AAS
Automatic Attendance System
Grant Hornback, Alex Babu, Bobby Martin, Ben Zoghi, Madhav Pappu, Rohit Singhal

RFIDSensNet Lab
Smart Distributed Systems Group
Abstract
Due to the easy availability of almost all information on the internet these days, students are less and less motivated to come to the lecture rooms than ever before. Professors and instructors have to come up with ways to ensure a healthy participation from the students, and make sure that the “classic” student professor interactive relationship is kept intact. This in the some cases may be in simple forms like roll call, while in more interesting cases, can be formats like surprise quizzes, extra credit in class, etc. These things can however be very time-consuming. Valuable in-class time that could have otherwise been used for lectures need to be dedicated to “attendance” taking. In addition to all this, the attendances are entered manually and therefore are error prone. Now, there’s a technology that can solve all this and MORE.

Using Passive RFID, the task of taking a classroom attendance becomes just a “single click” of the mouse. Because of wal-mart’s initiatives in the RFID domain, it is now possible to obtain very cheap RFID tags and create University/departmental ID cards with them. Antennas are placed in the classroom and can be activated with the click of a mouse. Once, this is done, the antennas will read all the RFID tags in the room and will report this information to a “attendance” server. This information can also be displayed to the students instantly. Since this data can be made seamlessly available to all interested level, it can be used to better serve the students.

RADIO FREQUENCY IDENTIFICATION (RFID)
Passive RFID technology is based on the simple idea that an electronic circuit or tag, powered intermittently through radiation from a distance, can transmit information in air that can be read by a reader located at a distance. These tags are nothing but plain antennae bonded to a silicon chip kept inside a plastic or glass case. Operation of an Ultra High Frequency (UHF) RFID system is illustrated in fig. 1. The reader emits an electromagnetic wave which charges up the tag. The tag in return transmits the data back to the reader. These tags have a greater range than their some lower frequency counterparts and can read a multitude of tags simultaneously.

Readers range from portal style readers that set up in a doorway, as theft deterrents, to handheld readers that can be manually utilized by say a warehouse manager to help keep track of a company’s inventory.
Use of RFID in Classrooms

Instructors, in a constant bid to keep the classrooms full of students, tend to adopt means like “mandatory” attendance, which are time-consuming and often error-prone in their enforcement. Using Passive UHF RFID systems, the task of taking a classroom attendance becomes just a “single click” of the mouse.

Automatic Attendance may be done in several ways.

1. Stationary Readers with Antenna.
2. Handheld Readers

Antennas can be placed around the classroom, in all the classrooms of a department/university. Whenever the instructor wishes, a) in the beginning of the class, b) at the end of the class, c) in the middle of the class or d) multiple times during a class, he/she can just invoke the antennas by the click of the mouse. The reader antennas will scan all the tags present in the room. This information will be sent to appropriate servers, that’ll process the information and publish it in relevant form to all concerned parties.

- The professor for grading.
- The university administration to better manage classroom statistics for allocation, etc.
- The students so that they can track their performance.
- The parents/guardians so they are AWARE!
If there is no departmental/university-wide consensus on the attendance system, the course instructor can adopt a stand alone system which consists of a hand-held reader. He/she can walk around in the class-room while delivering the lecture, and with a hand-held reader can scan all the tags that are present in the classroom at that instant. The handheld reader is attached to a PDA that hosts all the necessary databases and software to complete an attendance system.
IMPLEMENTATION DETAILS

Stationary AAS
The RFID SensNet Lab at Texas A & M University has implemented an AAS using a stationary Matrics (now Symbol) AR400 reader with 4 circularly polarized antenna. The antennae were placed on the classroom doors and continually scan the students as they enter and leave the class. The reader is driven by a linux operating system based server, which also houses a database and a web server. The web-server published real-time information about people in the class online. This information was accessed by a windows based PC attached to a projector, a standard equipment in Texas A & M classes.

