Pew Pew

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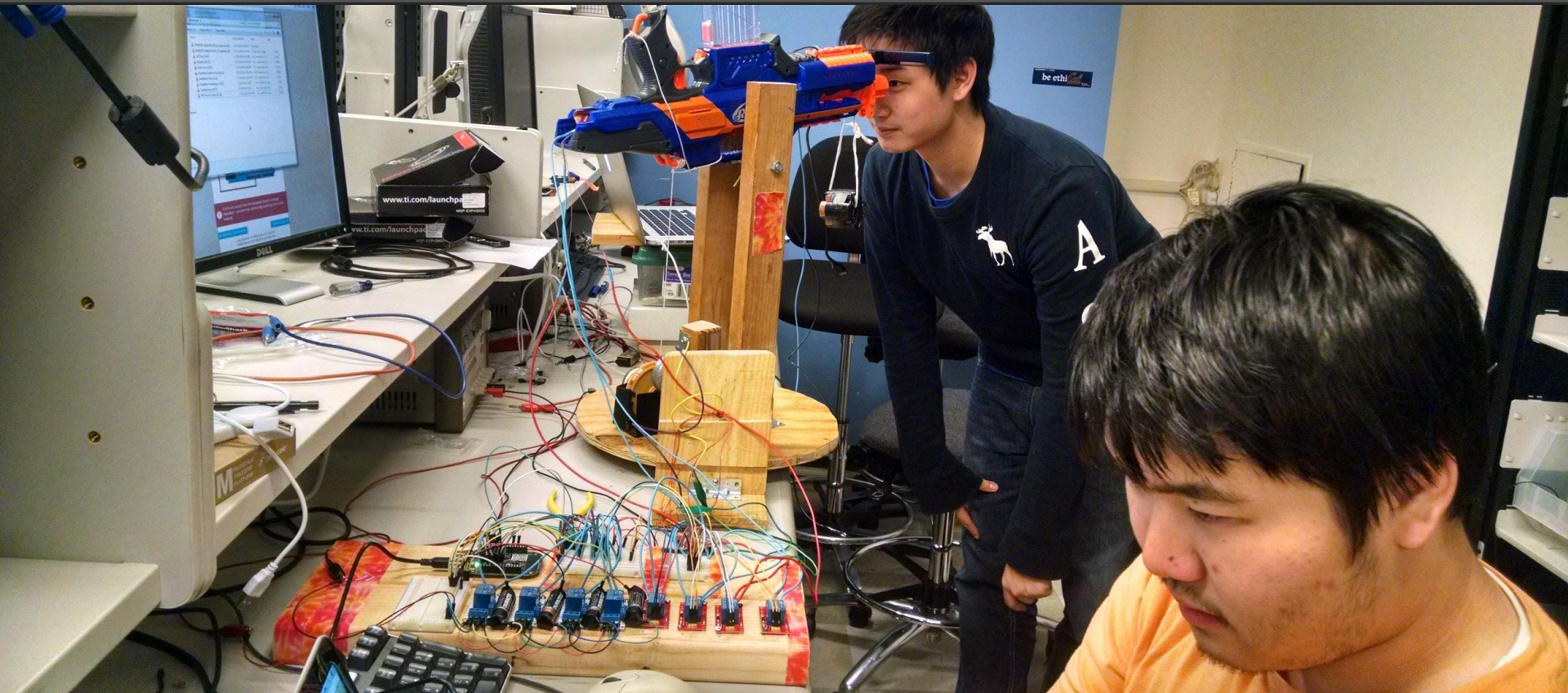
Our inspiration

- Craig’s Roommate
- At a hackathon...
- The idea sprouted

An automated turret!

Kevin Casey

What we made



Let’s back track

- Goal
- Requirements
- Components
- Models
- Demo
- Next steps

Goal

Creating an automated NERF gun turret that can detect, aim, and fire at a human face.

