RFID Access Control System
Introduction:
I propose to build an RFID access control system. The project will use an RFID reader to verify an RFID tag and then send a signal to unlock a door. When the user places the tag within reading range of the antenna, the reader will process the tag ID and send it to the microcontroller. If the tag is verified to be valid, then a lock will be signaled to unlock. After a small amount of time, the lock will automatically be reengaged. The system will be able to add and remove IDs, create a timestamp for tracking activity, and have a keyed backup in case of system failure.

Description:
The RFID Access Control System will consist of passive RFID tags, an antenna, an RFID reader module, a microcontroller, an LCD, a keypad, and an electronic door lock. The reader module continuously scans for a tag. When a tag comes within reading distance of the antenna, it detects an activation signal and wakes up. The information on the chip is then transmitted through the antenna back to the reader module. The reader module processes the information and then sends it to the microcontroller. Once the microcontroller receives the data, it is compared to a list of valid IDs. If the ID is confirmed to be valid, the data associated with the ID is displayed on the LCD, logged into memory with the current timestamp, and the microcontroller sends a signal to unlock the door. The system will also have a maintenance mode. In this mode, tag IDs can be added or removed from the system and the activity log, containing IDs and timestamps, can be transmitted to an external computer.

This system is meant to be installed on a door where there is a need for security along with a need for being able to handle a high volume of traffic in an efficient manner. The application that I have in mind is for a computer lab on a university campus. Certain labs contain specialized equipment that must be secured at all times and is meant for use by select students and not the general student body. The students who needed to access the equipment could easily unlock the door to gain entry and then the door would automatically shut and lock behind them to keep the equipment secure.

Block Diagram of RFID Access Control System:
Benefits:
An RFID access control system serves the same purpose as a traditional keyed lock, but there are numerous benefits that go along with using RFID. Doors are allowed to remain closed and secured from the outside yet still be unlocked quickly and efficiently by persons with the proper credentials. This eliminates the common practice of propping a door open for convenience, which in turn decreases security. A log of the system activity is stored in memory and could be accessed in the event of criminal activity or emergency. The same RFID tag could be used to access multiple doors, which is not always possible or practical with keys. A single RFID tag would take up much less space, and eliminate the need for, a keychain full of keys. Also, the act of adding or deleting IDs to and from the system, to respond to a fluid clientele, is easier and more efficient than changing physical locks.

Societal Impact:
In the times we live in, people demand convenience, security, freedom, and privacy. It is increasingly harder to sufficiently meet all of these demands. The increase of one usually means the decrease of another. While using RFID to control access instead of traditional keys is more secure and convenient, there is the possibility for an invasion of privacy by tracking someone’s activities. A solution to this is to have an agreement between the administrators and users of the system, which clearly states how activity logs will be used, and for what purposes. RFID systems aren’t as easily “picked” like traditional lock and key systems, but it is still possible to defeat an RFID system. The data on passive tags, the most commonly used, is rarely encrypted. Since passive tags are powered by the reader, and don’t have a battery, the amount of encryption that can be placed on the chip is limited. This means that the tag could possibly be “sniffed” and duplicated without the user even knowing. There are tags that have the ability to be encrypted, but they are more than twenty times the cost of the common tag. A simple and cheaper solution to prohibit “sniffing” involves storing your tag in a container that has a layer of RF shielding. This gives you the ability to control when, how, and by whom your tags are read. On a more positive note, passive RFID tags can be used over and over again and can last for many years without being replaced. Newer RFID technology is more eco-friendly and meets current environmental regulations.

Similar Products:
There are similar products available to consumers that provide access control using RFID. There are stand alone RFID readers, without door locks, or fully integrated systems with readers and locks. They range in price from a few hundred dollars to over a thousand dollars. The Keyless Lock Store website (http://www.nokey.com) offers some of these products.

Avea Proximity Reader:
- Just the reader, no lock
- No keypad
- No external PC needed to program IDs
- Accommodates up to 2730 IDs
- Single door system
- $150.00
IEI Proximity Card Reader:
- Just the reader, no lock
- Keypad
- No external PC needed to program IDs
- Accommodates up to 2000 IDs
- Compatible with multi door system
- $392.00

Trilogy 2000:
- Reader and lock
- Keypad
- No external PC needed to program IDs
- Accommodates up to 2000 IDs
- Single door system
- Many extra security features for connection to security system
- $1200.00

The RFID access control system that I’m proposing will use a mixture of the options that these products offer. It will include a reader, lock, and a keypad as shown in Figure 1. An external computer will not be needed to maintain the valid IDs. Since the system is standalone, a single, valid ID could be used to open multiple doors, but my system will only be a single access point. The cost of my system will hopefully be on the lower end of the scale of similar product prices.

Project Development:
I would like to use the Cypress development environment and PSoC board for my project. Although I am already familiar with the Freescale products, I feel that the challenge of learning a different set of products will be beneficial. This might extend the time frame of my project in order to learn the new hardware and software, but I don’t think it will negatively affect my project. For the RFID reader module and antenna, I am going to purchase OEM solutions that will meet the project’s needs. The development board already contains an LCD and a keypad will need to be purchased separately and interfaced. I plan on developing this project in both the ETEC 340 lab and in my home workspace. The software portion of the project will mainly be written at home, and the lab will be utilized for hardware construction and testing.

Project Demonstration:
To demonstrate my RFID access control system, I plan on constructing a small door with an electronic lock attached to my project. To show how the system works I will first add an ID to the valid list. Next, I will place a valid tag within the range of the antenna to show how the system unlocks the door. An invalid tag will then be placed within the range of the antenna to show that the door only unlocks for valid tags. Finally I will delete a previously valid ID and place the corresponding tag in the range of the antenna to prove that the ID does not unlock the door. In all cases, the door will open freely from the inside and automatically relock a set amount of seconds after unlocking.
Figure 1: