Artificial Intelligence and Robotics Driven Moving Telescope for Celestial Objects Observation

Mr. Fakruddin Mohammed
fam281@g.harvard.edu

Motivation

It was April 2019, peak Indian summer, I took my family to a 3 nights astronomy night sky star gazing holidays in remote holiday resort in the Kavalur forest region of Tamil Nadu state. We stayed in a small holiday resort which is very popular amongst keen astronomers because the resort has a powerful electronic telescope for night sky star gazing. For first time my life I seen all three big planets: MARS, Jupiter and Saturn. It was a thrilling experience to me and to my family which spurred interest in the Astronomy.

Problem Statement

The telescope at holiday resort was electronic; which means, once a planet position is locked in Telescope eyepiece, both telescope body and planets movement is synchronised and for hours that planet is visible. But on the last night of our holiday trip there was a power cut in the holiday resort, therefore, we had to operate the telescope in manual/mechanical mode which was very painful as : (a) spotting the celestial object requires precision calculations and (b) the celestial objects were moving at high very speed and keeping them in telescope view requires constant adjustments of the eyepiece and focus tube. This is when I thought wouldn't be nice if we had a moving telescope which moves and keep tracks of celestial object mechanically. Here is the small prototype of what I dreamt that night.
As a prototype I built a small robot car which has GPS, Raspberry PI mounted on it and it listens for voice commands received from Google Assistant and serves: (a) the details of celestial object, (b) gives the co-ordinates of celestial object and (c) the car position itself at a given GPS location in the direction of the celestial object.

Technology

The following software stack is used to build the device.

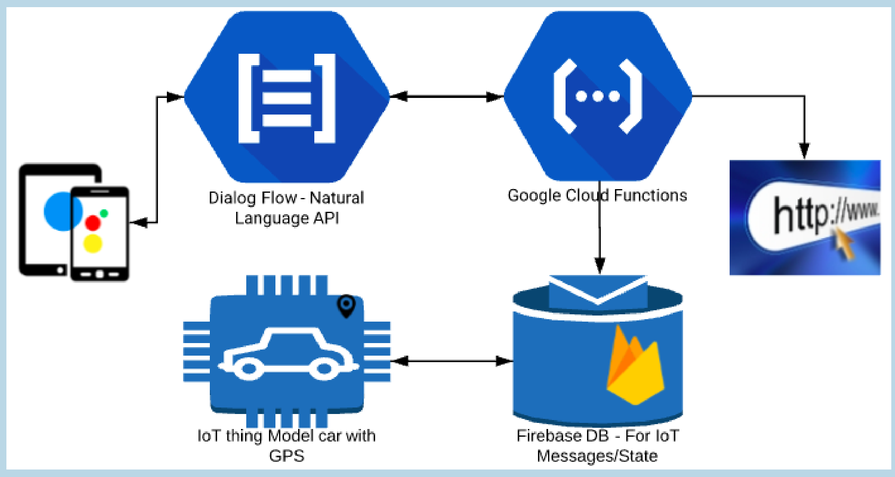
- Python 3.6
- Requests (TCP/IP)
- Crypto (Authentication)
- Dialogflow (NLP)
- Google Cloud Platform (Backend)
- Firebase (IOT State)
- Beautifulsoup (Webscraping)

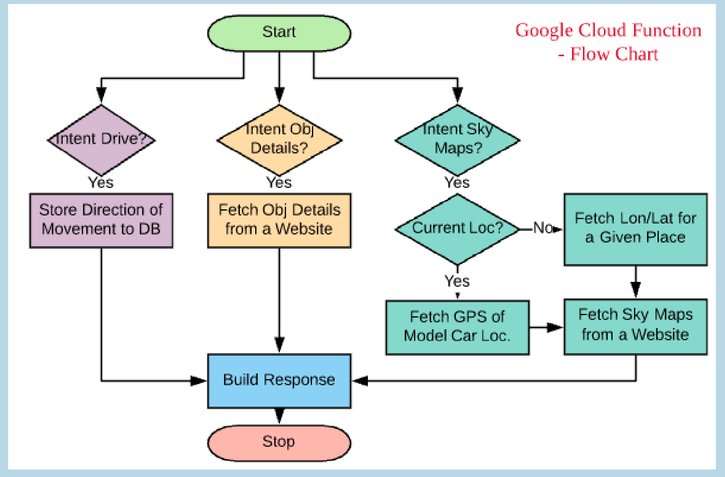
Hardware

The following hardware components are used to build the Robotic voice activated car along with GPS module to find the vehicle coordiantes.

