 Sean Fang

In this project, I spent majority of time on Server GUI and database design, which exposed to Qt development tool and several types of SQL database systems. As the role of Chief Engineer of the team, I was also responsible for solving possible issues during integration. It was a good learning experience because the first attempt of integration often led to unexpected problems, and we had to solve them with numerous constraints and limits in mind, which was a great practice for problem solving.

At early stage of project, to ensure the integration stage to be carried out with minimum resistance, I worked on Server GUI implementation as early as possible. The Server act as a centre component to

many different modules of our system, therefore it was logical that this component should be ready and finalized on majority of structure/format in order to smoothly integrate with other modules. During the implementation of Server GUI, I became familiar with Qt development tools and also enhanced my programming techniques. I also learnt to follow programming convention to reduce potential conflicts during code merge.

As we worked our way to the end of project, I had chance to work closely with each team member. To properly store and retrieve data with SQL database, I worked with Jeffrey on design of database schema. From these tasks, we better understood the limitation and benefit of using different database system. For example, mySQL is free and have great compatibility over different platform, but it may be lacked in term of supported features (compare to MSSQL).

To integrate communication between tablet and server, and to be able to transmit images, vital sign data, and paramedic electronic form over the network, I worked with Da, Danny, and Eric. In these integrations, we ran into many unexpected problem such as limitation of socket buffer, compatibility of Qt API with ARM architecture, and many logic issues related to usability. In order to resolve these issues, we researched and studied on examples related to the problem we were facing, and better understood the proper way of implementing those features we want.

Overall, I enjoyed working on this project, it provided us an opportunity to get a taste of a full cycle of project from planning, proposal, design, implementation, to testing and demo. We also took this opportunity to familiarize ourselves with different tools and resources such as SVN, Dropbox, Teamworks, etc to improve our productivity.

7.3 Da Zhou

Throughout this project, I have learned an immense amount of technical and non-technical knowledge by working together with my teammates. Since first year at SFU, I have heard good and bad rumours about ENSC 440; it's a course composited of stressful work load and fun learning process according to people who have taken it. I'm glad that I have a team that consists of people from different engineering options; system, electronics, biomedical, and computing. Their different in expertise in each field allowed us to utilize our strength in our design, implementation and testing process for the final prototype.

As the start of the semester, I have barely worked with Linux environment and ARM architecture chipset. The tight schedule of the project forced me to learn knowledge about configuring and working with Linux environment quickly. This is one of the most critical steps of the entire project, because the rest of the work will have to rely on a working and properly configured environment. Secondly, I have also spent significant amount of time learning image display through a digital webcam. Through the programming process, I acquired valuable experience with frame buffer, jpeg image display, and Linux library utilization. I believed that knowledge will definitely become one of my most valuable assets for my future career.

Beside the technical knowledge, I also had an incredible experience with the team dynamics and project planning. None of the team members has extensive expertise in working with Linux environment and Devkit8000 development board. Team members have to work together on understanding the project design. We have to resolve conflicts effectively without getting into lengthy arguments due to the time constrain. I have improved my interpersonal skill, especially in listening other people's ideas significantly. Project schedule management is also another field that I have learned through the course. As the VP of Operation, I assisted the team in dividing the project into independent parts that each team member could work on the separately without wasting time on waiting for others. Resource gathering and technical writing skills were also improved as well.

I really enjoyed working with my team in realizing our designed product. The team worked hard in getting the prototype system working as the way we have imagined. However, there are still some aspects we could improve ourselves on, such as integrating more often and provide adequate feedback on each other's work. I would like to continue with this project even further to test our concept of electronic paramedic assistance in the field.

7.4 Danny Cheng

For the project, I took the important role of being the Chief Executive Officer (CEO) of the group. I was responsible for organizing weekly meetings and keeping everyone on track to complete the project. Before I took this course, I knew how much effort was needed to do well on the project, but I didn't really know until now. I'm really glad that I took the extra effort to ensure our members were always up to date about each other's progress through our weekly meetings.

