AttendancePlus

MDR

Team 18
SDP 20

Meet the Team! (Again)

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CSE
Team Manager

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PCB Lead

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CSE

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CSE

Professor David Irwin

Faculty Advisor

Problem Statement

Teachers waste precious time throughout the day keeping track of where students are, cutting into time they could be spending teaching.

Further, in an emergency situation, it is impossible to know precisely who is in the school or where they are at any given time.

Our Solution

- An Automated Attendance System
  - Passive RFID (Radio Frequency Identification) System
  - Geared toward elementary schools
- Intuitive User Interface
  - Update when tags (students) enter and exit a room
  - Simple & secure Registration System

System Specifications

I. Automated detection & identification of students entering / exiting a classroom

II. Display location of students in school in real-time

III. Non-intrusive, low maintenance integration with existing tech in school

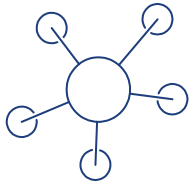
IV. Interactive GUI for administrators & faculty

V. Protect information from unauthorized individuals

VI. Keep privacy invasion to a minimum

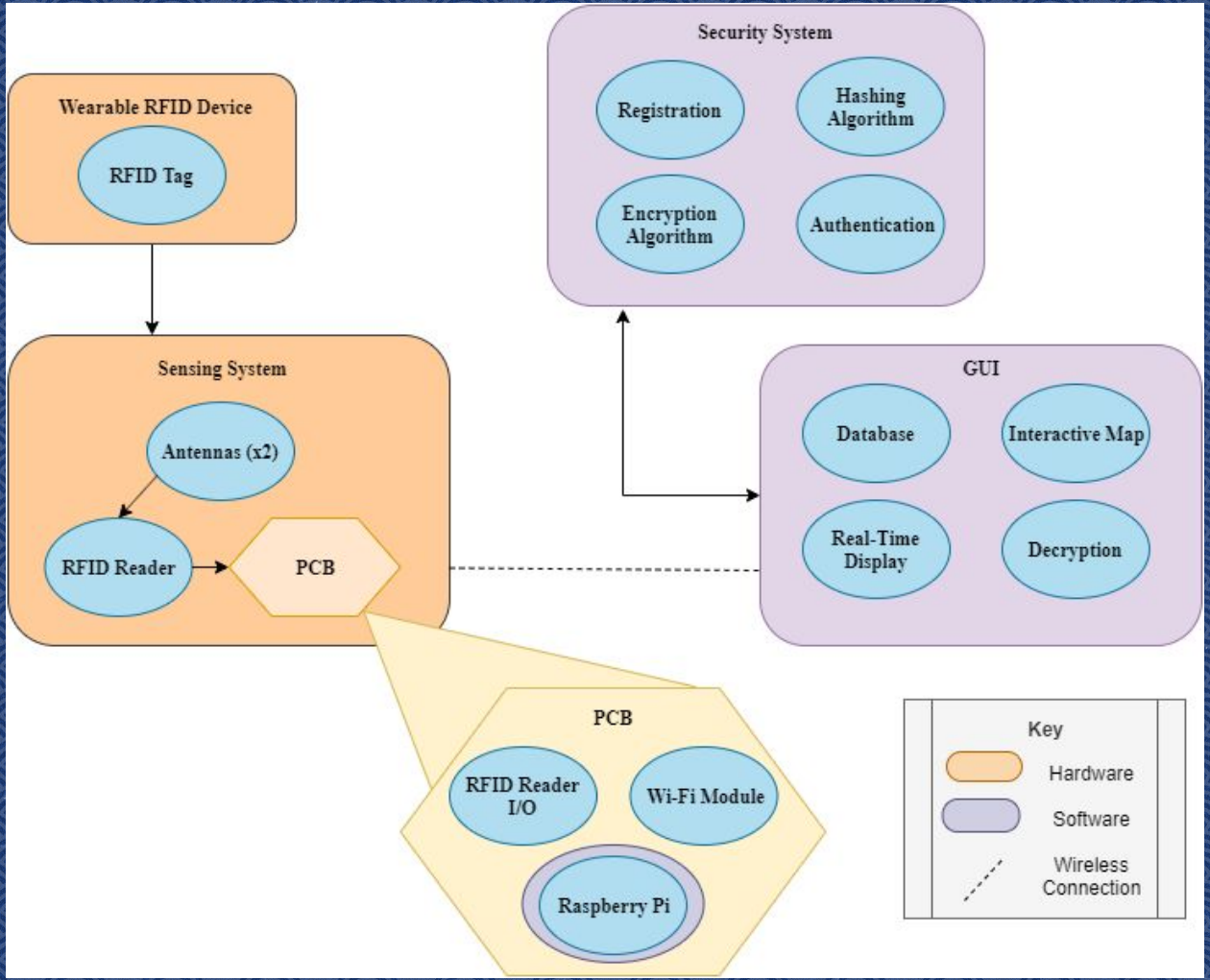
Quantitative Requirement Specifications

- High Degree of Reliability: > 95%
  - Failure to detect tag in room < 5% of all detections
- Easy Installation
  - System on ceiling of room
  - Connect to existing power source
- Privacy Protection
  - Tag registration for tag authentication (e.g. store hash of tag label in database)
  - Secure data transmission
  - Authentication & confidentiality for GUI

