

Android Enabled Camera Positioning system



Design Team 3

Chris Sigler

Yan Sidronio

Ryan Popa

Jeremy Iamurri

Austin Fletcher

Facilitator: Dr. Oweiss



Sponsor: Air Force Research Laboratory
Dr. Daniel LeMaster

Introduction

- AFRL needs an automated infrared camera positioning system
 - Points at specific GPS coordinates (latitude, longitude, and altitude) on a schedule
 - Used for studying infrared imaging technology and processing algorithms
- Systems such as this already exist
 - Requires manual GPS location entry
 - Manual landmark entry for orientation calibration
- Telescope systems require manual GPS/orientation calibration

Deliverables

- Tasked with designing this system controlled by an Android smartphone
 - Low cost
 - Sensors - accelerometer, magnetometer, GPS
 - Computing power and ease of use
 - Can communicate with a laptop to control infrared camera
 - Can capture context imagery and data
- Motorized camera mount
 - Tripod and infrared camera provided
- Must be able to point at specific GPS coordinates (latitude, longitude, and altitude) on a schedule
- Attached Android phone with control software
- Software for laptop to communicate with phone

Design Specs

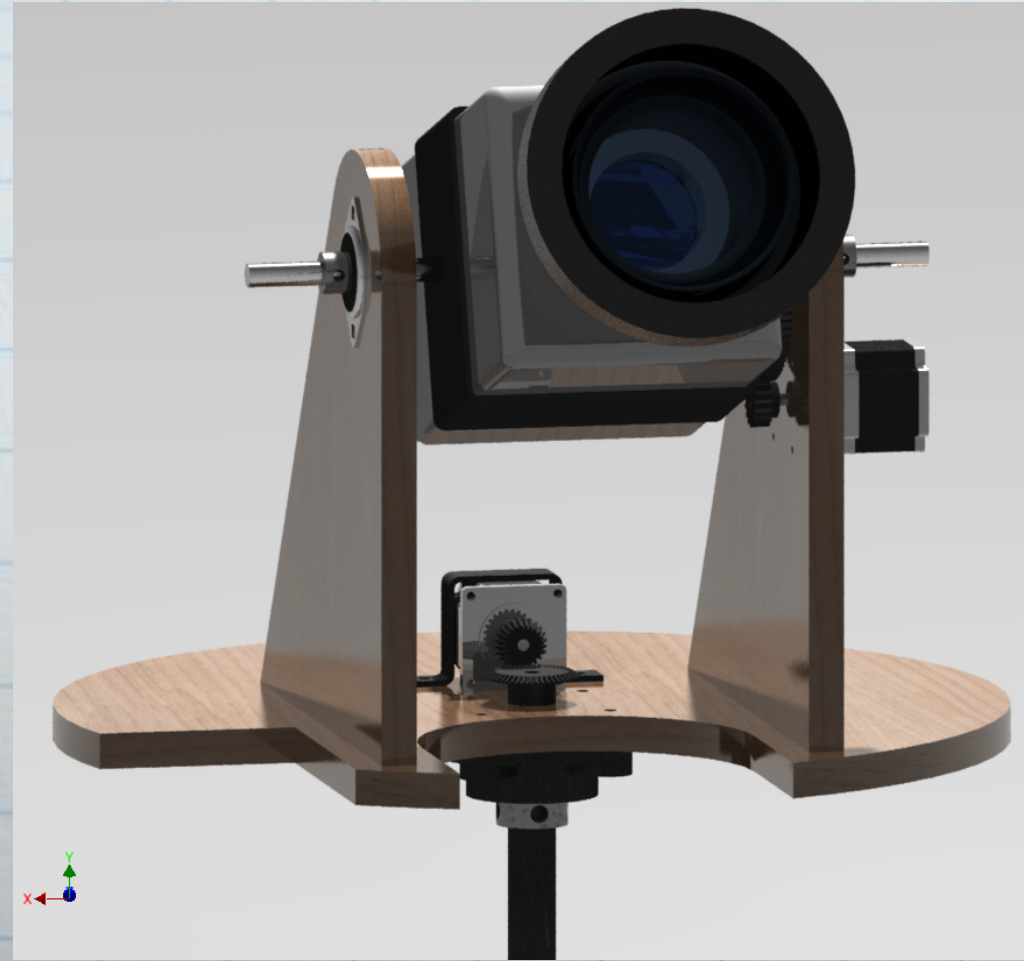
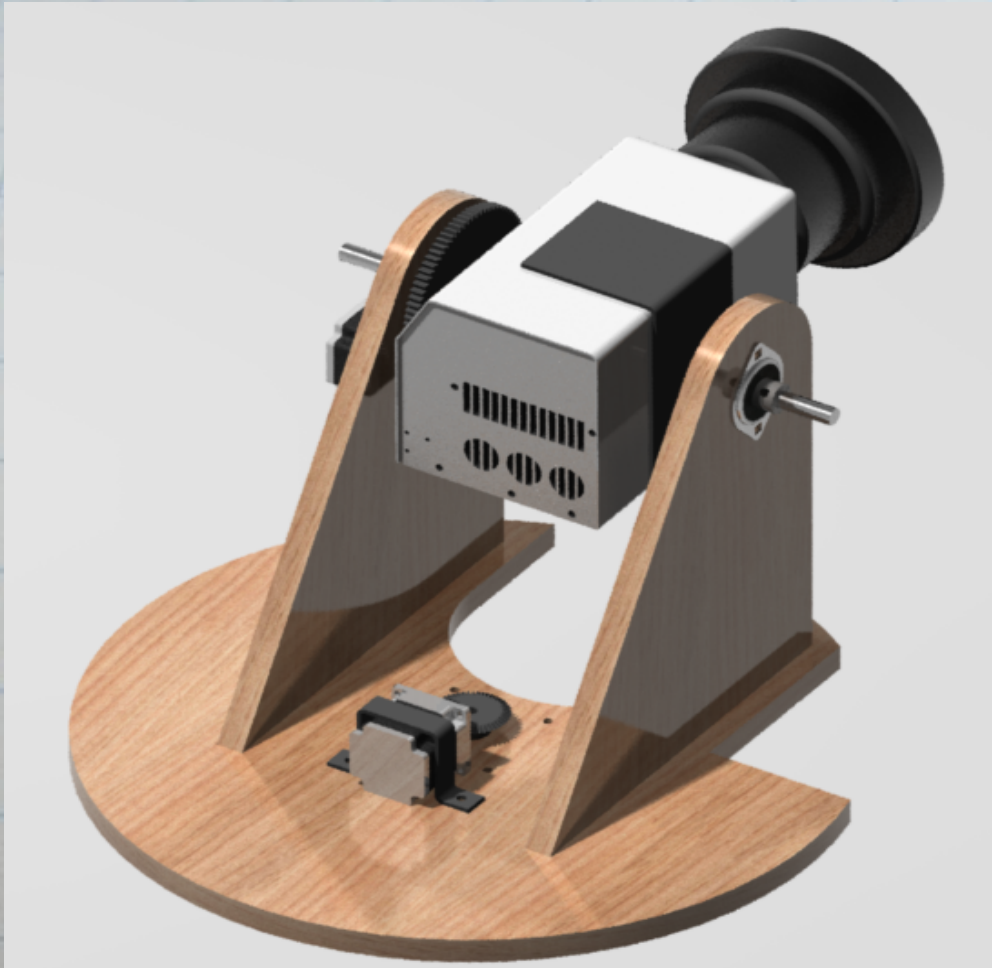
- AFRL Requirement

- Slewing between target points defined by GPS coordinates
 - Azimuth rotation between 0 to 360 degrees
 - Polar rotation between 0 to 90 degrees
 - Position mechanism able to take pictures
- Securing a 30 lbs load
- Taking as much advantage as possible of an Android phone
 - GPS, magnetometer, gyroscopes and accelerometers
 - Signal control and calculations
 - Infra-red camera imaging control signals

