

# **Moving Human Electromagnetic Scattering Simulator**

**Project Proposal | ECE480 FS12 Team 2**

# Introduction

- The team
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- Sponsor
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# Presentation Overview

- We propose designing an electromagnetic scattering simulator
- This proposal will include the following:
  - Background
  - Project Overview
  - Design Concepts
    - Including an overview of our parts
  - Specifications
  - Broad plans to accomplish this goal including:
    - Budget and risk analysis

# Background

- Tracking humans by radar is an important and a common method
  - Radar can track in rain, dust and smoke
- Create sensors that use radar technologies
- EM scattering simulations that model radar scattering are readily available
- Monitoring "human movement"

# Project Overview

- Automating steps in the analyzing of a person's walk
- The XBox Kinect enables engineers to track human movement in a variety of ways
  - Gestures and motions
- Microsoft enabled the Kinect to be open for developers and engineers
- Interface with a microcontroller (Pandaboard ES)

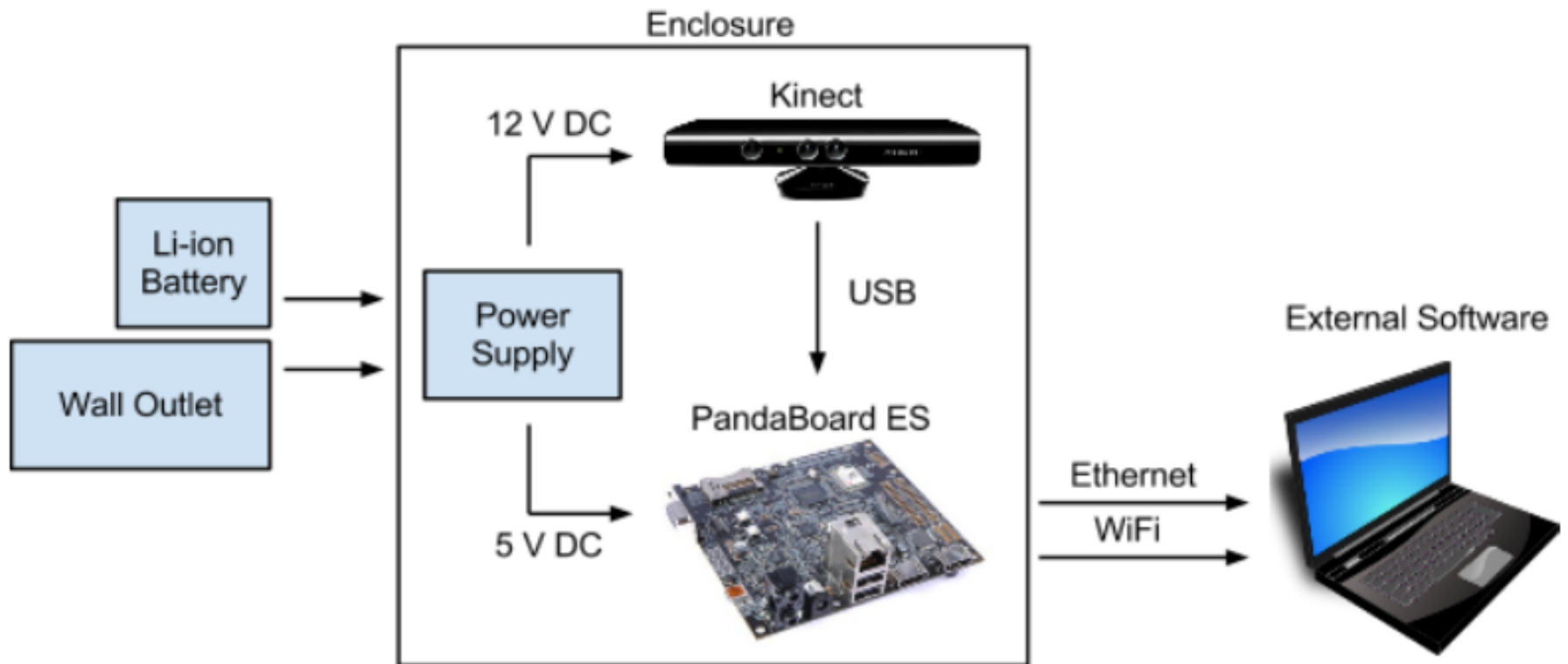
# Design



# Design Requirements

- Small and portable
- Needs to be enclosed
- The motion sensing device (Kinect) needs to interface with a micro-controller via USB
- Microcontroller will send data by a standard network protocol (Ethernet, 802.11, bluetooth)
- Identify humans and characteristics automatically
- Implement algorithms to plot data