Requirements

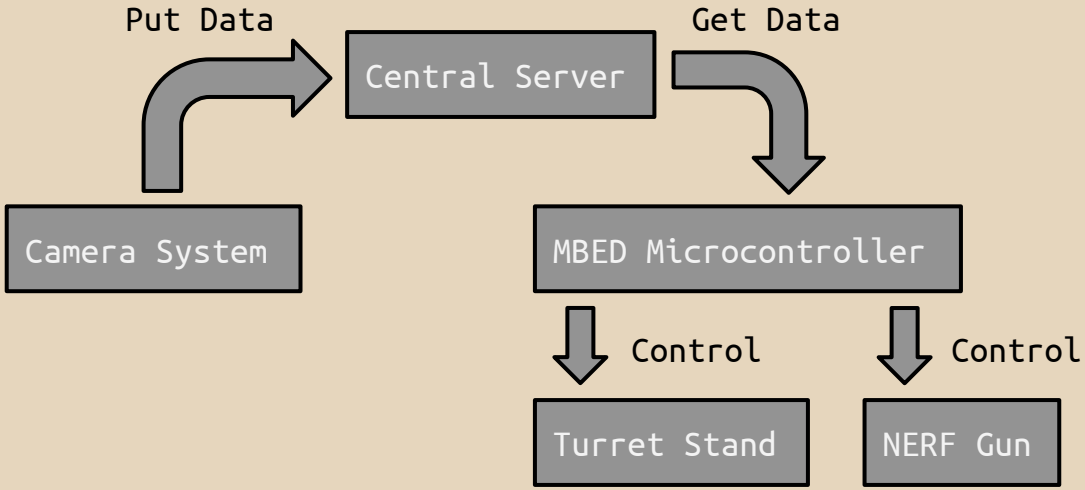
- A turret platform with a mounted NERF gun
  - Supports an incline angle between 0 to 30 degrees
  - Supports a horizontal field of view of 45 degrees
- The turret is able to perform facial detection
- The turret can accurately hit a target within 3 meters

- Communication errors are handled gracefully without damaging the turret.

Components

- Turret
  - NERF gun
  - Turret Stand
- Controller
  - MBED Microcontroller
  - Interface between microcontroller and the turret
- Camera targeting system
- Wireless communication

