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# Radio Frequency Identification Tags for Airline Baggage Tracking Interim Progress Report

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Group Number Nine (9)  
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*I pledge my Honor that I have abided by the Stevens Honor System.*

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## Abstract

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Radio Frequency Identification Technology has begun to surge over the past few years. RFID technology allows companies to improve real-time visibility of their inventory, track works in progress, and monitor shipping and receiving operations. As the demand for RFID increases, so does the demand for innovative ideas and implementations of the technology to make everyday tasks more efficient and to save companies money.

With the given potential in RFID, the group has chosen to focus its senior design project on a baggage tracking system for use in the airline industry. Successful deployment of RFID technology has the potential to save airline companies millions of dollars in resources and man-hours currently used to recover missing packages and compensate affected customers. The system that the group has created has the ability to track the baggage in a real-time network and notify the appropriate employees in the event that baggage has been routed incorrectly.

At this time, the team has begun integration, testing and debugging of the final technical design for a prototype RFID baggage tracking solution. The design includes an evaluation RFID kit, real-time network, server, and management software that will track all of the baggage present in an airline as well as have an early warning system to detect luggage that may have been misplaced. This prototype is expected to be fully functional by the end of the term and presentable prior to Senior Design Day.

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## Acknowledgements

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The group would like to thank our advisor Professor Hong Man for his help with the project. Professor Hong Man's contributions have allowed the group to obtain vital information which has aided towards the completion of this project. Professor Hong Man has provided the group with insight that allowed us to further improve upon our project as well as avoid potential difficulties which would have inflicted us without his help.

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# Project Progress

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## Overview

At this time the main hardware and software that will be used in the project have been finalized. The remainder of the project can be broken down into two categories which shall be furthered discussed in the progress report. The two categories are the following:

- The server which entails the real-time database and gather of information from the client reader and browser interfaces.
- The software which entails the interaction programs used for user interface as well as obtaining data from the readers and working together with the server to complete the system

## Server

The server uses standard HTTP requests to receive information from both client readers and browser interfaces. The versatility of these requests allows for a fast prototyping of the system. The entire application is being programmed in PHP, this also allows for a quick development process. One of the main aspects of this design is to implement several different abstraction layers. The database abstraction layer is complete, permitting easy interaction with MySQL databases with little effort. By abstracting this interface, not only is development expedited, it also allows for the database type to be changed without any functional code changes.

The hardware for this part of the project has already been acquired. This is a standard personal computer that is taking the roll of both a web and database server. The server is running Red Hat Fedora Linux. It uses Apache for a web server and a MySQL database. This server has been completed and tested.

At this point, the development is right in line with Final Report predictions. Several problems cropped up within the development process. Most notably it was extremely difficult to acquire a DHCP lease for the server. This problem was eventually solved, while development proceeded using an alternate web host.

The server and software will undergo practical testing via manual analysis. This will include users accessing the software within the course of a normal work scenario. A final product would be expected to go through extensive load testing and balancing, however this is not practical for a prototype. Our prototype server has nowhere near the standard computing power of an average server. It is not practical to extrapolate performance data from this hardware.

## **Software**

The reader side program is in development. Progress has been on pace with expectations. The group can retrieve and interpret the reader version information as well as tag identification numbers. There are many other functions that the reader can perform. The basic communication to the reader has been established, to finish the remaining functions is a matter of changing certain fields in the packets sent to the reader. The documentation included with the reader details what values to send to the reader for every function. However for our implementation it is not so easy due to the data types and the nature of java.