- Raspberry Pi B+
- Makerhawk GPS Module 51
- Android/IOS Enabled Device
- Model Car 2WD
- Motor drivers (L298 Duabl Bridge)

Architecture



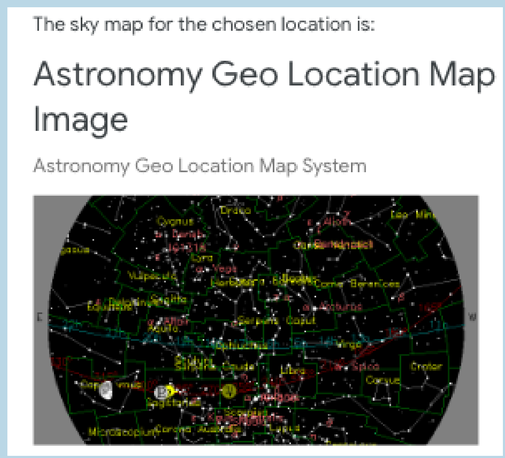


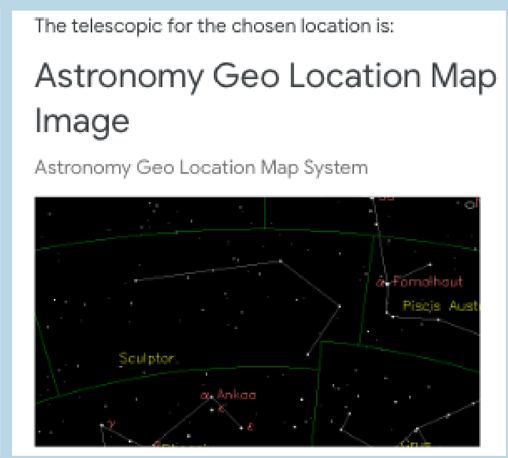
Data Flow, Current Status and Next Steps

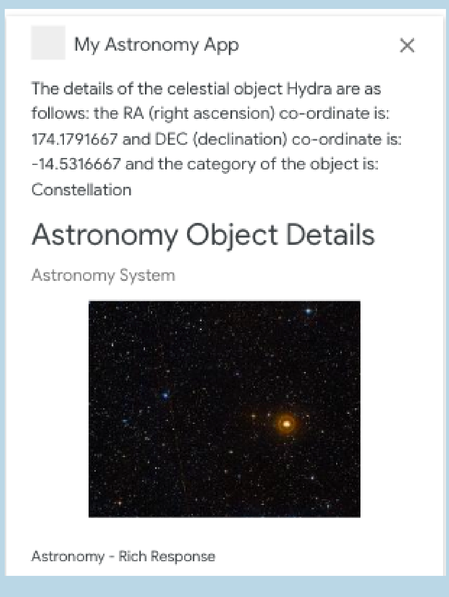
End to End Data Flow The user can have human like conversation with the device by speaking into Google Assistant enabled handheld devices. The user has choice to ask the device any of the following three:

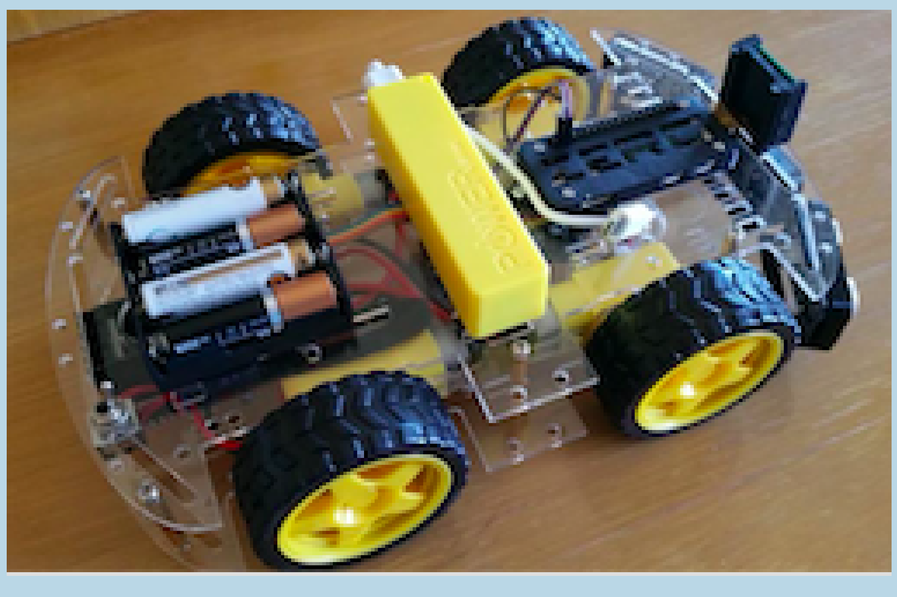
- Issue voice command to drive the model car
- Ask for details of 500+ clusters, constellation and stars
- Ask for sky or horizon or telescopic night sky maps

A function written in python language and deployed on Goolge Could Platform (GCP) is listening to all input requests from Dialogflow (NLP API platform), performs the web scraping [1][2] and responds back to the user with the requested details.









Current Status Using the Software (AI-NLP, Google Cloud Platform) and hardware (2 wheel driven model car equipped with GPS module) a low cost one-stop platform is successfully built where the user can ask for moving telescope platform to retrieve the details of celestial and localised maps.

Next Steps Enhance the platform to add more celestial object catalogues.

References

[1] Stuart Lowe's Website: `http://www.strudel.org.uk/lookUP/`, this website provides all the details, categories and image of stars, constellation and clusters (2017).

[2] John Walker's Website: `http://www.fourmilab.ch/`, this website provides the sky, horizon and telescopic map for a given location (2019).

YouTube URLs Github Repository

- 2 minutes video: `https://youtu.be/iwlGUlOnOzk`
- Github Repository: `https://github.com/mohammed-fakruddin/NLPDigitalAssistantForAstronomy`