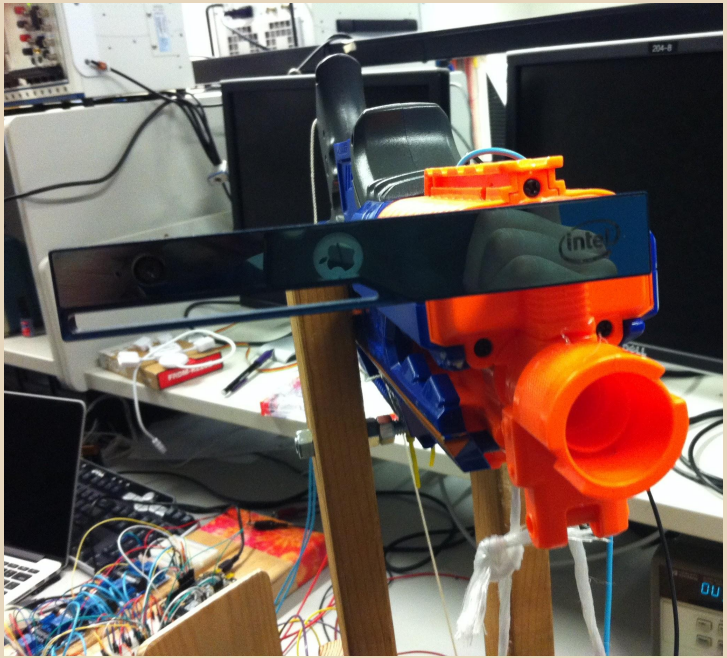
High Level Model



Sensors and Actuators

Camera Targeting System

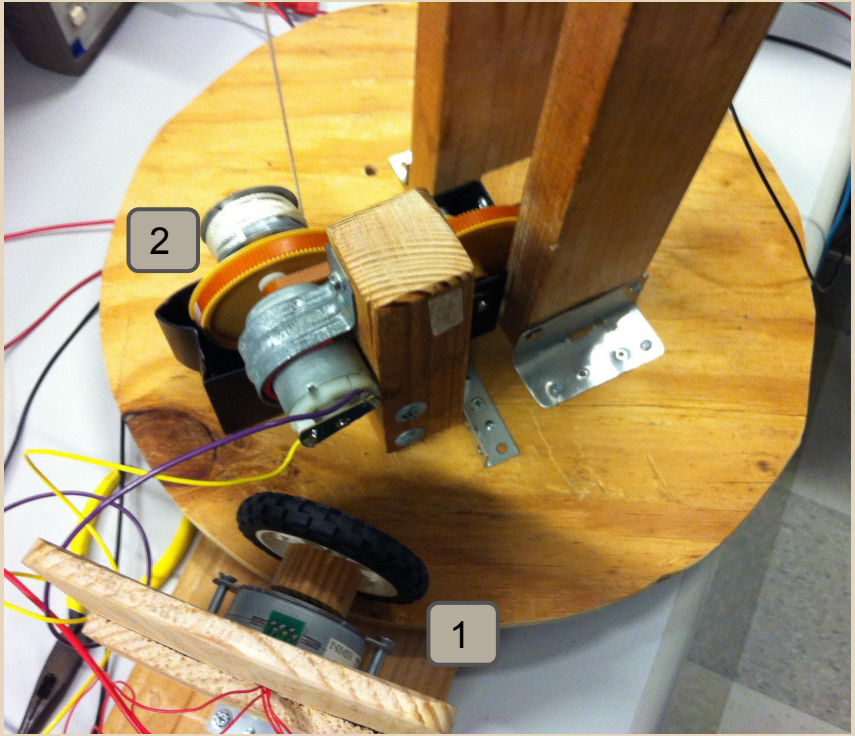
- Issues
  - Accuracy, speed, and depth
- Intel RealSense 3D Camera
  - Low cost (free)
  - Small form factor
  - Has depth information built in



Turret NERF Stand

- Issues
  - Robust
  - Achieves design requirements

1. Stepper Motor
   - Allows more fine tuned horizontal control
2. DC Motor
   - High torque to rotate gun
3. Hardware Design
   - Rotating stand and gun mount to achieve desired degree of freedom



NERF Gun

- Issues
  - Small
- RapidStrike CS-18
  - Relatively small
  - Cheap
  - Electronic

Controllers and Communication

Controller

- Issues
  - Speed, power, memory
  - Goal is to control turret motors and firing logic

- MBED
  - Good balance between speed, power, memory and cost
- Arduino
  - Memory quite low, extra cost and practical difficulties for no real gain

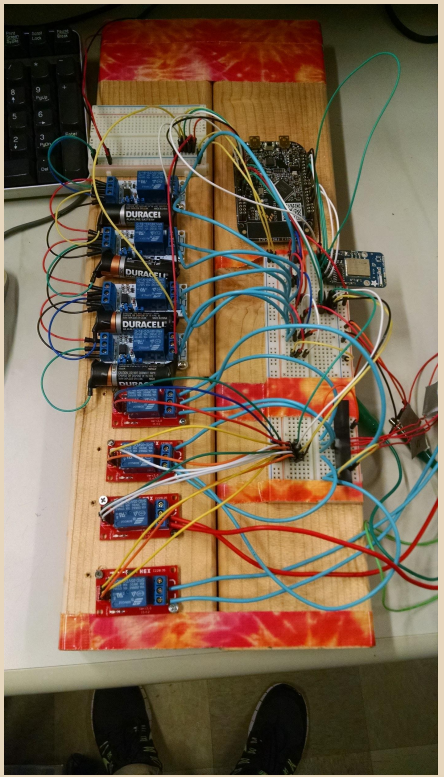
Wireless Communication

- Issues
  - Latency...not TOO important
- WiFi
  - A static target
  - Average latency ~60-100 ms
  - Implementation is simple for us