Outside of my CEO role, I was a Linux platform developer in the project team. I took the role of learning how to build a custom Linux system in case we needed it. I did not have any prior experience in Linux, and it was really tough to suddenly start doing something that's considered difficult even for most Linux developers. However, with time I was able to successfully build a custom system as a backup when needed. Also, I was responsible for coding and making the GUI for the vital sign monitor on our tablet. Since the pulse oximeter we used uses serial port communication, the interfacing part of the code wasn't too difficult as I had prior experience in such topic. Constructing the GUI was probably the most interesting part of what I did for the project. Since it was my first time developing a GUI software, I had a lot of fun researching and exploring what I could do. Thanks to Qt by Nokia, it was relatively easy to pick up and I didn't have too much difficulties making my GUI either.

There was one difficult part about coding for this project because of the environment differences between our development platform and our deployment platform. When I introduced official third party libraries for Qt, I had to learn how to compile and install them for both systems. Linux is highly customizable and thus requires delicate care when dealing with different architectures. In the end, I produced two different sets of header files and libraries for when I need to debug on my development environment or on our deployment tablet. Before I knew nothing about environment settings and libraries, but now, I am confident in compiling and installing any tool on any architecture out there as long as the sources are available.

Interpersonally, I got along with my team members relatively well, and most of that was because we knew each other for years already prior to this project. Since we knew each other so well, it also contributed in our timely communication and problem ratification of any kind. In the end, I learned a lot from this project from the coding C++ in Linux platform, to working within a group and organizing a project to finish within a deadline. Most importantly, I felt the project topic was one that's worth the effort to work on. Any engineer can make a product, but it is a good product that counts, and I believe our product is contributory to the society, thus, makes it a good product.

7.5 Eric Chow

It was a very unique experience to work with the individuals in this group. On one hand we all take this project very seriously and we push each other to work harder than we would normally. From that, one would imagine all of our work meetings to be very serious and all about the tasks at hand. However, we all had a lot of fun and some laughs even while trying to solve the most frustrating of problems. For example, even when it was 5am and we were at Danny's house trying to solve a problem we've been stuck on for three days, we would also joke around every once in a while and try to have a good time.

I believe one of the key components that resulted in the successful and timely completion of our project was that asking for help was encouraged. We stated from the beginning that if any member required assistance, they should let the rest of the group know as soon as possible so that we can analyze and discuss or come up with possible solutions. I saw this occur time and time again and regardless of what the issue was, even if none of the members had any previous experience dealing with the issue, we seem to be able to come up with workable solutions.

My responsibilities began with getting familiar with the demo angstrom Linux image that was preinstalled on the development kit and then my focus was shifted towards installing Ubuntu and trying to get touch screen library to work with that. When we realized that it was best to simply use the default Linux image, all of my time was devoted to creating an electronic form to replace the current patient care report that is to be filled by paramedics and this was done in Qt. Key guidelines that I had to follow was that all of the charts and data would have to somehow fit into a GUI that is being displayed on a 7 inch LCD, certain functions had to be implemented to save paramedic time while they fill out the form, and the user interface must be very intuitive. Having never dealt with Linux or Qt, the learning experience was frustrating but also rewarding. There were a few minor things that felt like it should have been very simple to fix, but possibly due to a lack of experience, the solution that we came up with either required extensive additional coding or too complicated for the purpose.

This project was rewarding not only because of all of the experiences I gained, all of the technical knowledge that was acquired throughout the process, but because our product has a real world application that could possibly save the lives of many. Being in the systems option, I had anticipated to be working on projects relating to mechanical and robotic side of things but this class has opened my eyes to a new field.

8. Conclusions

Rewinding back to early July when a group of five final-year engineering students arrived together to brainstorm for possible project topics, it really feels like it has been an eternity. From crazy project ideas like the turbo flies swatter to what we uniformly determined to be an excellent project – the Remote Diagnostic System. The MediCare Solutions team entered this project with one common goal, which is to design and build something that is beneficial to the society as a whole. It was then apparent to us that the RDS was the best project idea without a doubt.

To date, the RDS is a fully functional prototype that can allow paramedics to enter and transmit information from a remote location and connect with some of the existing vital sign devices available on an ambulance to transmit real-time updates back to the hospital for monitoring. Better yet, user friendly working environment has been developed for medical personnel from the ambulance service and emergency room to ease their transition to using our state of the art system. Although, there are still improvements to be made before it can become a commercialized product. However, our team hopes the concept itself along with a working prototype with critical functionalities will be the stepping stone to an even better system. Our team hopes a similar system will ultimately be adapted as a regular system to be implemented in all hospital alike in order to improve emergency room's efficiency and medical personnel's job satisfaction at the same time.

