January 21, 2012

Dr. Andrew Rawicz
School of Engineering Science
Simon Fraser University
Burnaby, BC V5A 1S6

Re: ENSC 440 Project Proposal for automated attendance system

Dear Dr. Rawicz,

Attached to this letter is our team's proposal for an automated attendance system, regarding our 440 engineering science class. The project aims to design and implement a system that will take students attendance at university through automatic Identification check and facial recognition.

The objective of the proposal is to present an outline of our project. Below, we will discuss our system overview, design considerations, projected budget, preliminary scheduling, and team organization for the project.

Our company, Secure Com Systems consists of five talented engineers. Omar Khlif, Tahani Trigui, Oldooz Pooyanfar, Hongxin Dai, and Dong Geun Shin are all fourth-year engineering students majoring in computer, electronics and systems engineering. We will be delighted to hear from you in order to further discuss our proposal. If you have any question or concern about our product, please contact me via email at okhlif@sfu.ca.

Sincerely,

Omar Khlif

Chief Executive Officer

Enclosure: *Proposal for automated attendance system*

Proposal For

Automated attendance system

Project Team	Tahani Trigui Oldooz Pooyanfar Omar Khlif Hongxin Dai Dong Geun Shin
Contact Person	Oldooz Pooyanfar scs-ensc@sfu.ca
Submitted to	Dr. Andrew Rawicz - ENSC 440 Steve Whitmore - ENSC 305 School of Engineering Science Simon Fraser University
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School of Engineering Science
8888 University Drive
Burnaby BC, V5A 1S6
scs-ensc@sfu.ca

Executive Summary

Educational institute administrators and educators are constantly concerned about the performance of students. Not only studies show that irregular attendance can influence the overall academic performance of students[1], but also many long-time educators recognize this fact through experience. Furthermore, during exams, both for legal issues as well as fairness to other students, it is required to have a valid proof of attendance for students to drive away room for dishonest behavior.

At almost all institute the conventional method is to go through all students one by one to check their IDs, this can be quiet time and energy consuming. As the National Center for Education Statistics reports between 2000 to 2010 the number of students enrolled in degree-granting institutions increased 37 percent, up to 21.0 million.[2] The resources and effort to keep track of this number of students is immense.

Hence, Secure Com Solutions proposes to introduce an easier and more secure way for tracking student attendances. The Radio Frequency Identification (RFID) has capability of checking attendances with the RFID tag in real time. Furthermore having the capability of doing facial recognition without the need of human supervision this technology can save time and man power. The flowing document introduces the capabilities of this product, as well as the financial aspects of manufacturing this product.

Research shows that even though very few schools have started using RFID for attendance, there are still numerous institutes that have not installed such technology. And there are no direct competitors with this product. This introduces a market just in the educational system. The product can also be used at companies.

Secure Com Solutions consists of five capable and ambitious students who are following their own route to higher education. With expertise and vast backgrounds in hardware design, analog and digital signal processing, software development and image processing. The members of Secure Com Solutions are eager, ambitious, driven individuals whom are combining their experience and knowledge from working in the industry and at Simon Fraser University to introduce this product.

The engineering cycle proposed for this project consisting of research, design, prototyping and debugging the design is 13 weeks. The proposed project will be completed in the duration of January to mid-April of 2013, with an estimated budget of 50$ with funding from Wighton funds.

School of Engineering Science
8888 University Drive
Burnaby BC, V5A 1S6
scs-ensc@sfu.ca

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School of Engineering Science
8888 University Drive
Burnaby BC, V5A 1S6
scs-ensc@sfu.ca

Introduction

Students' irregular attendance is a source of concern for most educational institutions. The most common way to track student attendance is to manually sign the attendance sheet every time they attend a class. There are a lot of problems with this conventional attendance system. Students spend a lot of time to find and sign their name on the attendance sheet. This may distract students' attention when they are listening to the lecturer. In addition, some students may mistakenly or purposely sign another student's name. The lecturer also needs to spend a lot of time to record the truancies accumulatively.