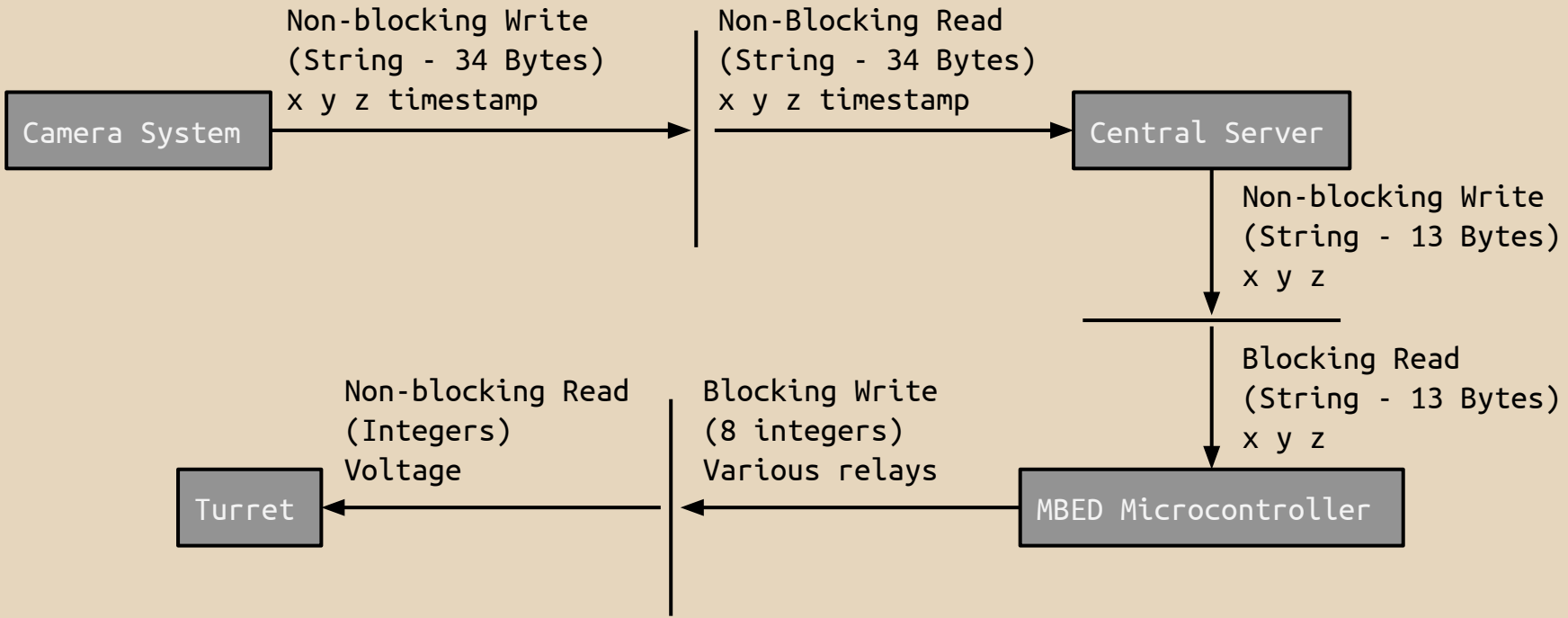
Not necessarily the optimal choice, but quickest to satisfy our requirements