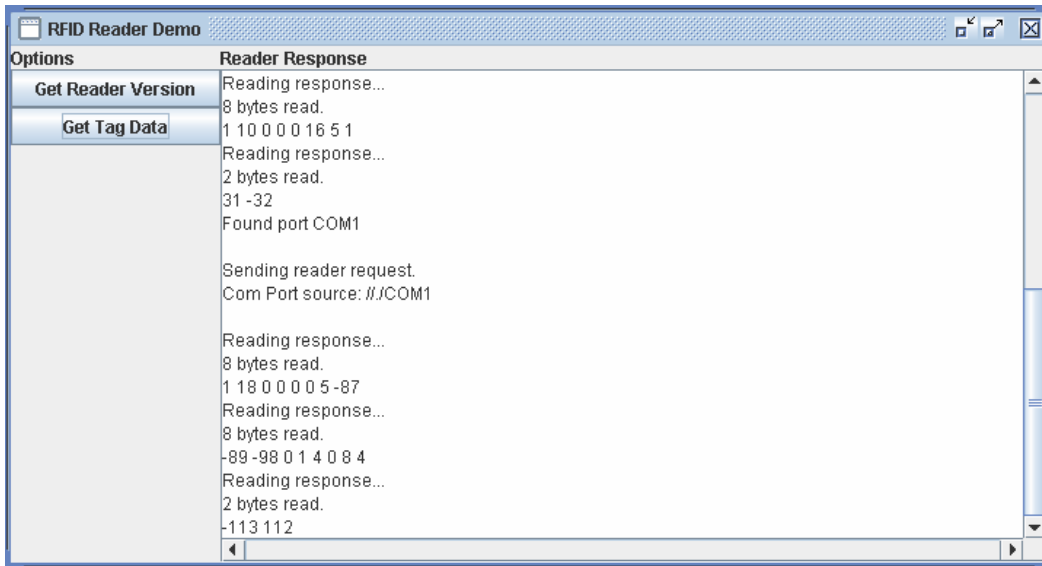
A critical issue that occurred during development involved byte formats. The reader expects unsigned byte values to be passed to it via RS232. JAVA does not support unsigned data types however. JAVA uses twos-complement to represent byte values from -127 to +127. In order to resolve this issue it was necessary to convert the expected values into compatible twos-complement format. For testing and preliminary coding, the byte values were converted by hand and hard coded into the program. The group plans to create a function to do this automatically for any input byte value. Once this function is completed the values specified by the documentation should be able to be input into the software and automatically converted to the correct byte value for the reader to interpret.

For example: in order to send the reader a byte value of (hex) F0, we would convert that to a byte value of (decimal)-16 instead. This sends the correct bit sequence required by the reader.

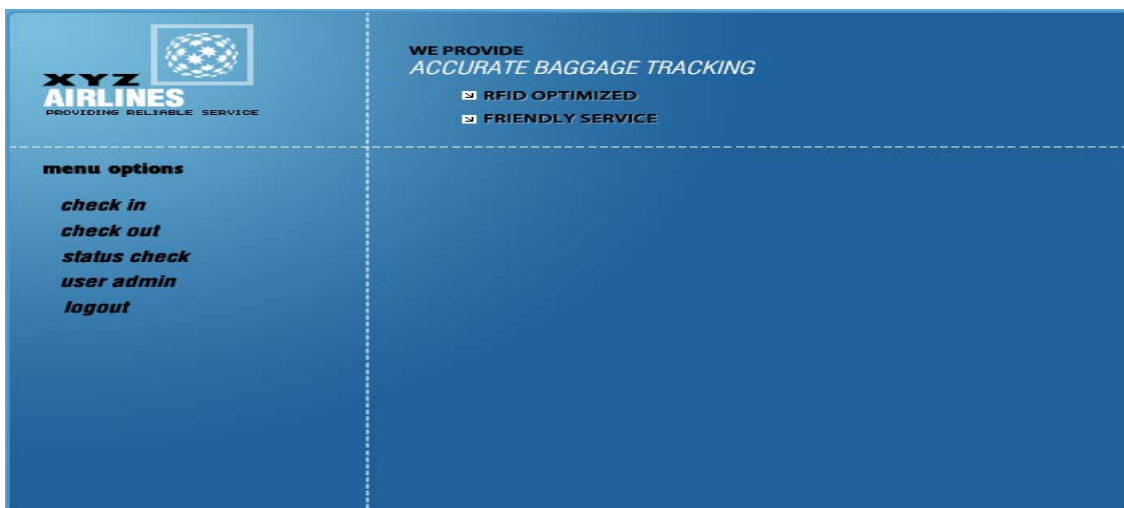
The software also uses error detection in its transmissions. A Block Check Character or BCC is attached to the end of each packet. This is to ensure that the correct request is being sent to the reader and there was no miscommunication anywhere. The BCC consists of a Longitudinal Redundancy Check or LRC and a cumulative Exclusive-