Our RFID and face recognition base attendance system can automatically capture student's attendance. The main idea behind the system is tracking the attendance by requiring students to flash their student card at the RFID reader when they are entering the classroom. Radio-frequency Identification (RFID) is a technology using radio-frequency electromagnetic fields to transfer data from a tag attached object through a reader for the purpose of identifying and tracking the object. RFID reader can uniquely identify a person or a product base on the tag incorporated. The process is real-time.
During exams, adding to the identification check, the face recognition technology is used for automatically identifying or verifying a person from a digital image or a video stream. By analyzing facial characteristic such as the distance between eyes, mouth or nose the system will compare the input picture with the student picture stored in a database.

With our RFID and face recognition base attendance system, the lecturer can easily and automatically check that the student is enrolled in the class and the student itself is taking the exam. Lecturer can also easily trace the students overall attendance record throughout a particular semester.

School of Engineering Science
8888 University Drive
Burnaby BC, V5A 1S6
scs-ensc@sfu.ca

System Overview

The product design consists of three main sub-systems: The RFID reader, the camera and a software solution. The RFID reader will continuously transmits a 125 KHz carrier signal to power the passive RFID tag. After receiving the information from the tag, the receiver digitizes it and transmits it to the computer. The software solution is responsible for extracting the information related to the tag from the database. The camera will capture an image of the student. The image captured will be compared to the one stored in the database to notify the user if an incompatibility occurred. Figure 1 below show the system communication.

