Development of Nano satellite for Education in Indoneisa

Riza Muhida

SURYA UNIVERSITY

Presented at **he 22nd Session of the Asia-Pacific Regional Space Agency Forum (APRSAF-22), Bali, Indonesia, December 1-4, 2015**

Presentation Outline

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SURYA UNIVERSITY

Abstract

Surya University students and lecturers are taking up the challenge to design and develop the first prototype of a Indonesian university nano satellite, (SuryaSat). The mission of this project is to achieve scientific and educational objectives in development of lab scale nano satellite.

Using provided modules and a combination of self-designed payloads will initiate students to become creative and practicing an engineering environment system as well as the components connection of a nano satellite.

The process of this project has been done through basic design and Engineering model. The nano satellite has been tested use High Altitude Balloon and results shows that telemetry, GPS and data communication have been work well based on design objective.

Background

- The initial idea of the project based from our observation that most of the famous universities worldwide have initiated projects to develop micro and nano satellites.
- The design and building of a nano satellite provides an excellent opportunity to integrate and apply the knowledge and skills acquired through the study of engineering.
- Although micro and nano satellites are physically very small, they are nevertheless complex and exhibit virtually all the characteristics of a large satellite - but in a microcosm. With design a nano satellite also can give opportunity to know how to design a large satellite.

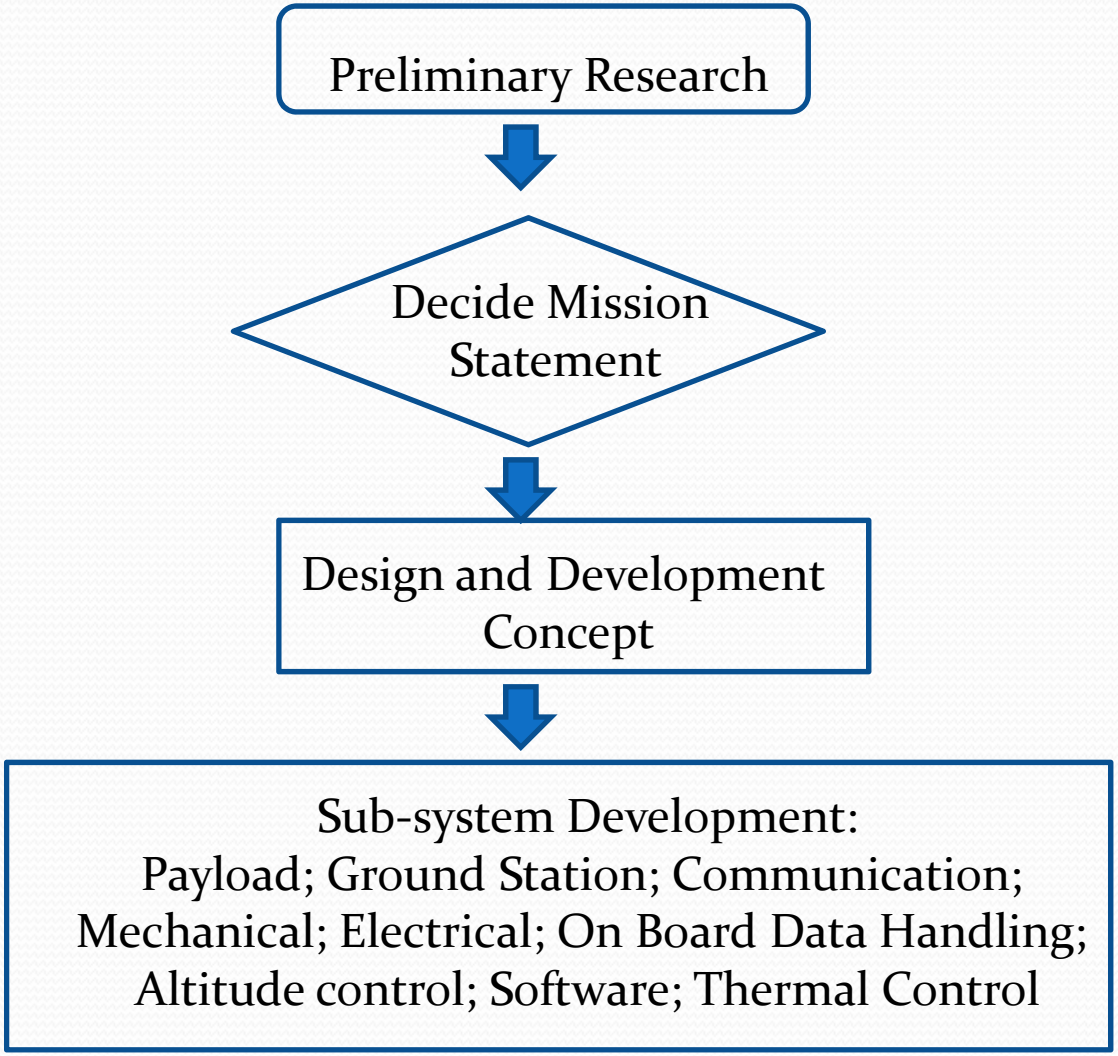
Objectives

- Provide students and lecturer the opportunity to learn, design, develop and build nano satellite systems to suit the mission. And involve in satellite construction.
- To create a platform for future scientific space missions and technology development.

