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**APPLIED AUTOMATIC IDENTIFICATION AND DATA CAPTURE SOLUTIONS THROUGH  
EDUCATIONAL RESEARCH**

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# APPLIED AUTOMATIC IDENTIFICATION AND DATA CAPTURE SOLUTIONS THROUGH EDUCATIONAL RESEARCH

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**Abstract** — This paper describes solutions delivered through a graduate course designed to address current issues in Automatic Identification and Data Capture (AIDC) technologies. Students enrolled in Purdue University's Industrial Technology 621W, are adults from industry who are pursuing a graduate degree through the College of Technology's Weekend Masters Program. Initial stages of the course educate students on current AIDC technologies. Students then assess the use of AIDC implementations within organizations, including their own, to provide recommendations and solutions for problems. Automatic Identification and Data Capture encompass a wide range of technologies including bar codes, character recognition, card technologies, magnetic stripe, touch or contact memory, radio frequency identification, and biometric technologies. Effective implementations of these technologies can be used to collect transaction information, track inventory, manage supply chain, track packages, and identify personnel; resulting in reduced cost and increased worker productivity for the organization.

**Index Terms** — Applied Educational Research, Automatic Identification and Data Capture, Deployment Environment Variables, Inventory Management

## MOTIVATION FOR WORK

TECH 621W AIDC for the Enterprise is a graduate level class offered to the College of Technology's Weekend Masters Program, and covers topics in Automatic Identification and Data Capture Technologies. The course is similar to IT 345 Automatic Identification and Data Capture (the undergraduate companion course) as described in [1], which examines how businesses can effectively track and manage their supply chain, inventories, and manufacturing work in progress. The course focuses heavily on implementation of these technologies within a business environment – how businesses can more effectively collect data on sales, how they track products throughout their processes, and efficiently secure their facilities. Although the graduate course follows a similar outline to the undergraduate course, the motivation is different.

All of the students in the course are non-traditional students in the fact that they are all employed full-time in various manufacturing and related industries. Therefore, through the use of applied research, academia can help these individuals solve problems within their company as part of the learning process. This is extremely powerful for those students in this program; many of which have not had a class in several years. The ability to focus the content that they have to learn in order to complete the course to their place of business also increases the rate of success in the course. This paper will provide a case study example on how one assignment can impact a workplace environment.

## COURSE WORK

TECH 621W is a semester long course where students attend 8 ½ hours of instruction on each of the three weekend visits. During the first weekend, students learn about character recognition, linear and 2-D bar codes, scanning technologies, and printing solutions. This first weekend visit is crucial to tying the needs of the student to the course. During the first weekend meeting, the students were introduced at a high level to various aspects of AIDC technologies; which encompass bar codes, card technologies, radio frequency identification, and biometric technologies. A class discussion ensued about where their own individual company's processes could use an improved deployment of Automatic Identification and Data Capture technologies. Students noticed an increased need to track and trace products both within their facilities and supply chains in general, and they all conveyed that one of the primary outcomes of deploying an AIDC system would be to reduce costs. The group's first assignment reinforces the connection between industry and academia. Firstly the students have to examine a process within their operations that uses AIDC technologies, specifically barcodes. They have to note the type of bar codes used, provide a copy of the bar code (used in a later assignment); write down the process that the bar code is involved in (parts replacement, inventory management etc.) as a flow chart; identify the type of bar code scanners are used; and make an assessment on whether the current situation worked and if it didn't what type of changes would be introduced to make improve the

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process. This needs analysis is the basis for the final deliverable that the students produce at the end of the course.

## SOLUTION

One of the outcomes of the course is to aid those in industry with the tools to improve their processes through the use of AIDC solutions. Through this assignment, the student was able to design a proof of concept bar code personal digital assistant (PDA) solution and present this to the company's upper management.

### Pre-deployment

The implementation took place at a security firm in Indianapolis, Indiana. The firm is an integrator of Closed Circuit Television (CCTV) and Physical Access Control products. Because of rapid growth and demand in the area, an increase in material tracking and data capture was apparent. The problem that the firm faced was the lack of tracking materials once they entered their warehouse.