Turret-Controller Interface

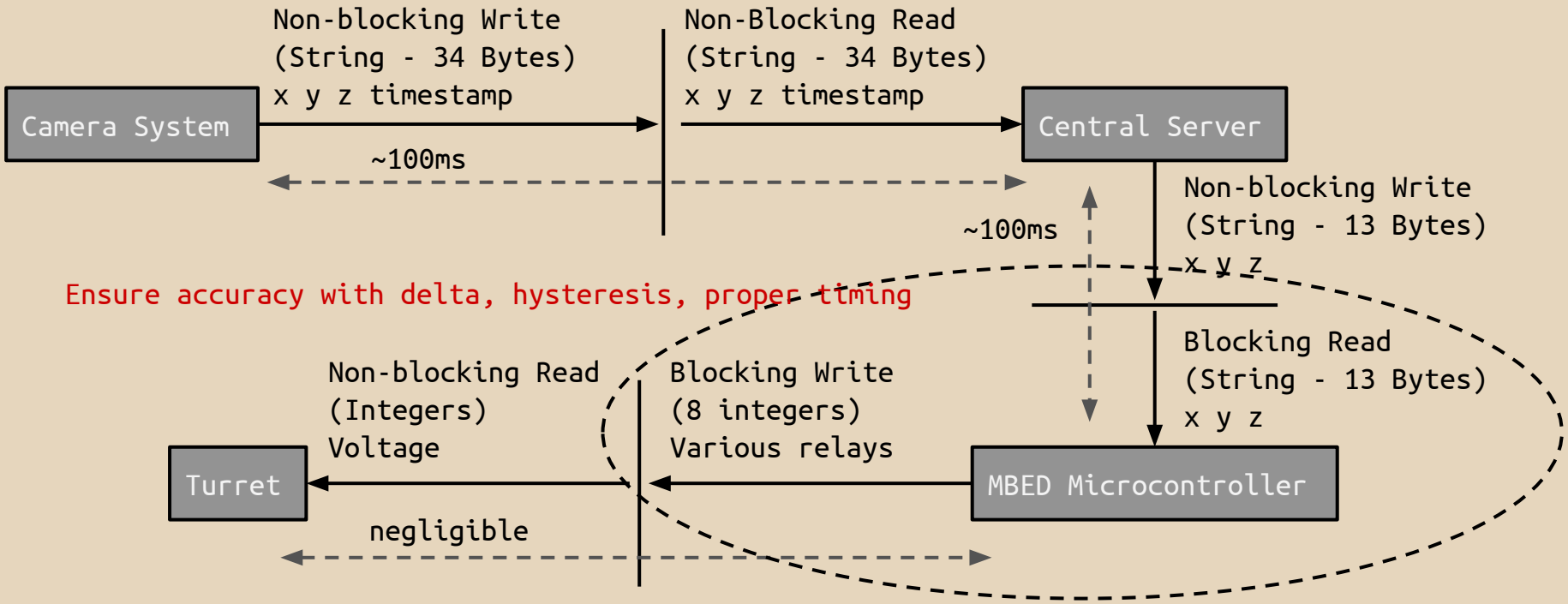
- 8 relays
  - H-Bridge DC motor control (4 relays)
  - Stepper Motor Full-drive (2 relays)
  - Turret triggers (2 relays)
  - Adafruit CC 3000 WiFi chip



Simple Process Network



Simple Process Network



Demo


Further Adjustment

Next Steps

- Revisit requirements
- Optimize form of communication
- Update hardware design
  - Meet updated requirements
  - Ideally be more flexible
- Downsize chip into a smaller form factor