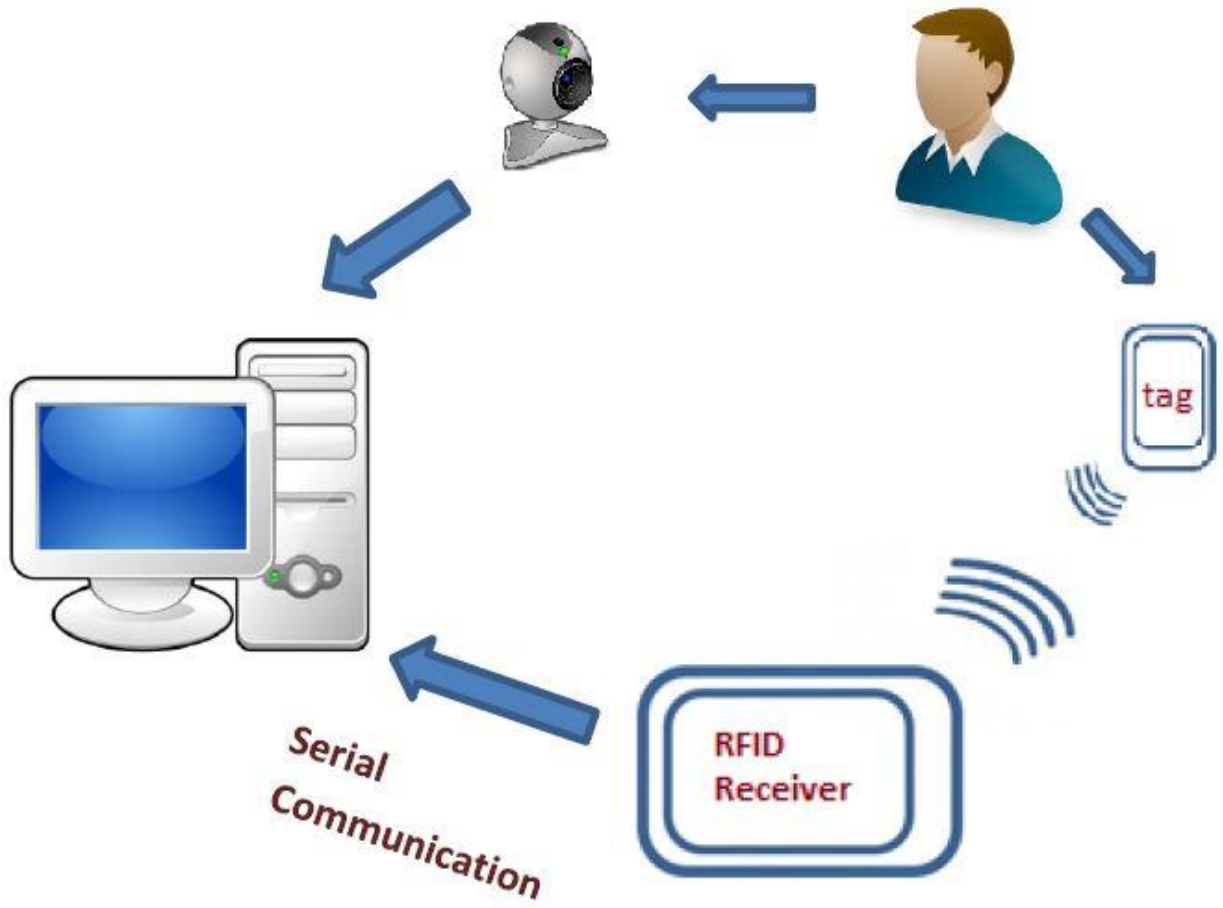

FIGURE 1- TOP LEVEL BLOCK DIAGRAM

School of Engineering Science
8888 University Drive
Burnaby BC, V5A 1S6
scs-ensc@sfu.ca

Possible design Solution

Existing solution

The conventional solutionfor taking attendance can be tedious and time consuming. The instructor or the TAs has to go through all students to check their IDs. Also, during an exam all students have to write down their names on a piece of paper. The instructor will have to enter the information manually for each student.

Possible solution

To meet the project's goal, the identification technology needs to balance between two major criterions ease of use, security.

Technology	Ease of use	Security
RFID	• No direct contact is required • Tags are durable since they resists to contaminated and dirty environment	**Good security (hard to duplicate)**
Magnetic stripe	• Requires contact with scanner • Cards are not durable as RFID card especially when it comes to contact with magnetic objects	**Poor (easy to duplicate magnetic stripe encoding)**
Barcode	• Requires scanning in certain way (time inefficient) • Cards are not durable as RFID card	**Poor (easy to photocopy the barcode)**

TABLE 1 - EXSITING TECHNOLOGIES COMPARISSON

Proposed Solution

Hardware:

The hardware part consists of two major elements: A camera and an RFID reader.

- Camera : For the purpose of this application it can be a webcam that captures the image of the user as soon as he/she passes his/her tag (student ID, pass-card ...) by the reader.
- RFID reader: It consists of four blocks:
  - Square Wave frequency generator : Generates 125KHz square wave for the carrier frequency
  - RF Choke: Buffers the signal and converts it into sinusoidal wave using RLC circuit. The output signal is amplified using an emitter follower PNP transistor and a half bridge.
  - Filtering module: An envelope detector is used to filter out the carrier frequency and any noise introduced. Bandpass filters will be used.
  - Microcontroller: has as input the filtered sinusoidal signal. Processes and extracts data from the signal. The digitized data is outputted through a serial port to gets copied into the CPU (PC, laptop …).