OR operation on all bytes. Like the unsigned bytes, the BCC has been calculated by hand thus far and the group plans to automate this into the software and append itself to the packets.

A basic user interface has been developed for testing purposes. This is a step above a command window waiting for user input. This interface will eventually have more functions available and be visually improved for commercial use as planned.



The next critical hurdle is communicating tag information to the server for processing. A preliminary website which will act as the user front-end is completed. The HTML and images were adapted from a template provided by "www.templatesbox.com". The links are blank and will be updated once the PHP scripts are prepared. Content will then be dynamically prepared for the body of the webpage.



## The Cost Analysis

The cost analysis summarizes the expenses of our project. There is no cost to the group so far due to the design of our project. All software installed on the server is free and readily available. Our project was not designed around the cost but was a convenience and coincidence that the software was free to download from the providers.

The RFID evaluation kit is a donation from Texas Instruments. It was originally donated to a previous group and the kit has made its way to our group. Thus there is no cost for the kit and included tags. The test server was provided by one of the group members. A spare computer has been reformatted into a Linux test server for our project.

This cost analysis only corresponds to our project. The cost of a production implementation of our project will be much higher and is covered in past and future deliverables.

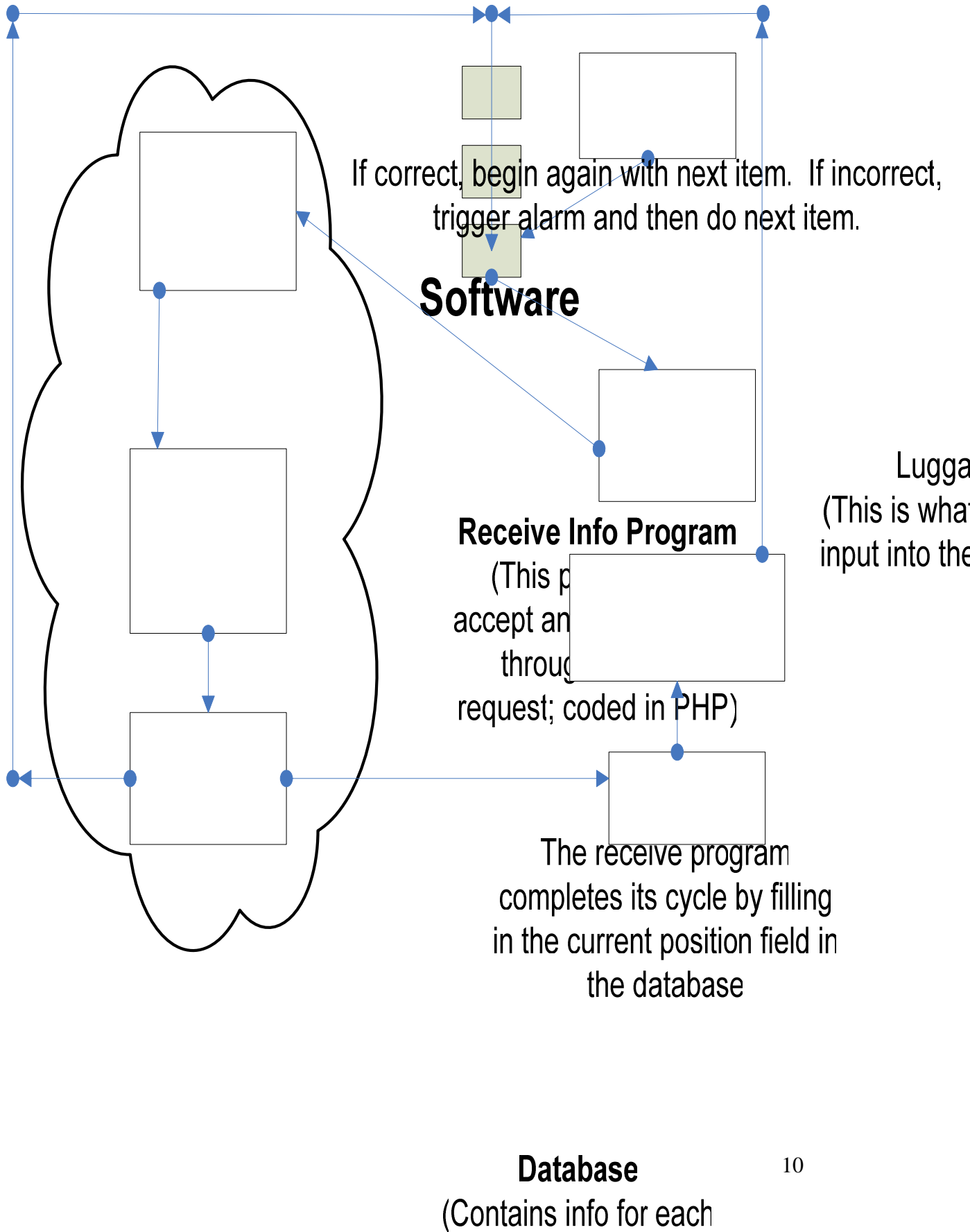
<b>Project Analysis:</b>	<b>Cost</b>	<b>Quantity</b>	<b>Total</b>
<b>Materials and parts:</b>			
TI Low Frequency RFID Eval Kit	\$0.00	1	\$0.00