# Design Concept



# Hardware



# Kinect Overview



KINECT™  
for  Xbox 360 Windows

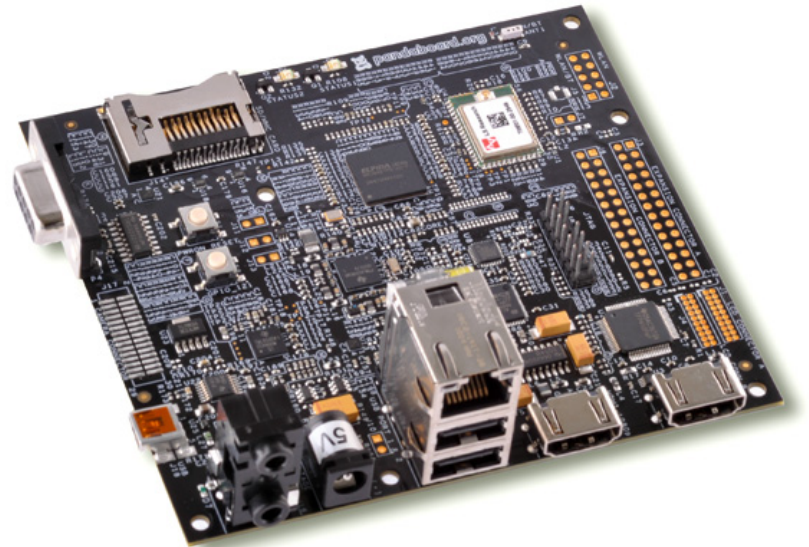
- Launched in 2010
- PrimeSense technology
- Not just for Xbox
- Affordable
- Reliable measurements
- Microsoft SDK

# Kinect Specifications

- VGA camera (640x480)
- Infrared camera (320x240)
- Uses structured light to collect depth information
- Range of 1 to 4 meters
- No calibration needed
- Voice recognition
- Can differentiate between multiple people

# PandaBoard ES

- Provides the required processing power
- 4.5" by 4"
- Boots Linux
- Ethernet, 802.11, Bluetooth, USB, microSD
- Cheap solution for our project requirements

