emStart Sprint 1 Status Report

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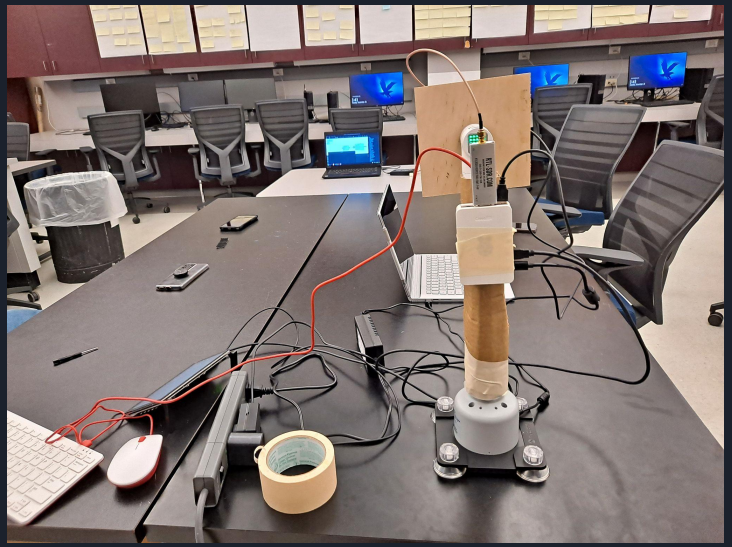
Project Introduction

Background

- Emulating system for an existing small radio telescope (SRT).
- SRT shall track a system in space.
- Must emulate Earth's rotation, as well as azimuth and altitude of SRT



Prototype set-up

Purpose

- Research
- Development
- Debugging
- Education

Example SRT

Design Considerations

- Assumptions:
  - Satellite transmits consistently
  - System in space stationary
- Earth emulator changed to 2-DOF arm.
- Do not interfere with radio frequencies.
- Simple design to be packaged for education purposes.
- Radio defined telescope hardware is predetermined.

Review of Last Semester

Climbing the Learning Curve

- Improved our understanding of the goal
- Researched the topics to complete the goal
- Planned out the execution of our tasks
- Implemented the design in hardware

Prototype

- Functional prototype
  - Demonstrates the motion of Earth and SRT
  - Does not implement actual SRT software
  - Uses different communication protocols
- Exposed planning flaws
  - Weight constraints
  - Testing limitations

What We’re Doing Different This Semester

Main Goals

1. Emulate the Alfa ROT2Prog controller using an Arduino
2. Run the current SRT software to control the motion of the ground antenna
3. Emulate the rotation of the Earth using custom software and the ROT2Prog interface
4. Emulate the signal strength based on the direction of the antenna

Software

- Integrate code changes into SRT software
- Use SRT software to control the antenna movement
- Write Arduino program to emulate the ROT2Prog serial protocol
  - Should control both pan-tilt mounts
  - Should determine the attenuation strength
- Write Python program to emulate the rotation of the Earth
  - Should include a user interface to simplify the process
  - User can control the current time of the emulation

Hardware

- Single Arduino receives commands to control Earth and antenna motion
  - Must use two fully independent serial interfaces
  - Must control the attenuator based on direction of antenna
- Attenuator added between antenna and SDR
  - Reduce signal strength when the antenna is pointing away from the object in space
- Two independent pan-tilts
  - Earth controlled by custom software
  - Antenna controlled by SRT software