The bar codes used for a majority (80-90%) of materials that enter the firm are linear bar codes. The linear bar codes are used in a label format that are made by Avery Dennison, and is 1 inch by 2 ½ inch format. The barcodes are printed on a white background, with all print (lines, check digits, numbering, etc) in black. The labels are found on the top of the packages when they arrive. Because most of the firm's materials come from the same vendor, GE, there is uniformity in the size, shape, and format of the barcode. That uniformity helps in the overall success of a barcode tracking system. Previously, no bar codes were used in the process, making it hard to tie the receiving products to their appropriate projects. The solution generated out of this assignment was to use a Portable Data Terminal with a bar code scanner attached. The initial project needed to make the technology as easy to deploy as possible, with minimum training and expense.

Before deployment of the project, the questions that the firm had to address were:

- Should docking station and database be located in the warehouse or central office?
- Should scanning be limited to manager level or all installers/technicians?
- After scanning, what is the best way to sort materials (Job #, part #)

Because of the size of the firm, cost was a driving factor in the decision. Symbol Technologies offered the most cost effective, easy to use Portable Data Terminal (PDT) solution. The solution chosen by the firm was the Symbol SPT1500, with Pendragon software providing the application based on Palm OS.

Figure 1 shows the flow of packages from the time they leave the vendor via United Parcel Service (UPS) until the time they arrive at the firm's receiving area.

FIGURE 1-PACKAGE FLOW  
(ORIGINATION TO DESTINATION)

### Vendor Shipment

Before packages are shipped from the specific vendor, they are affixed with a linear barcode. The package is then transferred to UPS.

### Carrier Transport

Upon receiving the packages from the vendor, UPS affixes a label (as shown in Figure 2). The label has both 2D and linear bar codes. The linear bar code with the tracking number can be used to tie the delivery tracking to the item bar code affixed by the vendor.

FIGURE 2-UPS LABEL

### Firm Receiving

Upon receiving the packages from UPS, they are scanned using a Symbol PDF. The linear barcodes are used for the

specific part number. This data is then loaded in to the office inventory system (running on MS Access) to help keep an accurate quantity of parts readily available.

### **Package Deployment**

When the packages sent out into the field for installation, they are again using a Symbol PDT by the installation crew. This scan updates the quantity information for each part which is then used for reordering information when inventory reach appropriate levels.

### **Software**

The software chosen was Pendragon Forms by Pendragon Software. Pendragon Forms is a software package designed for small mobile device platforms including Palm OS. The software was chosen as it integrates with Microsoft Access database software. The software is also easy to use and can be programmed with limited knowledge.

### **Hardware**

The Symbol SPT1500, shown in Figure 3, was chosen for the implementation because of its portability. The SPT1500 is a handheld device which allows the user to scan barcodes with out having to be in the vicinity of a computer. The data is uploaded in a batch mode through a cradle connected to a PC. No synchronizing programming knowledge is required. Another advantage of the SPT1500 is that it allows the user to view information from the barcode on the device. This allows the user to make decisions and take action on the spot without consultation of the tracking system.

important aspect of any AIDC solution is the relation between the human and technology aspects. With in the IT 621W course, this issue is then transferred back into the classroom and discussed. Those with experience in deploying technology can then share their experiences with others who are looking to deploy the technology.

### **REFERENCES**

- [1] Sickler, N., Kukula, E., and Elliott, S. "The development of a distance education class in automatic identification and data capture at Purdue University." *World Conference on Engineering and Technology Education*. 2004. Santos, Brazil.

FIGURE 3-SYMBOL SPT1500

### **Post-deployment**

Upon deployment of the PDT solution, there were still issues to be resolved. Although scanning packages into the system was not an issue, some materials were not scanned out of the system when leaving the facility. This created an inventory problem, which in turn created ordering problems. Simply deploying technology does not solve industry problems. An