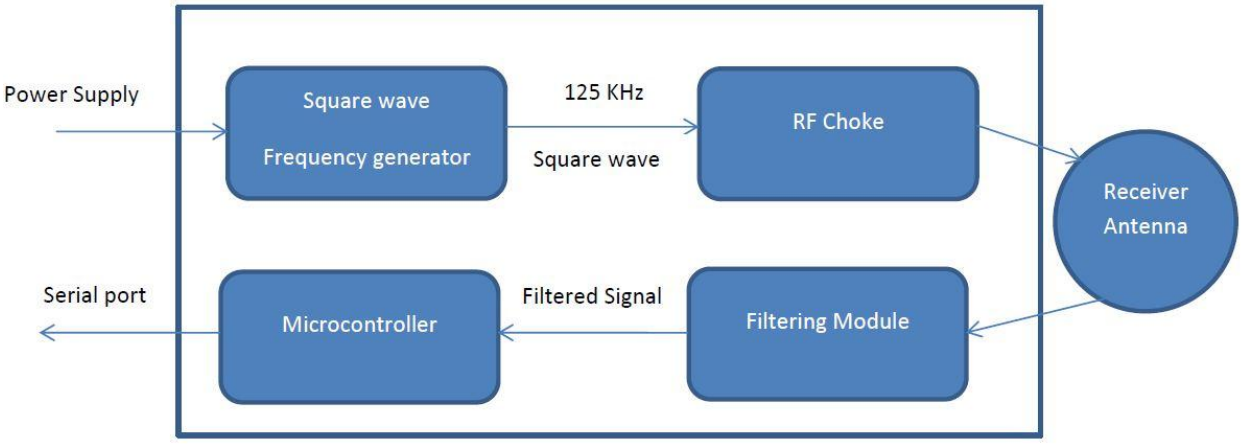

FIGURE 2 – RFID REDEAR DESIGN DIAGRAM

Software:

The software part is mainly a program that gets the unique RFID number associated with the tag, fetches the information associated with it in the database and outputs a file containing a list of the students who were present. The second input will be an image captured by the camera. The image will

be compared to the one saved on the database. The output status (same/ different) will be saved to a file.

The automated attendance system is mainly designed for university use. Besides that, this solution can be applied in areas where sign-up sheets/identification is required. This concept can be ported to Gyms as private businesses, Clubs, bars where your age is important.

So at a bigger scale the identification card (e.g. BC identification card) can be upgraded to RFID technology to help prevent fake IDs and then give the police more controls in solving crime cases.

However, due to the tight time frame of the project, our current design may not be polished to meet the criteria of a final product; it will rather be a prototype of it. Furthermore, the cost of a final product will be higher than the one estimated which will require funding. Also, the face recognition solution might need further research and testing to be more accurate. All these constraints make it hard for us to further optimise the system`s solution but will certainly push us to put pieces together and build a useful product with an efficient solution.

Source of information

This project incorporates a wide range of engineering knowledge and requires expertise in hardware and software fields. At Secure Com solutions, our team comes with a diverse background of computer, electronic and systems engineering options and great experiences in electrical design and video processing algorithms.

We will gain information from variety of sources: course textbooks, image processing publications and credible RFID readers' articles from the internet.

In addition, several faculty members at Simon Fraser University are currently involved in Wireless communication and image processing research and will be valuable resources for our project.

Finally one of the challenges faced by the team is the exposure of each member to new engineering areas. So communication will be the key to the success of our team: the ability to explain ideas and pass on knowledge to each other in order to achieve a finalized working product.

Budget

The table below outlines the estimated budget for this project. The prices listed are all sourced from different online vendors or creditable resources. A margin of error of ± 5% has been taking into consideration.

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Component	Estimated Price
74HC4060 14-stage Binary Counter	$1.00
2N3904 NPN transistor	$0.86
2N3906 PNP transistor (x2)	$1.72
78F102J RF Choke	$0.30
TL084 Op-amp (x2)	$1.60
PIC16LF88 18-Pin Microcontroller	$3.10
Wires, resistors, capacitors, breadboard..	$20.00
Sabrent webcam (SBT_WCCK)	$23.50
Estimated Total cost	**$52.08**

Table 2 - Estimated Budget

Schedule

A Gantt chart which indicates our tentative schedule for the realisation of the product is displayed below, in figure 3.

