Project RT CS Report December '19

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1 Introduction

The CS Team is divided into two major parts:

1. **The Superficial Coding Team:** We specialize in working on creating modules based on "basic motion codes" created by the Team working basic motion of the dish using Stepper Motors. Their code moves the dish by one step angle (The minimum in the Stepper Motor) in both Altitude as well as Azimuth direction, either together or separately.

   We devise algorithms for both Tracking as well as Mapping to minimize power loss and to maximize accuracy.
2. **The GUI Team:** We specialize in making a GUI compatible with the 5-m dish, one that will be an easy-to-use interface. We will keep options for moving the dish to a specified angle, tracking and mapping. The GUI is coded on Python using PyGame module and will be interfaced to our codes using PySerial module. The data that is obtained will be stored locally for further data processing.

2 Work Completed

2.1 The Superficial Coding Team

The motion of the dish has two major components, a forward loop which moves the dish and a feedback loop which checks for the current position

of the dish and rectifies for any error in the forward loop.
The forward loop is guided by an Arduino Mega connected to two Stepper motors (with the appropriate torque to move the dish as precisely as possible) via their respective motor drivers. The Arduino stores the code and programs the motor drivers to move the stepper motor situationally.
The Feedback loop is guided by Optical rotary encoders. These are connected to the shaft of the motor and provide direct output via the Arduino about the position. Using these encoders, one can, before an observation, calibrate the dish (by pointing at Polaris, the Pole Star) and working with the Alt-Az coordinate system, do an observation.
Currently, the team has successfully worked and tested with the encoders, converting the 8-bit output to angles, in degrees.
They are now working on getting more familiarized with Arduino coding to work and develop on the algorithms. Basic motion codes are ready, but circuit connections are yet to be worked out and tested.

2.2 The GUI Team

The team, in the first few weeks, was getting familiar with Python and PyGame, creating basic and crude interactable windows. Once done, they are now working towards making a UML Diagram of the GUI and then will be implementing them. They have also written code to convert given RA-Dec (Right Angle - Declination, another type of coordinate system) to the coordinate system we are working on, the Alt-Az coordinate system.

3 Future Plans

3.1 The Superficial Coding Team

The Future Plans for the Team include:

1. Move both the motors based on the input W,A,S,D. (Immediate, to test for code efficiency and correctness)
2. Devise algorithm for Tracking for maximum accuracy. This will include handling both reaching the centre of the object from an initial position of the dish accurately and given the size/solid angle subtended by the object, get data for the entirety of the object as it moves across the sky.
3. Devise algorithm for mapping with minimum power loss. This includes mapping a given part of the sky as the entire section moves along with the Earth's rotation and minimize data loss. These type of observations will help in detecting Pulsars and similar objects.

3.2 The GUI Team

The Future plans for the Team include:

1. Making a UML diagram of the GUI (Immediate)
2. Efficiently storing data from observations for post processing
3. Interfacing the GUI with the codes using PySerial