



# Radio Telescope

## Astronautics Club - Project Proposal

International Institute of Information Technology, Hyderabad



*Respected Sir/Ma'am,*

We, the members of the Astronautics Club, are excited to propose a project to build a small-scale low-cost radio telescope. This project aims to provide hands-on experience in a range of inter-disciplinary domains, including electronics, computer science, signal processing, and radio astronomy.

## Project Overview:

Through this project, we aim to build a small-scale radio telescope that can be assembled and operated by students primarily for experimental and educational purposes.

The initial objective is to detect strong and reliable sources such as the Sun, the artificial satellites, the Milky Way, etc. As the project progresses, we aim to improve the sensitivity and resolution of the telescope to detect weaker sources.

Our design and methodology will be guided by well-documented open-source radio telescope projects, like - CHART [1] and Project RT [4]

The telescope system will consist of the following modules:

- Antenna system: A parabolic dish antenna & a custom feedhorn
- Signal conditioning chain: LNA & bandpass filters
- A Software-Defined Radio (SDR) receiver: RTL-SDR with a dipole antenna
- Data acquisition and processing System : GNU Radio and Python-based tools

## Project Impact:

- Foster interdisciplinary collaboration among students in electronics, computer science, and radio astronomy
- Develop hands-on experience in antenna theory and design
- Enable exploration of signal processing techniques using tools like GNU Radio and Python
- Enhance research and analytical skills through data collection, processing, etc.

In the following sections, we share our implementation timeline and potential future improvements. We welcome suggestions and collaborations to make this project a valuable learning experience for all involved.

## Key Components:

1. **Antenna System:**
2. **Signal Conditioning Chain:**
3. **Software-Defined Radio (SDR) Receiver:**
4. **Data Acquisition and Processing System:**

## Project Timeline

### Phase 0: Initial Research & Design

- Research existing radio telescope designs and their components
- Identify suitable materials and suppliers for the project
- Create a detailed project plan with milestones and deliverables

### Phase 1: Research & Planning

- Study radio telescope designs, focusing on HI-line detection and planetary emissions
- Develop a detailed blueprint for the antenna, receiver, and data pipeline
- Estimate budget and procure required components

### Phase 2: Construction & Assembly

- Build the parabolic dish and feedhorn system
- Assemble the LNA, filters, and SDR receiver setup
- Perform initial system integration and debugging

### Phase 3: Testing & Calibration

- Test the system using terrestrial radio sources
- Conduct celestial tests and compare signals with public datasets
- Calibrate the telescope for accurate measurements
- Optimize performance through iterative refinements

### Phase 4: Data Collection & Analysis

- Implement data processing techniques to extract meaningful information
- Document findings and prepare presentations for the club

- Schedule and conduct observation sessions, beginning with the Sun

Other timeline :

1. Literature survey and component procurement
2. Mechanical design (Dish setup and feedhorn)
3. Electronics setup (LNA, Filter, etc.)
4. SDR configuration and testing
5. Data collection and analysis
6. Final testing, documentation and future enhancements

## Bill of Materials: Radio Telescope Project

The following table outlines the estimated components required to construct the small-scale radio telescope.

Component	Specification	Estimated Cost (INR)	Supplier Link
Aluminium Foil adhesive tape	-	200	Amazon
Aluminium Foil	-	400	Amazon
Cardboard Sheets	4 36" x 48"	500	Amazon
Coaxial Cable	-	-	Amazon / Local
SMA female connector	-	790	Amazon
SMA male to male right angle connector	-	-	Amazon
male to male & female to female connectors	-	-	Amazon
RTL-SDR with Dipole Antenna Kit	-		Amazon
RTL Dongle	-	8450	Amazon
TATA Sky Set up (Reflector Parabolic Dish, the mount attachment, LNB and set-top box)	-	5000	Link

Table 1: Estimated costs

# Bibliography

- [1] CHART (Completely Hackable Radio Telescope)  
[https://astrochart.github.io/telescope\\_design](https://astrochart.github.io/telescope_design)
- [2] NASA's Radio Jove Project  
[https://radiojove.gsfc.nasa.gov/radio\\_telescope/building\\_testing.php](https://radiojove.gsfc.nasa.gov/radio_telescope/building_testing.php)
- [3] CBSS Nsukka  
<https://astro4dev.org/nigerian-project-develops-diy-low-cost-radio-telescope-for-teaching/>
- [4] Project Radio Telescope - BITS Goa  
<https://projectrtbits.wordpress.com/>
- [5] MIT Haystack Observatory  
<https://www.haystack.mit.edu/haystack-public-outreach/srt-the-small-radio-telescope-for-education/>
- [6] IEEE Penn State Harrisburg  
<https://edu.ieee.org/us-psu/2024/01/20/radio-telescope-project/>

## To-do:

- complete the bill of materials table with actual working and reliable links
- format the doc in a better way
- complete the key components and project timeline
- add few images of what can be expected from the project (use Project RT images as reference)
- highlight the research benefits
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Thank you for considering our proposal. We look forward to your support and are happy to provide any additional details or clarifications as required.

Sincerely,

Name

On behalf of the Astronautics Club

Department and Year

Contact info