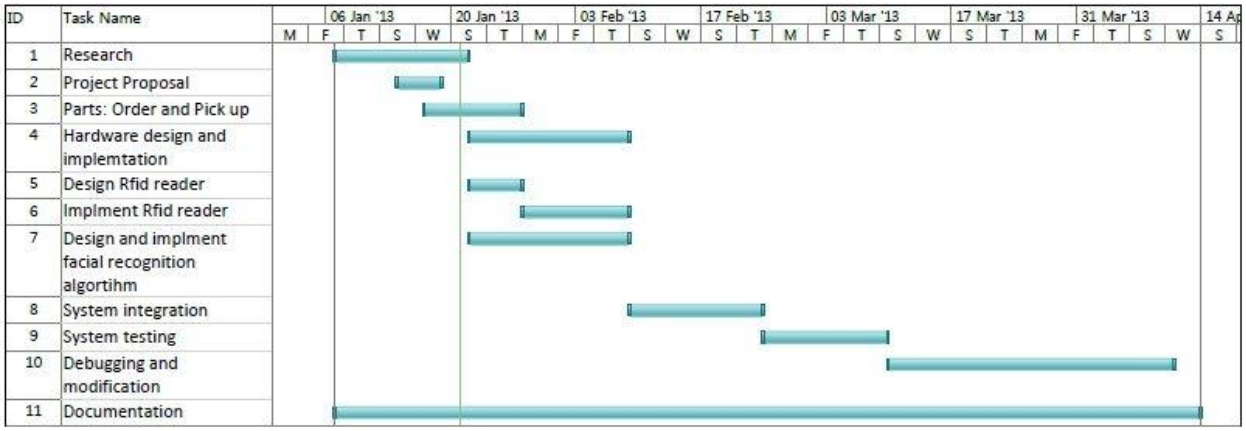

FIGURE 3- GANNT CHART

A milestone chart which highlights the project schedule is displayed below, in figure 4

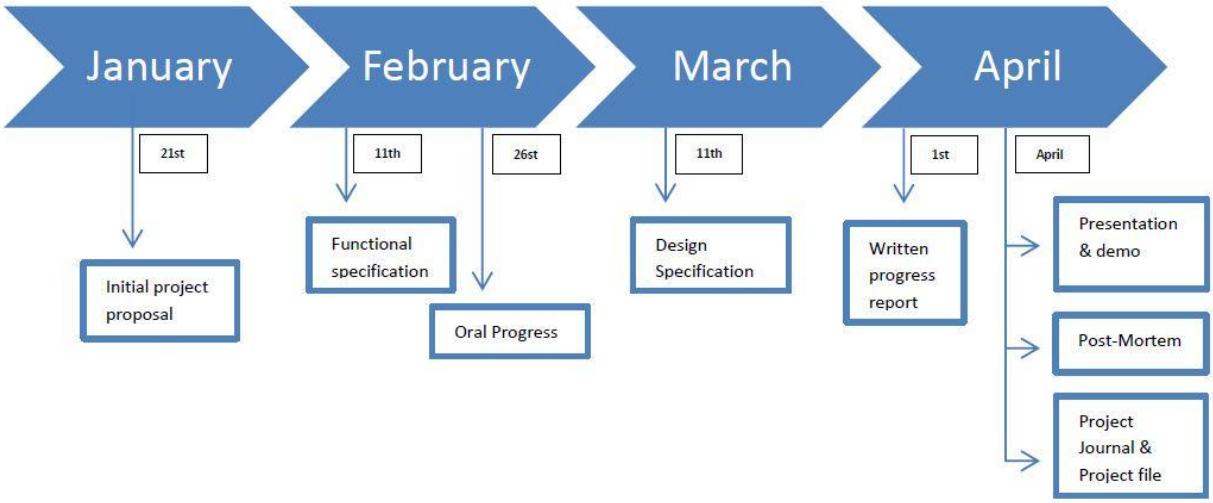

FIGURE 4 - MILESTONE CHART

Team organization

Secure Com Solutions consists of a team of knowledgeable and eager fourth year Engineering students with diverse backgrounds. These motivated individuals have different backgrounds in the industry and research. The team consists of Tahani Trigui, Oldooz Pooyanfar, Omar Khlif, Hongxin Dai and Dong Geun Shin. Their experience both as computer and electronic engineering students makes the team strong in both software and hardware design. The team has had the opportunity to work together before on other project hence making them familiar with their group dynamic.

