WINONA STATE UNIVERSITY

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HARDWARE .astronomy:

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Abstract

A Small Radio Telescope (SRT), originally developed by MIT's Haystack Observatory, was donated to Winona State University by Mayo High School in Rochester, Minnesota. The assembly includes a 2.3 meter dish with mount and motors that allow pointing over the entire sky. The SRT, unfortunately, has been weathered over years of exposure to the elements, and was absent all the electronics necessary for pointing and collecting data. Here we report our efforts to repair, replace, and refurbish the SRT for future undergraduate research. Specifically, the replacement of pointing hardware, the development of a motor control system and graphical user interface (GUI), and future work to implement a software defined radio (SDR) for detection of astronomical signals.

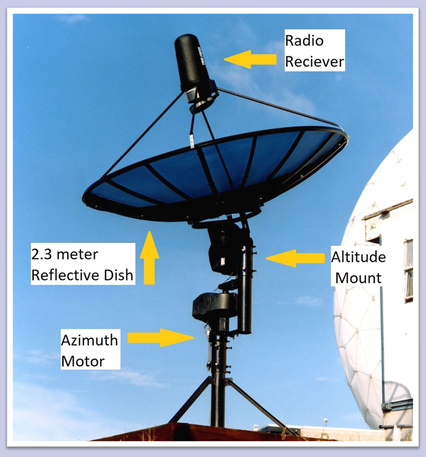


Figure 1: A fully assembled SRT with a similar design to our own.

Motors

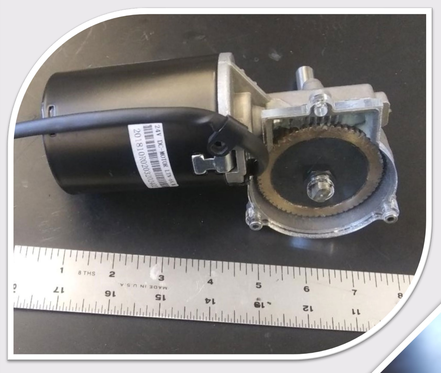


Figure 2: The two motors used to point the dish required replacement.

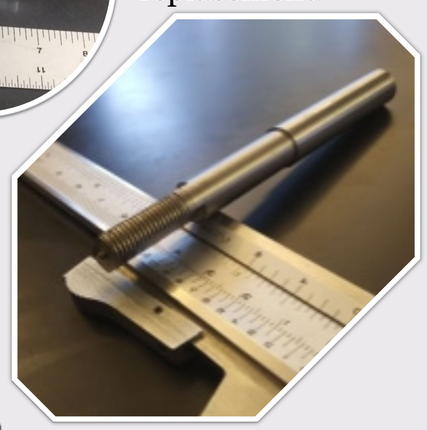


Figure 3: New gear shafts needed to be cut for the motors on a lathe to meet the specifications of the system.

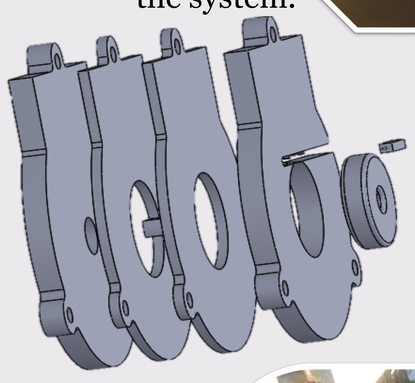


Figure 4: New non-magnetic covers are first modeled in Solidworks, then laser printed on a Glowforge.

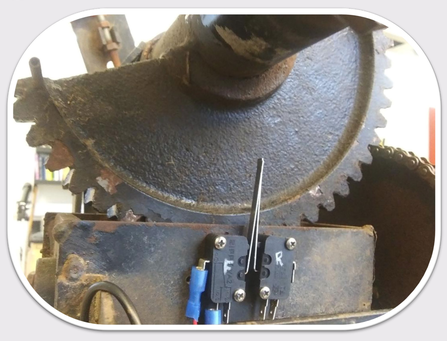


Figure 5: Two switches will limit the turning of the final conversion gear and assist in calibration.

Hall Effect Sensor

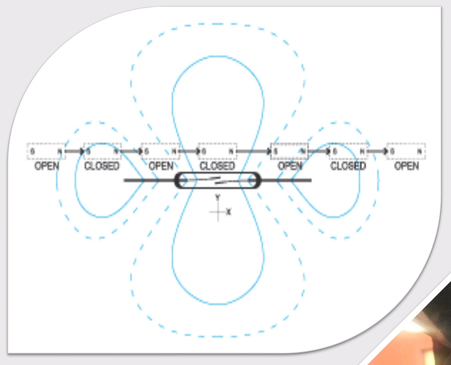
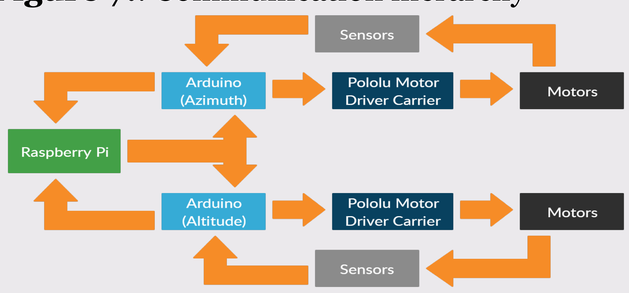


Figure 6: A reed switch in a circuit on the digital input port detects the proximity of a magnet.

Figure 7: An Arduino microcontroller will track the dish's direction by counting the pulses from the reed switch.

Figure 7:. Communication hierarchy



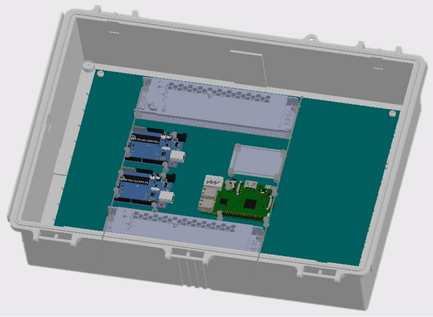


Figure 8: A water proof plastic box will house the electrical components required for the SRT's movements.

Figure 9: Running on the Raspberry Pi; a DashDAQ GUI has been created to allow for a user friendly interface to control the SRT operations. Taking inputs of Right Ascension and Declination the user can choose between several observation functions and see the trajectory of their object mapped on the local sky.

Future Work

- Further finalization and completion of the work presented here
- Implementation of an SDR for data taking
- Software to analyze information received by the SDR
- Astronomical observations to be made with this telescope

Figure 10: Example of and SDR that might be used on the SRT.

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astropy A Community Python Library for Astronomy
Dash DAQ
POWERED BY Raspberry Pi
ARDUINO
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