



Progress Report for LiteSpeed Gate

A pleasant, fast and light shopping experience

Project Team:

Alex Yang
Brian Lew
Joyce Zhang
Kelvin Chu
Noah Balzer
Tim Chu Peng Lei

Contact person:

Noah Balzer
nbalzer@sfu.ca

Submitted to:

Dr. Andrew Rawicz – ENSC 440W
Dr. Steve Whitmore – ENSC 305W
School of Engineering Science
Simon Fraser University
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ShopLite Solutions has almost completed phase I in the development of the [LiteSpeed Gate](#), a retail store gate system allowing customers to have their merchandise scanned wirelessly. The motivation of this project is to greatly reduce the amount of time spent in store checkout lineups and significantly improve the overall shopping experience.

Phase I is composed of the following:

1. Planning and Research
 - a. Background research
 - b. Functional requirements and user interface analysis
 - i. Store managers
 - ii. Potential customers
 - iii. RFID technology experts
2. Design and Material/Part Acquisition
 - a. High level system block diagram
 - b. Hardware considerations
 - i. RFID module and antennas
 - ii. Microcontroller and Motors
 - iii. Scale
 - c. Software considerations
3. Assembly and Testing
 - a. Subsystem assembly
 - i. Structure
 - ii. Location control unit
 - b. System requirement verification
 - a. Performance requirements
 - b. Security requirements
4. Documentation
 - a. Functional specification
 - b. Design specification

Planning and Research

The background research has been completed which involved analyzing the current problems supermarkets and other retail stores are facing during the checkout process and specifying appropriate functional requirements. After the function requirements were

drafted and several user interface mockups were drawn we then consulted a wireless communication expert in order to further understand RFID technology and how to maximize reader accuracy using antenna movement.

Design and Material Acquisition

The high level system block diagram has been completed which has facilitated the formation of smaller teams of people were to work on the different subsystems. Currently we have acquired all of the RFID equipment needed for this project as well as coordinated the borrowing of a Salter Brecknell PS500 scale from BC Scale Co. We also have obtained the micro-controller needed for the control unit as well as one motor which has been used for experimentation. The three additional 28BYJ-48 stepper motors needed for the location control unit have been purchased and should be delivered sometime this week.

In terms of the software system development, the main subsystems including the user interface unit, central reading unit, verification unit and location control unit have been successfully interfaced together. As planned, we adopted source code from the RFID reader provider in order to successfully interface with the reader. Up to date, the LiteSpeed Gate system is able to start scanning for RFID tags when the start button is pressed, rotate the stepper motors automatically and display the scanned RFID tags on screen. One of the last major tasks left for the software team is to create a link connection to the database so that the C# application can look up the item name, price and weight given the tag ID.

Assembly and Testing

A wooden frame for the antenna has been constructed, and a 28BYJ-48 stepper motor has been fixed on one side of the frame. The side of the antenna structure was drilled and filed to facilitate direct coupling of the motor shaft to the antenna. In testing, the motor was capable of rotating the antenna at higher speeds than required for our application, thus exceeding our requirements. The plan is to support the other side of the antenna using a wooden dowel, though this configuration is yet to be tested. Furthermore, the frame will be redesigned since it is slightly larger than needed.

Documentation

We have successfully completed the major functional specification and design specification documentation involved in this project.

Schedule

The LiteSpeed Gate is currently on schedule. We are finishing our second round of implementation and moving towards the final acceptance test. The final acceptance test will be verifying the integration of the RFID module, antennas, and the location controller (which includes the micro-controller and the motors). We expect that the whole project will be done by the middle April.

Budget

The total cost of the project has exceeded the initial estimated budget of \$910. The main reason for this is due to the expensive RFID equipment which totalled \$1084. Additionally, more motors were needed in the location controller than originally thought. Our new budget estimation shows that the total cost will be approximately \$1200. We received \$600 from ESSEF, and will be applying for further reimbursement from the Wighton fund. All extra costs will be shared by each member in the team.

Remediation

Supporting the other side of the antenna with dowel may result in excessive friction. If this is the case, we will purchase a Lazy Susan rotary bearing to reduce friction. We would rather avoid this solution, however, since it adds more metal in close proximity to the antenna.

Conclusion

In summary, we are on schedule and slightly over budget with the [LiteSpeed Gate](#). We will have phase I completely accomplished for the final demonstration of our project on April 17th. In particular the following tasks will be accomplished: assembly of the location control unit and interfacing with the database in order to retrieve RFID tag information such as the name and price.