- Team Addendum

- Azimuth rotation between 0 to 720 degree
- Polar rotation between 0 to 180 degrees
- Mount sturdy enough to also do video.
- Avoid additional micro-controllers.
- Complete project under \$500

Conceptual Design

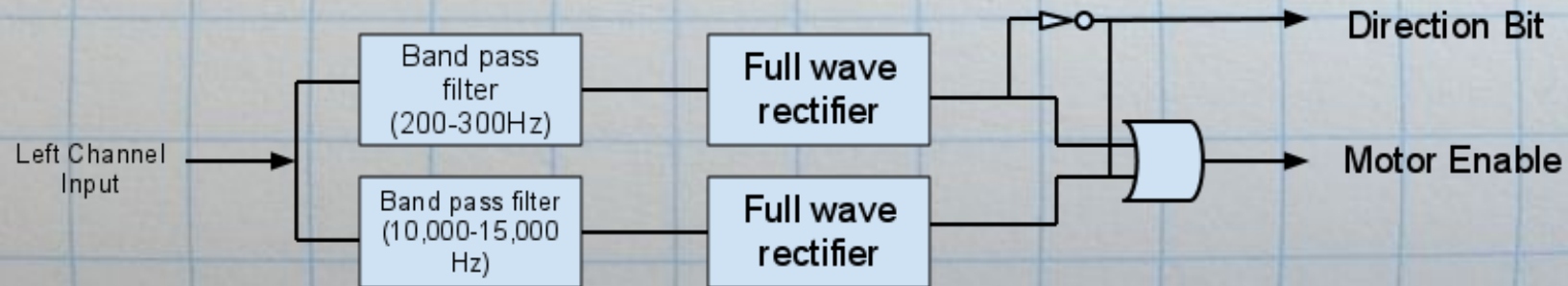


- Notches for looking straight down
- Stepper motors for holding torque, and precision

Control Method

Motor Control

- Use the headphone jack of the phone for motor control
 - Frees the USB for communication with the computer
 - Frequency will control forward or backward rotation
- Analog circuitry
 - Band-pass filters
 - 555 Timer for stepping motor



Single Channel Control Circuit
(Left channel will be used for azimuthal rotation)

Control Method cont...

Phone

- Read scheduling file from SD card
- Use GPS and digital compass to get current position and orientation
- Generate the correct frequency for motor control via the audio jack
 - One axis at a time
- Monitor current orientation until pointing in the right direction

Risk Analysis and Concerns

- Android Phone
 - Very limited physical I/O
 - Using wireless would complicate design
 - Wireless communication a potential risk
- Motor and mount
 - High torque motor required
 - Magnetic interference from motors
 - Need to find balance between speed, stability, and accuracy
 - Infrared sensor needs time to refresh
 - Camera costs \$40,000
- Power
 - Bulky power supply
 - Reliability

Project Management

Team Roles

- Austin - Project Manager - Motor control circuitry
- Ryan - Webmaster - Audio jack interface circuitry
- Yan - Presentation prep - Camera and motor mount
- Chris - Document prep - Location awareness and camera aim
- Jeremy - Lab Coordinator - File I/O and scheduling

Project Milestones

- Construction of camera mount - Friday
- Phone to motor interface circuitry - End of February
- Laptop control program - Mid-March
- Android Development - End of March
 - Output of signal to control circuitry - First week of March
 - File I/O and scheduling systems - Mid-March
- Final design integration and testing - First week of April

Budget

Our proposed budget based on current designs:

- Positioning System - \$200
 - Motors \$90
 - Gears \$35
 - Bearings \$40
 - Assorted parts \$35
- Electronics - \$100
 - Power Supplies \$50
 - Motor controllers \$50
 - Filters \$0
 - Logic circuitry \$0
- Android Phone - \$200

Questions?

Program flow