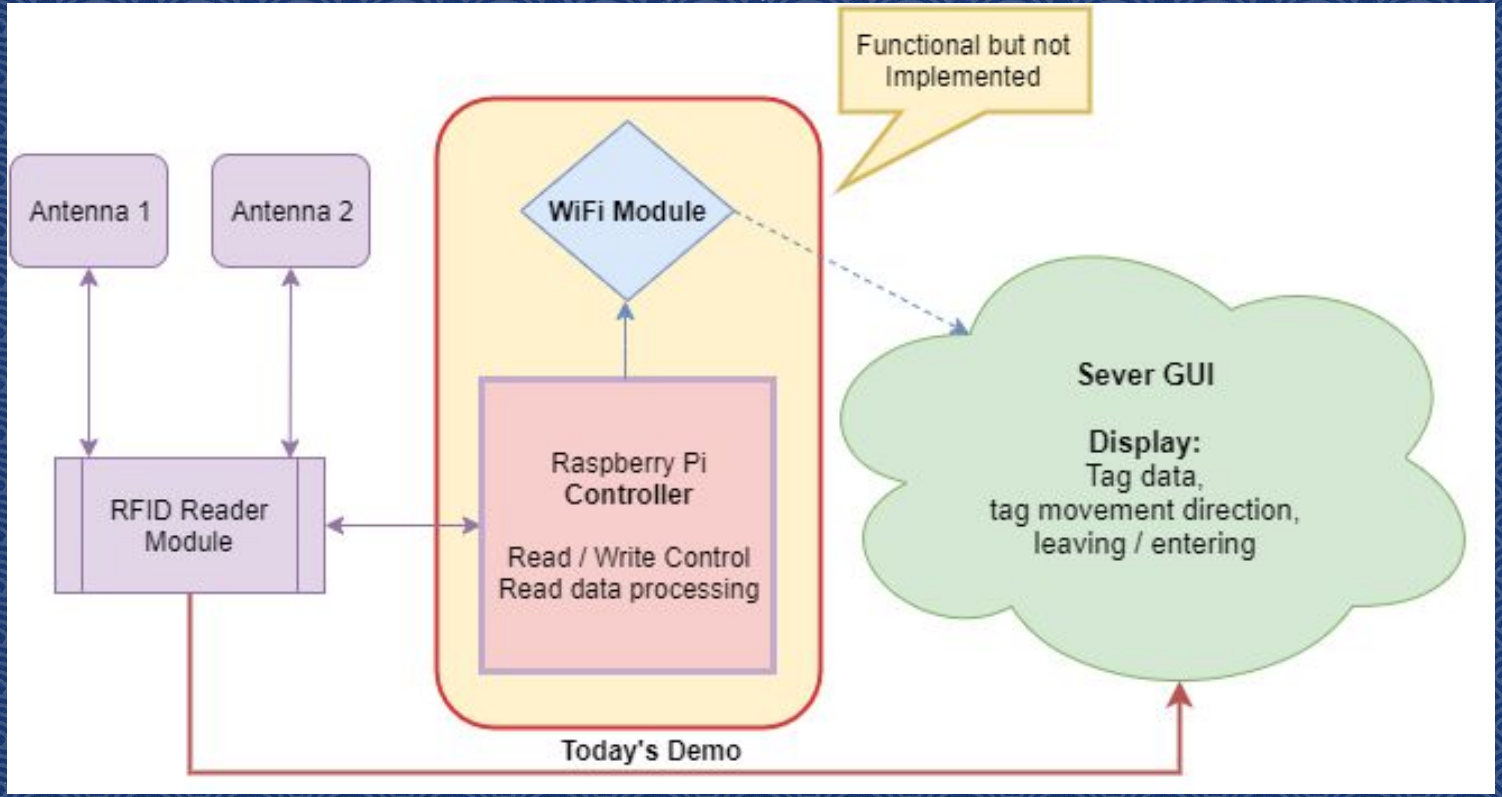


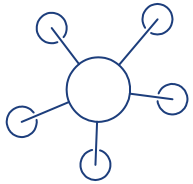
Block Diagram

MDR Prototype & Block Diagram


Security System
Registration
Hashing Algorithm
Encryption Algorithm
Authentication
Wearable RFID Device
RFID Tag
Sensing System
Antennas (x2)
RFID Reader
PCB
GUI
Database
Interactive Map
Real-Time Display
Decryption
PCB
RFID Reader I/O
Wi-Fi Module
Raspberry Pi
Key
Hardware
Software
Wireless Connection

MDR Prototype





MDR Deliverables:

Promised and Delivered

MDR Prototype: Promised & Delivered

Reading from Tags:

Promised:

- Parses tag data correctly
- Hash of tag EPC
- Confirmation of hash found in memory

Delivered:

- Reads tag correctly and gathers required data
- Matches to correct tag stored in memory using hashmap

Writing to Tags:

Promised:

- Tag data before & after encryption when writing
- Hash of encrypted data

Delivered:

- MD5 hash of 96 bit EPC name (tag label)
- Encryption/decryption of registered name for tag

Not Delivered:

- Reader will not yet write to tags

MDR Prototype: Promised & Delivered

Tag Data Transmission:

Promised:

- Tag data transmission (EPC, RSSI, read cnt, ant. #, timestamp)
- Decryption of data on server

Delivered:

- Data is decrypted on server
- Data is transmitted from reader to server
    - However:
        - Unable to write to tags today (in progress)
        - Pi → server connection not fully integrated

MDR Prototype: Promised & Delivered

RaspberryPi Integration:

Promised:

- Wi-fi Module sends tag data to server for data processing/display

Delivered:

- Data able to be sent over a secure connection (SCP) programmatically via Wi-Fi module
- However:
  - Functionality not fully integrated with existing system
    - Will be shown in demo
  - This full integration is a priority for next semester

Raspberry Pi Software

Reader.py:

- After secured connection wait for commands
- Can start and stop reading, write to tags
- Write to file for Wifi codeserver

WiFi.c:

- Raspberry Pi capable of sending commands to module
- Module sends commands to another computer over WiFi
- All accomplished programmatically rather than manually

MDR
WIFI MODULE

- ESP8266 WiFi Module Activates
- RaspberryPi and nearby computers connect to module
- SCP command allows transfer of files from Pi to other computers

Server/GUI Software

Server/GUI (C++) Pseudo Code:

- Store hash of tag labels in a hashmap
- Calculate direction by checking for continuous stream of 20 antennas reads after reading opposite antenna
- Two levels of availability of information:

No Authentication Provided

Tag Label:	Current Location:
tagHash1	*RESTRICTED*
tagHash2	*RESTRICTED*
...	...

