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Self-Focusing Digital-Telescope

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***Abstract*- The outer space and universe are quite mysterious with star intrigues and we are fascinated about the deep sky objects, simulated eclipses, etc. But most of the time, as space enthusiast, we fail to identify and point each and every star in our night sky. Design a cost-effective device to make a star tracking system using an Arduino UNO and Stellarium. It also includes the processing of the image that is obtained from Stellarium, a free open source planetarium software. The telescope is self-focused by the Stellarium's positional instructions with the help of Arduino and Motor with Driver. There is a dual axis control for the telescope- azimuthal and altitude axis. Hence, these two directional controls will help the system for precise locating and focusing.**

***Index Terms*—Stellarium, Arduino Uno**

I. INTRODUCTION

In most of the cases, we are failing to recognize and focus each and every star in our night sky. Project designs a self-focusing digital telescope that is operated in auto-tracking for focusing particular star from my mysterious outer space. The self-focusing digital telescope by using **Stellarium** and **Arduino Uno** may help to solve with this. Generally, digital computerized telescopes are available in the market, but it may be high cost and non-customizable facilities [5]. The methodology aims to develop a cost-effective device for tracking stars in the far field in a simple way.

II. METHODOLOGY

The system design to self-tracking of stars by using Stellarium and Arduino Uno. The azimuthal–altitude axis controlled by motors. Users can also display stars and other celestial objects as seen from reference points other than the Earth or any other object by Stellarium's multi-lingual interface features zoom, time control, in-built scripting to record and playback shows, fisheye projection for planetarium domes, spherical mirror projection for personal domes, telescope control, equatorial and azimuthal grids, twinkling and shooting stars, simulated eclipses, landscapes and other deep sky objects [6].

Our main objective is to use that software and link it with our analogue telescope, so that whichever sky objects the user points by clicking on the interface of Stellarium the telescope rotates and points itself to that direction [1] by the help of Arduino UNO controlled Servo/Stepper Motors.

Fig.1. Digital Telescope

III. SETUP AND BLOCK DIGRAM

A. Setup Diagram

Figure.2 shows the coordinate data of the pointed object/star from the software „Stellarium" is fed back into the Arduino microcontroller where a necessary program is written to make the Motors connected to the telescope rotate in the specified direction and angles.

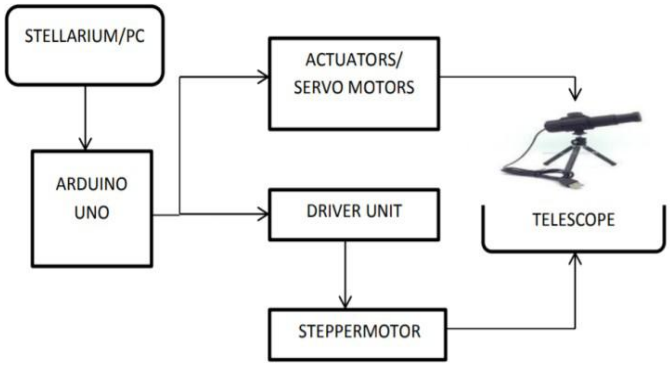

Fig.2. Block diagram of the setup

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Fig.3. Circuit Setup

B. Stellarium

Stellarium, an open source free software planetarium, for simulating the astronomical landscapes of the ancient stargazers. Here we will focus on the motion of the stars, or, more specifically of the "heaven of the Fixed Stars" that seems to turn about the "axis mundi" [2]. The Stellarium will helpful to locate the telescope in specified coordinates.

Fig.4. Stellarium software

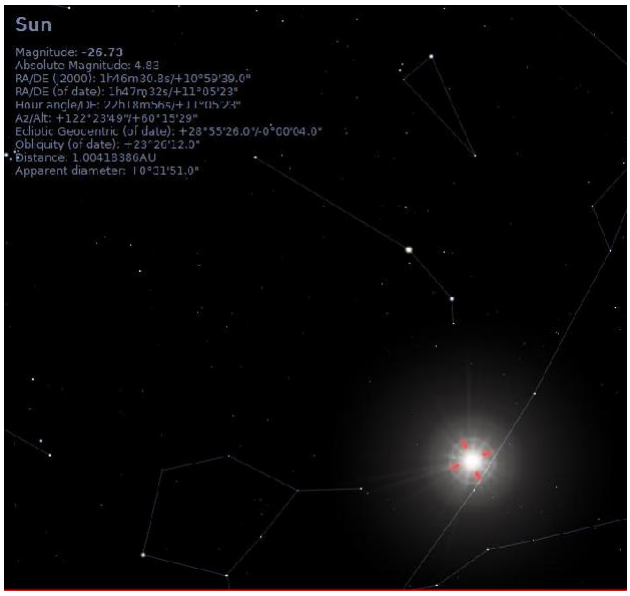

Fig.5. Locating Sun

Figure.5 shows the locational view of the sun with coordinate in azimuthal and altitude axis. The Arduino will direct the telescope to that direction.

C. Driver Unit

L293D Driver unit (Breakout Board) will make a connection with motor and Arduino Uno. The Microcontroller L293D is designed to provide bidirectional drive currents of up to 600-mA at voltages from 4.5 V to 36 V [7].

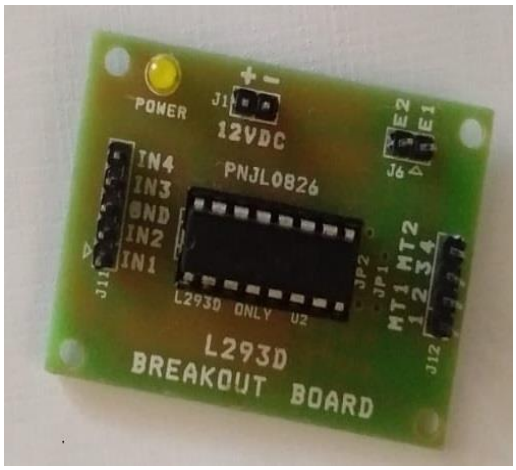

Fig.6. Breakout Board

D. Motors

Figure.5. Stepper motor with 6 wire connections and maybe Unipolar or Hybrid in nature. The stepper connection with driver will rotate the telescope in the specified location.

There are two types of stepper motors: the unipolar stepper motor and the bipolar stepper motor. A unipolar stepper motor has current flowing through each of the coils in a single direction, and the bipolar stepper motor has current flowing in both directions of the coil [8].

Fig.7. Stepper Motor

E. Arduino Uno

Arduino Uno with microcontroller Atmega328P is an open source prototype platform with hardware and software. The board provides potential to driver unit and motors.

Fig.8. Arduino Uno

IV. CONCLUSION

The self-focusing digital telescope will accurately reduce errors and makes a precise angular resolution. Digital-Telescope can point the stars by two directional controls in each and every time with the help of real-time Internet of things (IoT). Hope, this design will encourage space enthusiasts to learn easily about space and star intrigues.

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