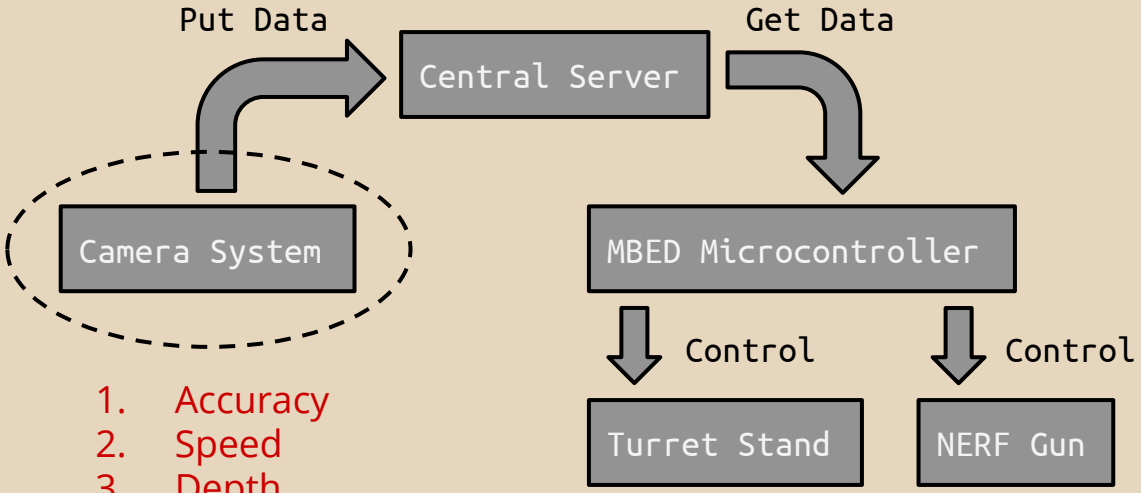
Thanks!

