BOARD FOR DOBSON PUSH-TO TELESCOPE

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A Dobson Push-To telescope is constructed with a simple azimuth mount that is easily removable and portable. It is originally without motor, and it is the user who moves it manually to point to celestial objects, hence the name "Push-To".

The goal of the project is to allow a DOBSON telescope to communicate wirelessly via Bluetooth link with an Android tablet or smartphone.

When the user manually moves the telescope, we see a target moving on a celestial map on the screen of the tablet and which indicates where the telescope is pointing in the sky.

The app contains a list of many celestial objects in the solar system and the deep sky and helps to easily find these objects in the sky.

To complete the project, the user must install two position encoders on his Dobson, one for the azimuth and one for the altitude, then connect these encoders to the board which contains two Skypikit, an Arduino Nano and a Bluetooth module. Compatible position encoders can easily be found on the internet.

This project is still in development. The electronics are complete and functional but there is still the Android application to be completed (during year 2020).
The project can be applied to all types of Dobson telescopes with manual movement, both large with 600 mm mirrors and small with 100 mm mirrors.
Although the project can be applied to large telescopes, we used a small 114 mm diameter Dobson Lightbridge with a F/4 focal ratio to more easily develop the project and give demonstrations. This document contains all aspects of modifications to this mount in addition to the description of the board.
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Contents of the board

- Connector for azimuth encoder
- Connector for altitude encoder
- SKYPIKITS
- JY-MCU Bluetooth Module
- Regulators
- ARDUINO NANO
- +12V_IN
- 5.0V
- 3.3V
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Electronic diagram of the board
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Component identification
A full signal quadrature encoder provides a signal that alternates between 0 volts and 5 volts during rotation. The connection of this type of encoder is very simple. Just connect the 4 wires from the encoder to the corresponding connector on the board.

Warning: you must use an encoder which works with 5 volts.
A quadrature encoder with open collector or open drain requires adding pull-up resistors between outputs A and B and the 5-volt line so that the signal can alternate between 0 volts and 5 volts during rotation.

**Warning:** you must use an encoder which works with 5 volts.

The azimuth encoder connects in the same way but in the AZIM connector.

Example of an open collector rotary optical encoder.
10K pull-up resistors and a 4-pin male connector were added to a small development mounting plate to make the encoder connector.

The rotary encoder is a Chinese encoder costing around $25 found on Amazon. It works with a supply of 5 to 24 volts.

It provides 600 pulses per revolution, therefore 2400 steps of quadrature per revolution.
The 135-tooth pulleys and the encoder supports were made of PLA-PLUS plastic with a 3D printer.
The pulley on each axis of the mount has 135 teeth.

The pulley on each encoder has 36 teeth.

The multiplication ratio of the belt-pulleys is $\frac{135}{36} = 3.75$.
That is, the encoder rotates 3.75 times faster than the axis of the mount.

The encoder supplies 600 pulses per revolution, therefore 2400 steps of quadrature per revolution.

There are therefore $(2400 \times 3.75) = 9000$ steps of quadrature per $360°$ turn of the axis of the mount.

Each encoder step is therefore equivalent to $\frac{360°}{9000}$, or 2.4 minutes of arc.
This is equal to around 8% of the diameter of the Moon.

It is more than enough to find a celestial object with this little Dobson who has a field of at least $2°$ with an eyepiece of 24 mm focal length.

For a larger telescope, you can use an encoder with higher resolution and choose a different multiplication of gears.
By adding a 3000 mA lithium battery, the telescope becomes completely autonomous. In testing, the battery was still 75% charged after 4 hours of use.
To complete the project, an ANDROID tablet application will allow the Dobson telescope to communicate via Bluetooth link with the tablet.

The app will contain a list of many solar system and deep sky objects.

Tools will allow you to easily point these objects with your telescope, even those that are too weak to be visible to the naked eye.

It will be enough that the mount is well aligned on at least two stars for everything to work.

A target will indicate where the telescope points on a celestial map.

The app is scheduled to be available during the year 2020.

Check this document again to know the progress of the project ...
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