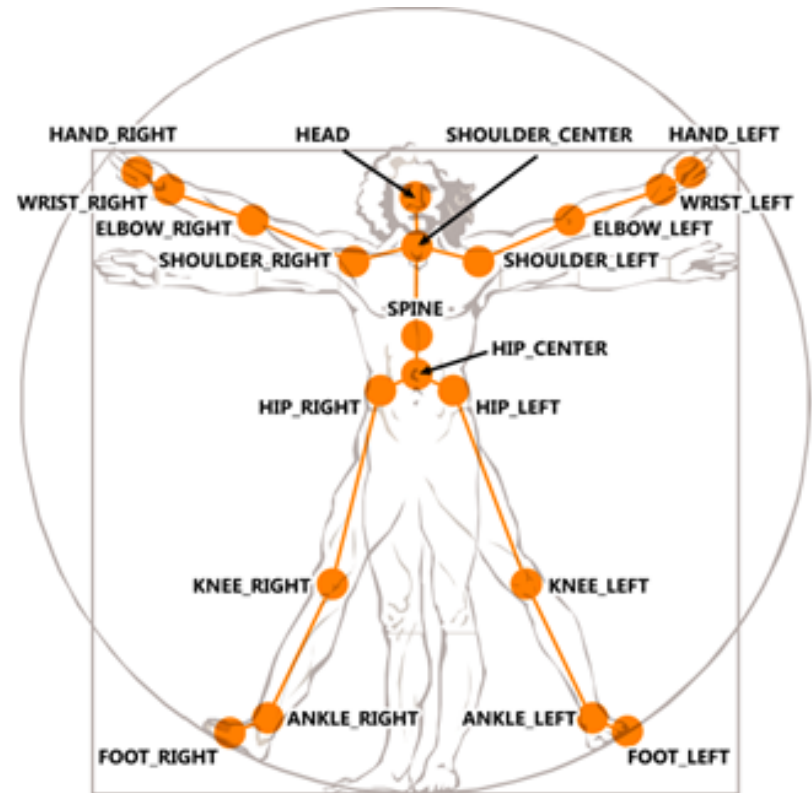


# Software

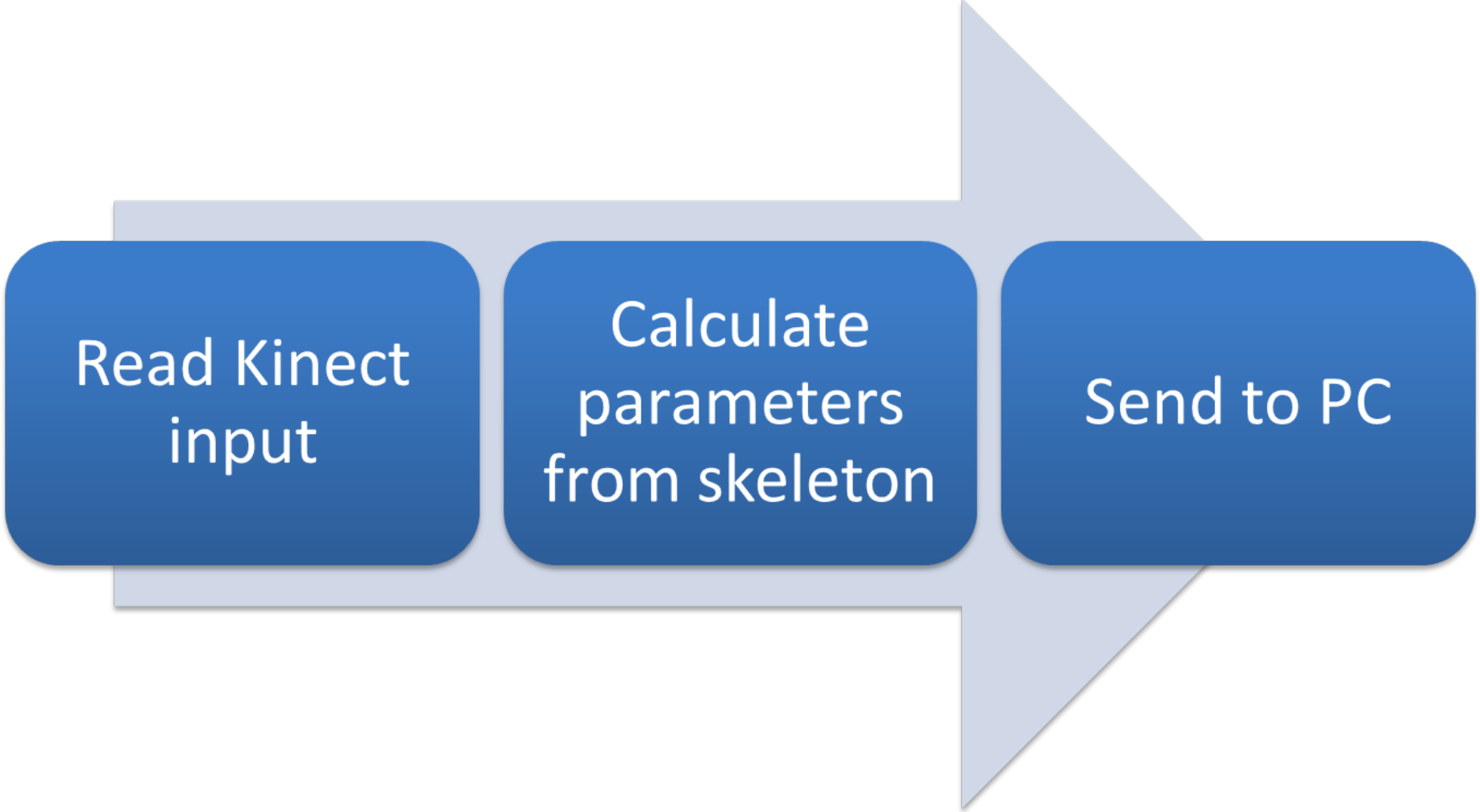


# Human Detection

- Kinect has built in skeleton frame detection
- OpenKinect
  - LED
  - Tilt
- OpenNI
  - Get skeleton
  - Get joint positions