Sources

- OpenCV (BSD license)
- Mbed WiFi
- Intel RealSense Documentation

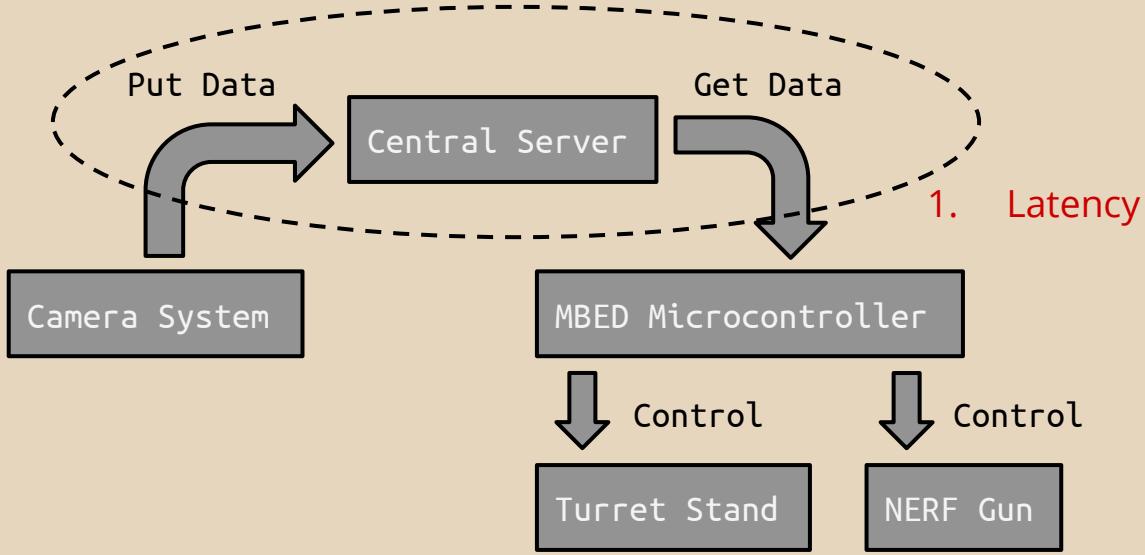
Appendix

High Level Model



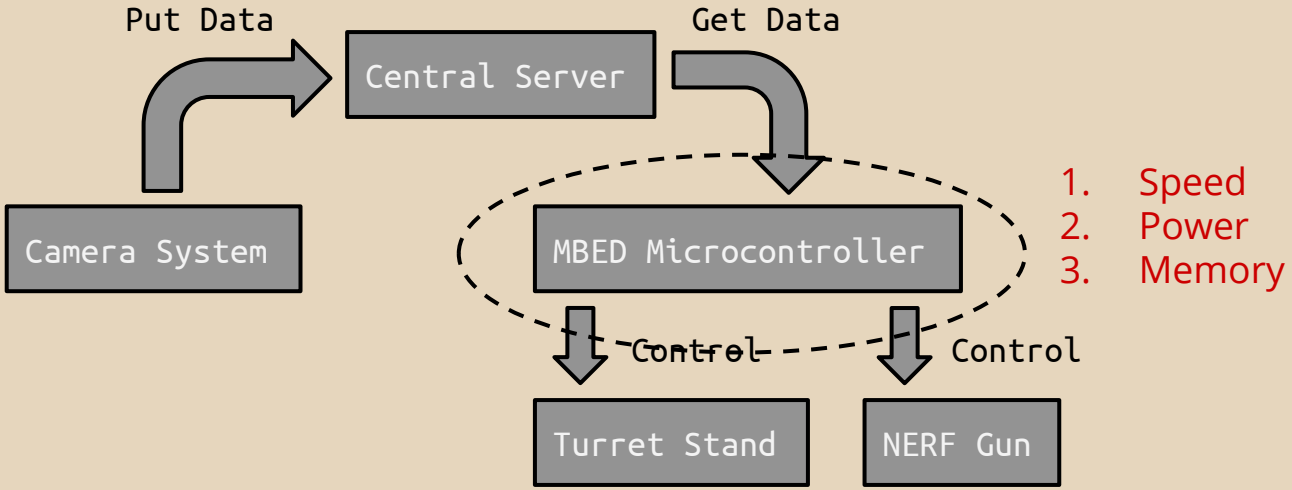
1. Accuracy
2. Speed
3. Depth
4. Small

High Level Model