The project is divided to two streams, the software and hardware aspect to make it easier to develop. The software side includes all the image and ID processing. And the hardware stream is designing the RFID reader circuit. The tasks were divided based on the capability and experience of individuals. And each task has one person driving the task and one person following the procedure in case of any emergencies.

The group uses Trello to keep track of all tasks and Dropbox to keep track of all the documents. The members are also committed to attend weekly meeting for duration of one hour to assure the smooth progress of the work. In these meetings the task leaders report their advancement, issues, and other developments to the CEO and other members so that the whole team is up-to-date and also to resolve any problem. A mail list has also been creates for all communications.

The Gantt chart and the milestones will be used as a guide to manage the time and help the research and development progress go as efficiently as possible. Not only are the members familiar with each

other's work but also are friends, the dynamic of the team is open and we believe that this will provide us a superior organization.

Members of Secure Com Solutions see this project as an opportunity to introduce the knowledge they have gained as engineers. Also they want to realize any engineers' dream, and that is to design and develop their ideas into a product. This has motivated all to put their best into work and make this project happen at its best.

Company profile

Tahani Trigui is a fourth year computer engineering student at SFU. She had the opportunity to work with eBrisk Video Inc. as an intern video engineer. During her co-op, she gained knowledge not only in video compression algorithm developing but also in x86 optimization.

Oldooz Pooyanfar is a fourth year Electronics Engineering student. Through her studied as an engineer at SFU she has gained valuable experiences in design, integration, and developing projects for her school projects. She is a proficient programmer in C/C++, VHDL, and MATLAB. She is also experienced in circuit design, working with microcontrollers, and signal processing. She has had experience working at Ballard as a co-op student, which has familiarized her with control systems, and sensors.

Omar Khlif is a fourth-year computer engineering student at Simon Fraser University. Through his studies and co-op terms, Omar built a strong C programming skill and a good design vision.
He is working as a video systems engineer at eBrisk video inc, a video compression algorithm developer.

Daniel Dai is a fourth year Electronic Engineering student at Simon Fraser University. He is competent with basic lab equipment such as: oscilloscopes, DMMs, power supplies, multi-meters, and function generators. He has experience with multi-stage and feedback amplifiers, as well as digital and analog communication systems. He is proficient at designing, testing, and debugging circuits using semiconductor devices such as MOSFETs, BJTs, and Diodes. As well, he has working knowledge of C++, VHDL, Matlab, and Assembly programming language.

Dong Geun Shin is in last year of studying Systems Engineering at Simon Fraser University (SFU).
He has completed 2 co-op terms at Technip USA as a piping engineering intern. During his co-op at Technip USA, he did software testing and debugging on piping system. Through his experience of the projects in courses at SFU and work terms in industry, he has obtained the skills in Hardware and software such as C/C++, VHDL, MATLAB and electronic circuit design, sensors and actuators. Also, He is familiar with lab equipment such as oscilloscopes, function generators and digital multi-meters. Besides his technical skills, His enthusiasm and good communication skill will contribute to this project.

Conclusion

As the proposal shows, the automated attendance system aims to facilitate and make taking attendance faster and easier. The project idea can also be functional for other application as discussed in this document. Our proposed system will provide the user with a list of information associated with the tags and will give feedback.

The team's envision is to make the system embedded in a portable device which will make it marketable. Moreover, as the timeline outlined in the Gantt chart and the milestones chart, this project will be completed in the timeframe devoted to it.

Furthermore, this document highlights our source of information and research material.
We have shown our potential budget and clearly described our product and planned for its accomplishment.

Reference

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