# PandaBoard Application



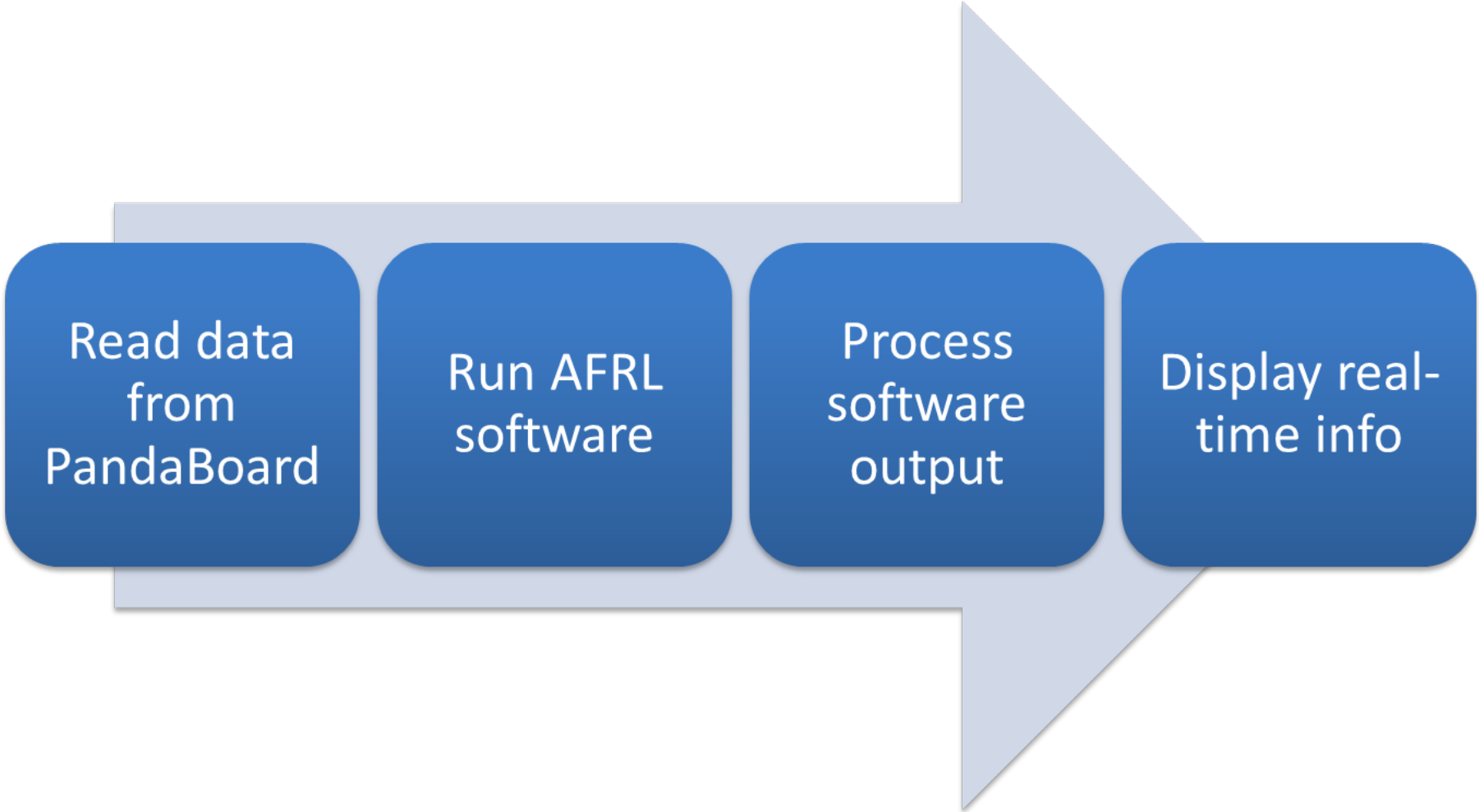
```
graph LR; A[Read Kinect input] --> B[Calculate parameters from skeleton]; B --> C[Send to PC];
```