Sprint 1 Accomplishments

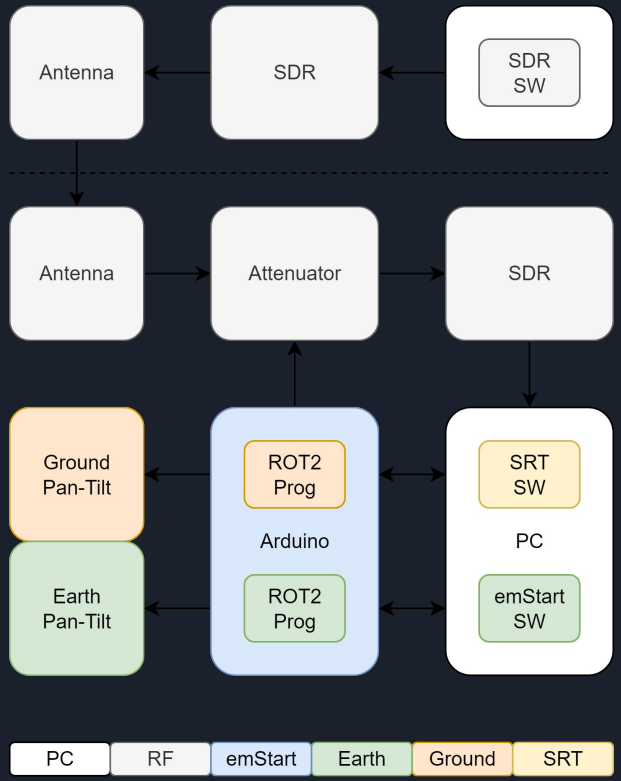
Hardware Acquisition

- Generated BOM
  - 2x SPT50 Pan-Tilts
  - 4x HS-55 Servos
  - 1x Attenuator
  - 2x USB breakouts
  - 1x Coaxial Cable
- Part Replacement
  - Shipping times made us find a substitution for the attenuator

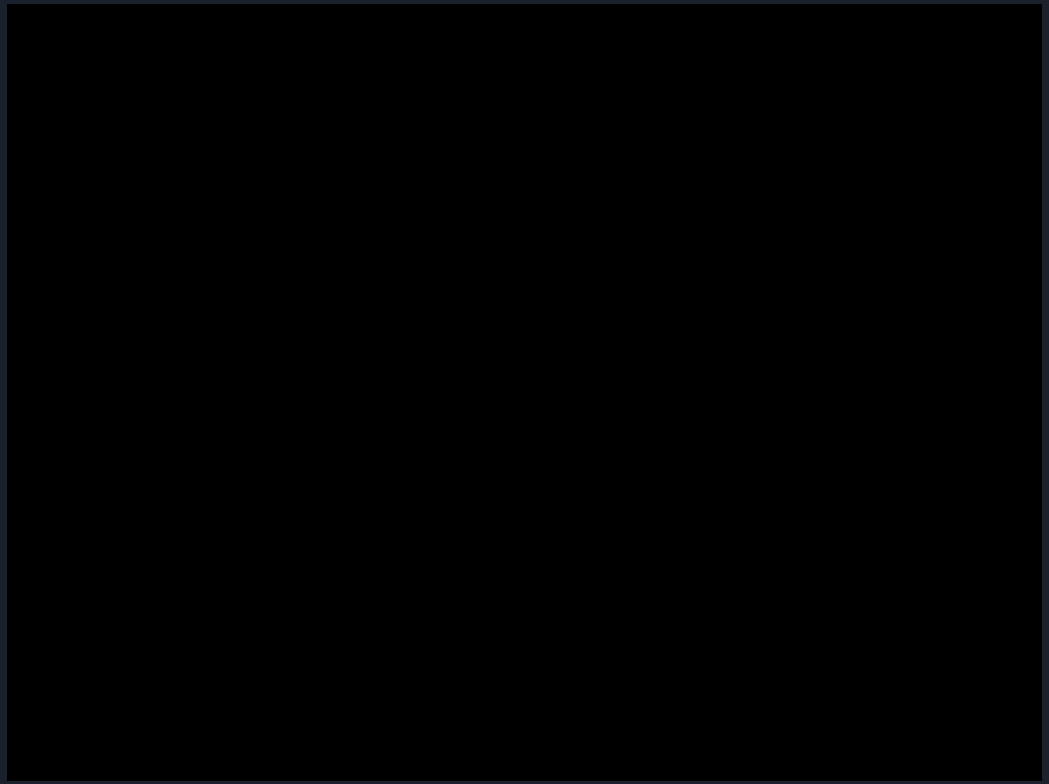
Item Name	Purpose	Item Link	Item Cost	Quantity	Total Item Cost
Attenuator	To reduce amplitude of in coming signals	https://www.walma	$13.18	1	$13.18
Coaxial Cable	to connect Attenuator to SDR	https://www.amaz	$9.99	1	$9.99
Pan-tilt	To move the antenna	https://www.serv	$19.99	2	$39.98
Servo	To move the antenna	https://www.servoc	$13.49	4	$53.96
Usb breakout	To connect Arduino to Attenuator	https://www.amaz	$7.99	2	$15.98
				Total:	$133.09

Bill of Materials (BOM)

System Hardware Architecture



Software Development



Our Plan for the Future

Project Timeline

Sprint 2 Goals

- Get the SRT software running
  - Make code changes
- Get the Arduino running
  - Receive commands
- Get the Earth software running
  - Process astronomy data
  - Send commands

Sprint 3 Goals

- Improve documentation
- Simplify code
- Improve SRT code
- Finely tune the attenuator
- Add Earth GUI features

Questions?

Thank You!