RFID Tags	\$0.00	10	\$0.00
Test Server	\$0.00	1	\$0.00
<b>Software:</b>			
Fedora Core 4 Linux	\$0.00	1	\$0.00
Apache HTTP Server 2.0.55	\$0.00	1	\$0.00
MySQL Database	\$0.00	1	\$0.00
		<b>Total Cost:</b>	\$0.00

## Project Schedule

As seen on the project schedule, the main tasks left for the group to complete consist of testing and debugging the server and software. After these main tasks are done the group will focus on improving upon the user interface and finishing up the final report and presentation.

<i>Task Name</i>	<i>Duration</i>	<i>Start Date</i>	<i>End Date</i>	<i>Assignment</i>
Interim Report	10 days	3/10/2006	3/17/2006	Team
System Testing and Debugging	50 days	3/5/2006	4/10/2006	Team
User Interface	10	4/1/2006	4/10/2006	Justin Ong and Jeff Smith
Server	15	3/15/2006	3/30/2006	Reid Borsuk
Software	15	3/15/2006	3/30/2006	Brian Compter
Reader Interfacing	10	3/5/2006	3/15/2006	Chris Lubin
Final Report	10 days	4/1/2006	4/10/2006	Team
Senior Design Day Presentation	10 days	4/1/2006	4/10/2006	Team

**Block Diagram**



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## Conclusion

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As the project due date draws nearer, the group is confident that it will be able to meet the deadlines and have a fully functional project. What lies next on the group agenda is to finish the testing and integration between the software and server to be used in the system. After all the testing has been completed and the system is stable the next step to be taken is to make the format of the interface program more user friendly and provide quick and easy interfaces that would allow virtually anyone to use with little or no difficulties. As of now the group is confident that there is enough time to improve upon our project as well as fix any unforeseen problems that may occur before the final due date of the project.