The students can see their names on the screen as they enter the classes, and they are assured that their “presence” has been entered in the instructor’s database. One important result of the implementation that warrants attention is that a lot of engineering students carry calculators and laptops to classes. When the tags are kept close to these electronic devices, the read rate degrades tremendously. The students have to retry their tags in front of the antenna to make sure they are read.
Handheld AAS
The RFID SensNet lab has also implemented a standalone mobile AAS. The handheld RFID reader chosen for this implementation was the Symbol MC9000-G. This handheld reader has a nominal reading range of up to 10 ft, and supports EPC Gen 1 (Class 0 & Class 1) and Gen 2 type tags.

Even though complex applications can be written on the windows mobile environment, we relied on standard PC environment for complex computations towards a “proof of concept”. The reader comes equipped with Microsoft® Windows Mobile 2003. This gives the reader the ability to export all RFID data into an excel file.

This file was actively synchronized to a file on a standard windows PC using Microsoft ActiveSync. Once this file is on the PC, an application reads it and places the data into a database. A web-server then running on another machine, scans this data and publishes the information online.

System Costs
The AAS is a revolutionary classroom device. AAS is able to automatically count and identify the students in a class. This section estimates the equipment cost of such a system for a typical implementation.

Stationary AAS
- Passive UHF reader with 4 antenna - $2500 per classroom
- PCs and Servers - $3000 per system
- Tags - $1 per student
- Networking Equipment - $500 per classroom

Total equipment cost is roughly about $3000 per classroom plus $3000. Note that this cost does not consider labor costs and software costs.

Handheld AAS
- Handheld passive UHF Reader - $3500 per classroom
- Tags - $1 per student

Total cost is roughly about $3500 per standalone system.

Results and Conclusions
The Automatic Attendance System (AAS) consist of an RFID reader, RFID tags, a personal computer, and a server. The function of the entire system is very simplistic; it involves using the reader to read the tags. The information in the tags is transferred to a database. This is later published for people to see in a legible format via methods like a web-server.
The AAS is a possible option for replacing the current attendance methods. Not only does the AAS take attendance quickly, but also efficiently. The AAS is a must-have system for those professors that value every minute of his/her lecture time. Assuming a “roll-call” takes about 5 minutes per lecture and that the class meets 3 times a week for 15 weeks in a semester, then the AAS can save up to 4 hours! This easily gives the instructor 4 extra lectures that can be used towards other better purposes.

About the Authors:

Ben Zoghi, Ph.D., is professor and director of RFID/Sensors lab, http://rfid.tamu.edu, at Texas A&M University. He was the holder of prestigious Leonard & Valerie Bruce Leadership Chair Professor, Director, Thomas & Joan Read Center for Distribution Research & Education, and Program Coordinator, in the Industrial Distribution Program, at Texas A&M University, College Station, TX from 2001-2005. Dr. Zoghi’s recent research focuses on RFID, Sensors and Networking application for asset management and other none supply chain application of RFID. A member of the Texas A&M University faculty for 18 years, he has distinguished himself as a teacher, writer, and researcher. His diverse background includes heading an advanced research group in semiconductor manufacturing to working with major industries, state, and federal organizations like Los Alamos National Laboratory, R.P. Kinchloe Company, and Applied Materials in design of intelligent networked devices for health, medical, and automation systems research. Dr. Zoghi has served as a Motorola Faculty Fellow and Faculty Fellow with Applied Materials.

Rohit Singhal, is a lecturer in the Electronics Engineering Technology Program, a former Senior Research Associate in the Consortium for the Accelerated Deployment of RFiD in Distribution, and a Graduate Student at Texas A&M University. He has a Bachelors degree in Electronics Engineering from the Indian Institute of Technology (IIT) Kharagpur, India, Masters in Electrical Engineering from Texas A&M University and is currently pursuing a Doctorate in Computer Science.