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Capstone Project

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Honor Pledge: I acknowledge that the Capstone Project is an independent study project to be completed individually. On my honor, I have not received aid on my Capstone Project other than what was provided by my faculty mentor and any persons explicitly cited in my work. I further acknowledge that if I have given any aid to another student in this course, the instructor of this course was made aware of my contributions.

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Objective

RFID could be said to be invented in the mid 19th century with the development of a tool for espionage that was used to covertly listen and retransmit radio waves incident on it with audio information. However, it was not until the 1973 patent of a passive radio transponder that had memory by Mario Cardullo that we could really say the modern RFID was born. This first device with a 16 bit memory was a passive transponder that took energy from the interrogating radio waves to power it and was used as a toll device.

The first commercial applications of RFID to prevent theft of goods at the point of sale was the Electronic Article Surveillance (EAS) equipment developed by Sensormatic and Checkpoints were witnessed in the 1960s and 1970s (OECD, 2008).

The three main components of an RFID system are the RFID tags, RFID readers and databases. The tags are composed mainly of an integrated circuit and an antenna for the transmission and reception of signals. The tags with transponders are attached to the objects that need to be identified. The tags may be read-only where it has its serial number written to it from the factory or read-write (RFID Basics, n.d.) where the user can program specific data pertaining to the object to be identified on it. The RFID readers transmit radio signals to interrogate an RFID tag for information and read the response. The readers are more sophisticated than the tags as they can have their own processing capability, internal storage and network connectivity (Weis, n.d). Databases map the data that identifies a tag to records on objects being identified by the tag. The records often contain all necessary information on a product for tracking and assessment. For readers

without its own internal storage, is often a conduit to the database that stores the information read by it.

Frequency range	Frequencies	Passive Read distance
Low Frequency (LF)	120 – 140 KHz	10 – 20 cm
High Frequency (HF)	13.56 MHz	10 – 20 cm
Ultra-high Frequency (UHF)	868 – 928 MHz	3 meters
Microwave	2.45 GHz and 5.8 GHz	3 meters
Ultra-Wide Band (UWB)	3.1 – 10.6 GHz	10 meters

Content Advisor

Dr. Liu currently serves as Associate Professor of Information Management as well as my advisor and my capstone mentor. I chose her because she's always been helpful when I needed and was always willing to open up her office hours if you needed her. She taught my first Cyber Security class where I learned a lot about security. I think we both have a passion for security because that's when people are most at ease – when they feel like they are secure. As far as work done in this area, Dr. Liu stated that she doesn't have much experience in the RFID technology field. But, she has published many journals and has done conferences on technology and how it helps people. Nonetheless, she was helpful in putting together this project.

Project Plan

The main tasks that will be involved in completing this project and the time frame and time duration for the completion of the tasks are presented in table 1 below. The duration for the completion of each task has been carefully determined to give some allowance for delays that may arise owing to unforeseen circumstances. Most of these factors are included in the Risk Factors section.

Activities	Week												
	1	2	3	4	5	6	7	8	9	10	11	12	13
Topic Selection and approval													
Literature review on topic													
Project proposal writing													
Research on the topic													
Compiling information													
Report writing(Draft & Final)													
Project submission													

Project Details

Over the years, barcode technology has been deployed at the checkout counters in retail stores and super marts to monitor goods. The barcode papers placed on items for scanning cost next to nothing to produce. The RFID chip costs more per unit to deploy on goods to be tracked in stores. The main research question then is “can the RFID tags

effectively replace the barcode technology as a means to tracking goods in stores?”

Answering this question will entail looking critically at the features of the barcode technology and juxtaposing it with RFID. At first examination, I think the advanced features and complexity of RFID will make it preferred over barcode despite the higher cost per unit owing to the autonomy in the management of the goods carrying the tags and the greater overall efficiency of its use. The flaws as have been experienced in the past in the use of barcode technology will be used to reinforce the argument vis-à-vis the merits of the use of RFID.

My Capstone Project will outline all the reasons why RFID is better for security as well as to why all companies should make this change, permitted they are able to handle the economical and time consumption.

At this point in the project, I’ve gathered some resources as well as decided what my focus for this paper will be on. I’ve met with my mentor, Dr. Liu, and have discussed possible topics for my paper as well as picked one that we both seem to like.

RFID in Passports:

Currently, RFID is used in passports of a variety of countries to help prevent passports from being stolen and used by wrongful individuals. This is security and the protection of identities of individuals (Brown 2015).

RFID in the Military:

In the military, RFID-based weapons tracking allows secure measures for military and other law enforcement officials. This occurs because a level-by-level clearance can be obtained depending on the security clearance of your RFID chip. This makes the

means of how weapons are accessed, and by whom, is very critical information if something goes wrong.