Authentication Provided

Tag Label:	Current Location:
Jonah	*Classroom 108*
Jackie	*Classroom 108*
...	...

System Performance

- Testing during design process
  - Unstructured but frequent
  - Optimal performance in “perfect use” case
- But what's affecting the data transmission?
  - Suboptimal orientation of…
    - Antenna placement
    - RFID tags
  - Algorithm unreliable in certain edge cases
    - Times out after 5 seconds
      - I.e. time out during transition
    - Explore optimal data processing options

Looking Ahead

CDR and More…

Gantt Chart

Task Title	Team Member	October			November			December			January			February			March			April	
Reader		Beg	Mid	End	Beg	Mid	End	Beg	Mid	End	Beg	Mid	End	Beg	Mid	End	Beg	Mid	End	Beg	Mid
Setting up Anntenas with Reader	Colin																				
Get Mercury Api Working on Pi	Colin & Jonah																				
Set up reader to connect with URA	Jonah & Colin																				
Reader algorithm for filtering through commands	Colin																				
Command Protocol for Reader	Colin																				
Advanced Read/Write Programming URA/Pi	Jackie									WINTER BREAK	!!!!										
WiFI Transmission																					
WiFi Module Intial Setup	Jon & Colin																				
WiFi Module Algorithm	Jon																				
Server / Client Setup	Jackie & Jon																				
Data Encryption	Jonah & Jackie																				
Troubleshoot Wifi Module Transmissions	Jackie & Jon																				
GUI																					
Tag Registration System	Jonah																				
GUI Display for direction, name, timestamp	Jonah																				
Interactive Map	Jonah & Jackie																				
Easy to use UI complete	Jonah & Jackie																				
PCB																					
Design PCB	Colin																				
Fabricate PCB	Colin																				
Algorithm																					
Algorithm for parsing and storing data	Jonah & Colin																				
Algorithm for detecting direction	Jonah																				
Perfect/Optimize Current Algorithm	Jon & Colin																				
Other																					
Website	Jackie																				
Design & Build Mount	Jackie																				
Project Refinement	Team																				

CDR Deliverables

- GUI will be complete with real-time updating map & tag info display ***(Jonah & Jackie)***
- WiFi module will be working to transmit data from RPi to server ***(Jon & Jackie)***
- Have PCB designed, tested, and integrated ***(Colin)***
- Improve accuracy of algorithm for determining direction > 95% ***(Jonah & Colin)***

Demo!

Thank You!

Any Questions?

Testing

1 Tag Moving through Doorway

2 Tags Moving Simultaneously

Tag Number	92		92		40	
Test Number	Tag 1		Tag 1		Tag 2	
	EXT	ENT	EXT	ENT	EXT	ENT
1	1	0	1	1	1	0
2	1	1	0	1	0	1
3	1	1	1	1	0	1
4	0	0	1	1	1	0
5	1	1	0	0	0	1
6	0	1	0	1	0	0
7	1	1	0	1	0	1
8	1	1	1	0	0	1
9	1	1	0	1	0	1
10	1	0	0	0	1	0
Accuracy	80.00%	70.00%	40.00%	70.00%	30.00%	60.00%

Testing

2 Tag Moving Through Doorway with Standby Group Inside Room

92		1691	1708	1678	1740
Tag 1		Standby Tags			
EXT	ENT				
1	1	0	1	1	1
1	1	1	0.75	1	1
1	0	1	0.75	1	1
1	1	1	1	1	1
1	1	1	1	1	1
1	1	1	1	1	1
1	1	1	1	1	1
1	0	1	1	1	1
1	1	1	1	1	1
0	1	1	0.75	1	1
90.00%	80.00%	90.00%	92.50%	100.00%	100.00%