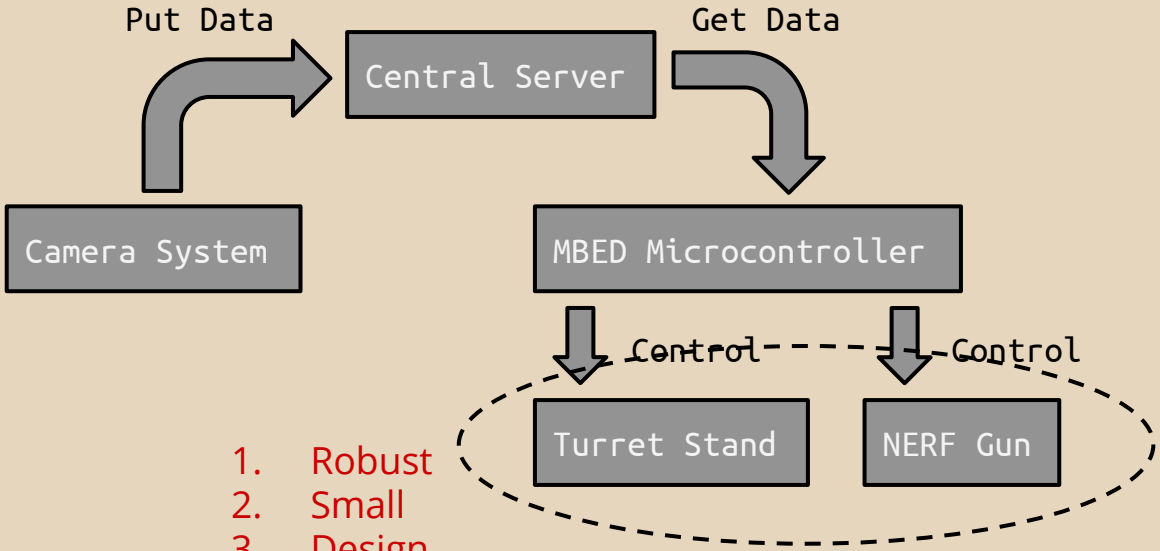
1. Latency

High Level Model



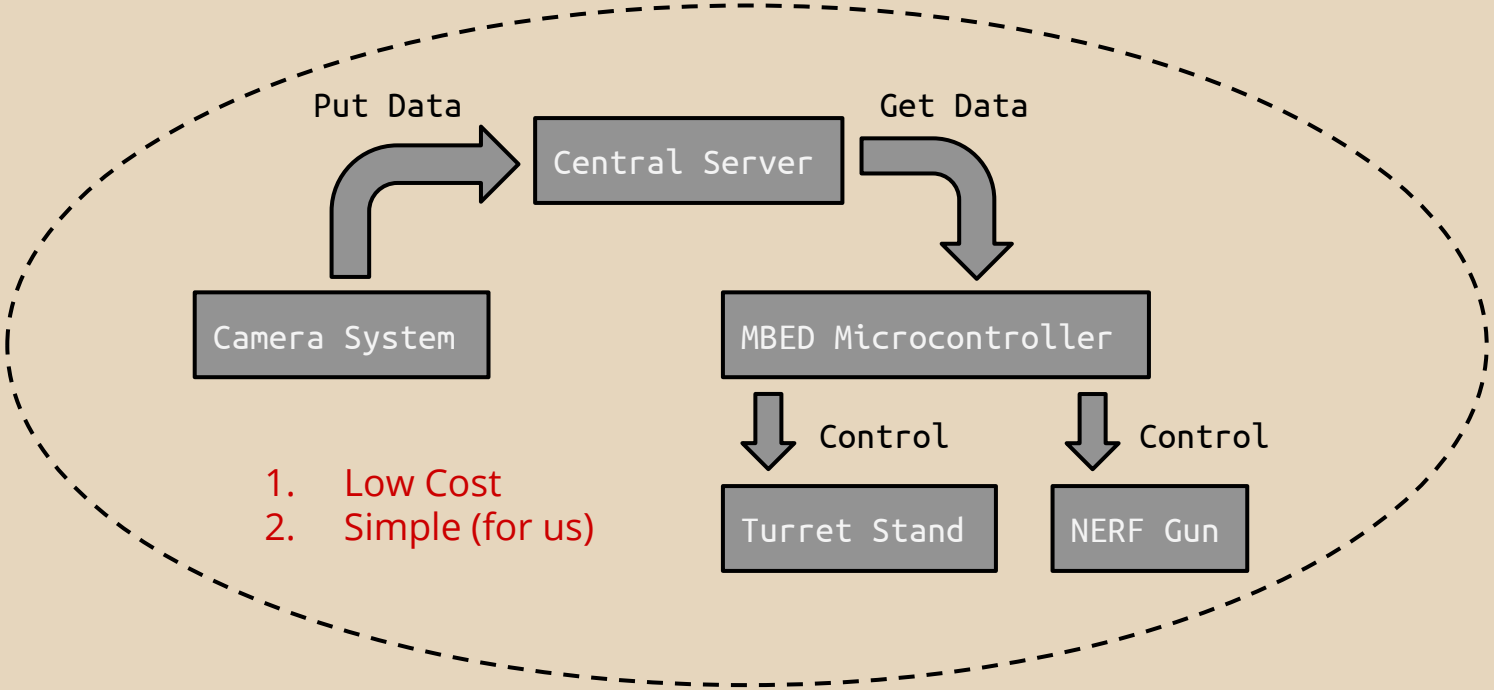
1. Speed
2. Power
3. Memory

High Level Model



1. Robust
2. Small
3. Design Requirements

High Level Model



1. Low Cost
2. Simple (for us)