Passive RFID Gesture Recognition
Justin Cruz, Sai Kotikalapudi, Christopher Chen, Terry Oh
{cruzju, saik, chrichen, ktoh}@scarletmail.rutgers.edu
Advisor: Ivan Marsic

Motivation
The interface between computers and humans is evolving. We have moved from simple inputs like keyboards and mouse to different forms of interfaces like voice and visual interfaces, like the revolutionary Kinect, to gesture recognition like the Nintendo Wii. These interface technologies are the forefront of the future, however, there has been little to none researching done on alternative forms of recognition. One being, the possibilities of using Passive RFID, short for Radio Frequency Identification, tags for gesture recognition.

Objectives
There are two main objectives of our project:

- Analyze the possibilities and limitation of the RFID technology as an alternative to other recognition technologies.
- Demonstrate the practical uses of the RFID as a source of gesture recognition.

Research Challenges
- Recognizing gestures using output of passive RFID readers
- Positioning of RFID readers
- Real-time gesture recognition
- Hardware synchronization

Future Work
- Test by increasing the number of covered zones and gestures
- Test different RFID reader orientations
- Improve our gesture recognition algorithm

Acknowledgement
We would like to thank Xinyu Li, Young Lee, and Ivan Marsic for all their help and the opportunity to work on this project.

Methodology
Radio Signal Strength based distancing
RSSI (Radio Signal Strength Indicator) increases the closer you are to the RFID reader and decreases the farther away you go [1].

Zoning:
We can create extra coverage zones by having either more RFID readers or overlapping their range. These zones are unique to the RFID readers that can read the tags. These zones allow us to create unique gestures by crossing them in specific orders [2].

Gesture Recognition:
Histogram of Oriented Gradients (HOG) are feature descriptors used to detect objects. The technique counts occurrences of gradient orientation in localized portions of an image [3].

Results
- Able to detect our defined gestures
- RFID signals obtained are dependent on the surroundings
- The ranges of the antennas limits the gestures that can be created
- Practically, this system can be used in controlling devices at a workstation

References