RFID in Credit Cards:

MIT researchers have developed a new type of radio frequency identification (RFID) chip that is extremely difficult to hack.

If such chips were widely adopted, it could mean that an identity thief couldn't steal your credit card number or key card information by sitting next to you at a café, and high-tech burglars couldn't swipe expensive goods from a warehouse and replace them with dummy tags. One way to thwart side-channel attacks is to regularly change secret keys. In that case, the RFID chip would run a random-number generator that would spit out a new secret key after each transaction. A central server would run the same generator, and every time an RFID scanner queried the tag, it would relay the results to the server, to see if the current key was valid (Hardesty 2016).

RFID in Pharmacy

Not surprisingly, a big threat in the drug industry is counterfeit pharmaceuticals. Pharmaceuticals are generally high-value items and are fairly easy to fake. Pfizer is one of the companies that have turned to RFID to make their supply chain more secure.

In Pfizer's RFID execution, RFID tags are put on drug bottles, where a pharmacist can check the authenticity of a particular bottle just by scanning its RFID serial number and validating it through Pfizer directly. This is confirmed via the customer's personal information through Pfizer directly. This is a great example of authentication through proprietary encoding (Pfizer 2006).

RFID in Imports

Another region where authentication is needed for security reasons is on inbound overseas container shipments. The goal is to knock out two birds with one stone. One goal is to enable containers from trusted countries to be routed through customs faster, and to prevent containers that have been fiddled with from entering the country. These containers could contain drugs, weapons, and other contraband. Many of the largest seaport operators have formed a coalition to explore the use of automated tracking and RFID for containers shipped to the US. The idea behind the Smart and Secure Tradelanes Initiative (Savi 2006) is to apply an e-seal using RFID at the outbound port, and track the container throughout its whole route until it reaches its final destination. At the destination, the e-pedigree of the container gets checked, along with the originality of the e-seal. Not only does this offer a higher level of security, but it makes inspections at ports more unnecessary, which leaves more time for other tasks. Preliminary studies (Lee and Whang 2003) on the effectiveness of this method reveal large cost savings. For one pilot program, savings were estimated at \$1,000 per container (Johnson 2004).

Knowledge Being Applied

During my tenure here at Marymount, I have taken a lot of classes that I found interesting and engaging. Some of which have helped in the progress of my Capstone Project. My Project Management class allowed me to better analyze the project from start to finish as well as time managing and finding the adequate time to complete the tasks before they became due. It also helped in the preparation of my timeline because I got an

idea of realistic times needed to complete tasks. While a Capstone Project is different than a work project, it still is something that requires planning and execution. My literature classes allowed me to improve grammar and writing skills as well as expanding my vocabulary. My Cyber Security class with Dr. Liu provided me with the knowledge of knowing what “secure” and “unsecure”. I learned how open ports could lead to security risks through email, firewalls, etc.

Risk Factors

Currently, as my Capstone Project is not depending on any other software or organizations, I should hopefully not run into any problems. At the moment, however, I am currently enrolled Full-Time as well as working Full-Time. Time would be the only risk factor that comes to mind. Most of the resources required for my to do my project are time and an online library or search engine that will assist in conducting my research. If RFID chips were used in most things where it is considered an alternative, it could be possible that people may lose their jobs. With RFID, the need to have inventory personnel scan and make sure things are accountable for wont be necessary. If RFID is implemented in let us say for example, a t-shirt, it will get flagged as the shirt leaves the store. Now, hopefully the culprit is caught, but if not, then the system automatically knows that we have one less item that we need to keep track of. In fact, one privacy consultant from Wal-Mart admitted that it didn't threaten consumer privacy, “But it's going to kill jobs” (Roberti). It is likely that Walmart employees will spend less time checking shelves for missing jeans of a specific size; but instead, they'll be doing other

activities such as helping customers or folding clothes. This might not necessarily eliminate jobs, but it would cause a shortage of hours.

RFID seems to be the way to go as more companies move towards it, but it is not that easy. Transitioning costs a lot of money. From the time it takes to implement the chips as well as the equipment needed to operate and keep track of these chips undoubtedly needs cash. Not all companies are able to afford these luxuries so we could still see traditional inventory checking, even if it does take up more time and more work is required.

Work Performed by Others

For this particular Capstone Project, most of the work is actually being done solo. Aside from gathering information from faculty, libraries, and the Internet, I am not compelled to have anyone other than perhaps Dr. Liu read over and give suggestions. The information I gather will require the same resources needed for most research papers. Dr. Liu has given me an abundance of great ideas and things I should conduct some time gathering information on because they'll tie perfectly into my Capstone project. In fact, the main focus of my project, which is mostly security, is due to her guidance.

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