Read Kinect  
input

Calculate  
parameters  
from skeleton

Send to PC

# PC Application



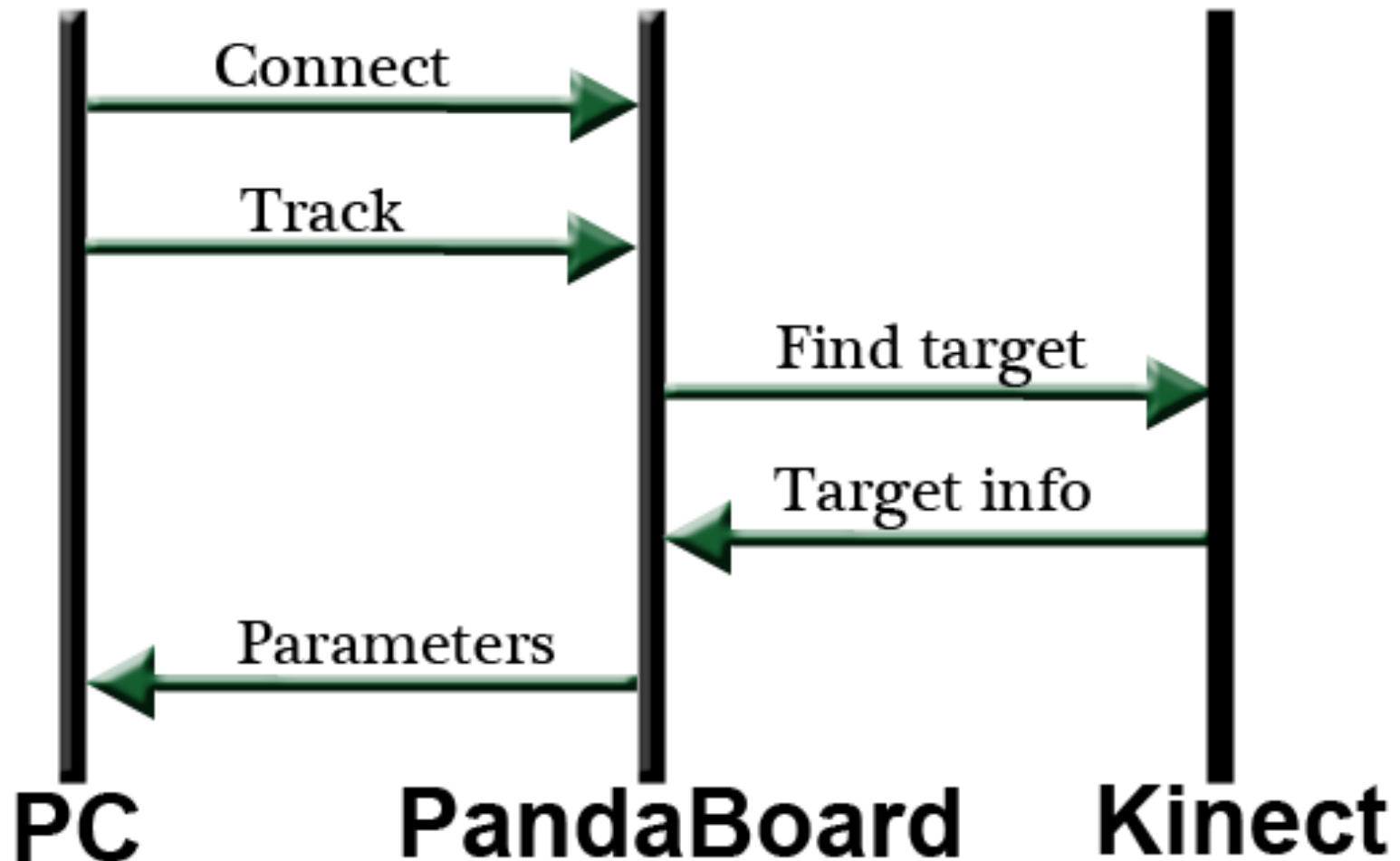
Read data  
from  
PandaBoard

Run AFRL  
software

Process  
software  
output

Display real-  
time info

# System Overview



# Management



# Management

- Three different sub-projects
  - Hardware and power
  - Microcomputer software
  - PC software
- Teams will be allocated first on projected need
- Resources will be shifted as needed

# Budget

|                                     |              |
|-------------------------------------|--------------|
| Xbox Kinect                         | \$110        |
| PandaBoard ES                       | \$162        |
| 16 GB SD Card                       | \$15         |
| DC-DC Converter                     | \$40         |
| Enclosure                           | \$0          |
| Lithium Ion Battery                 | \$30         |
| Misc (Cables, shipping, components) | \$100        |
|                                     | <b>\$457</b> |

# Risks

- Near top of budget
- Potential very complex algorithms
- Possible power supply issues

# Summary

- Need for radar system
- Small and portable
- Using an Xbox Kinect and PandaBoard
- Software to automatically detect humans and their characteristics
- Close to maximum budget
- Few foreseen risks in design

# Questions?