Project Scope

- The project mainly focuses on designing a nanosatellite (to be named SuryaSat).
- Mission of this satellite is to test telemetry data in satellite and send to ground station.
- Test a system communication and repeater to send and receive a short data (like SMS) between 2 ground stations.

Methodology

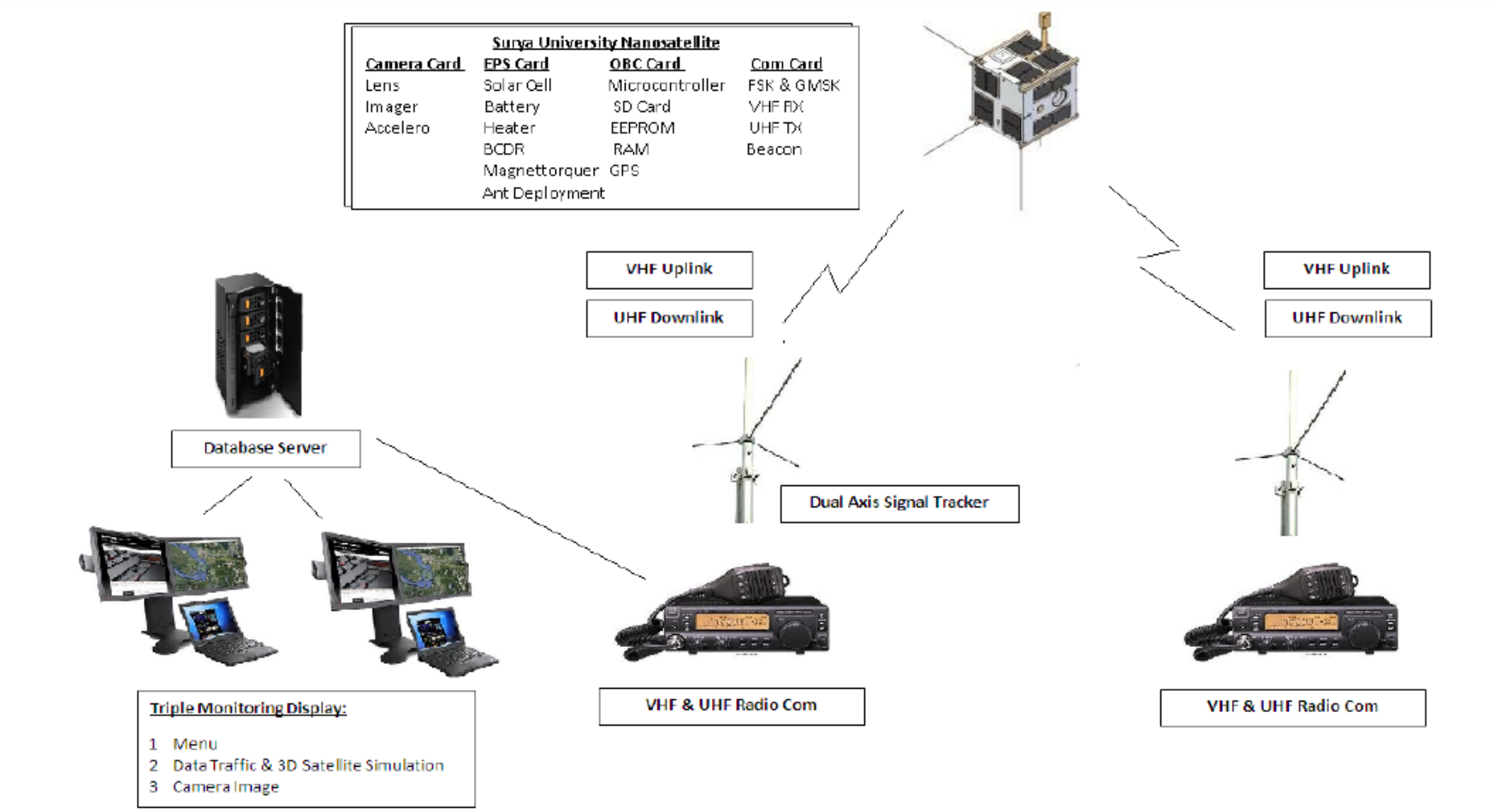


Involving the students, in workshop organized by LAPAN and ORARI

No	Tanggal	Jenis Kegiatan	Tema
1	31 Januari 2015	Workshop	Menyolder APRS Kit Test APRS Tracking
2	28 Februari 2015	Workshop	Teori dan Pembuatan Antena Fox Hunting dan Memperingati Hari Radio Dunia (World Radio Day 2015).
3	21 Maret 2015	Workshop	Desain antene dengan Komputer
4	25 April 2015	Workshop	Mendesaian Payload untuk High Altitude Balloon
5	30 Mei 2015	Workshop	Merakit Payload untuk Balloon
6	29 Agustus 2015	Workshop	Menginstal APRS Tracker
7	26 September 2015	Workshop	Meluncurkan Balloon ARHAB
8	31 Oktober 2015	Workshop	Komunikasi dengan satelit LAPAN-ORARI A2 (Data dan Voice)

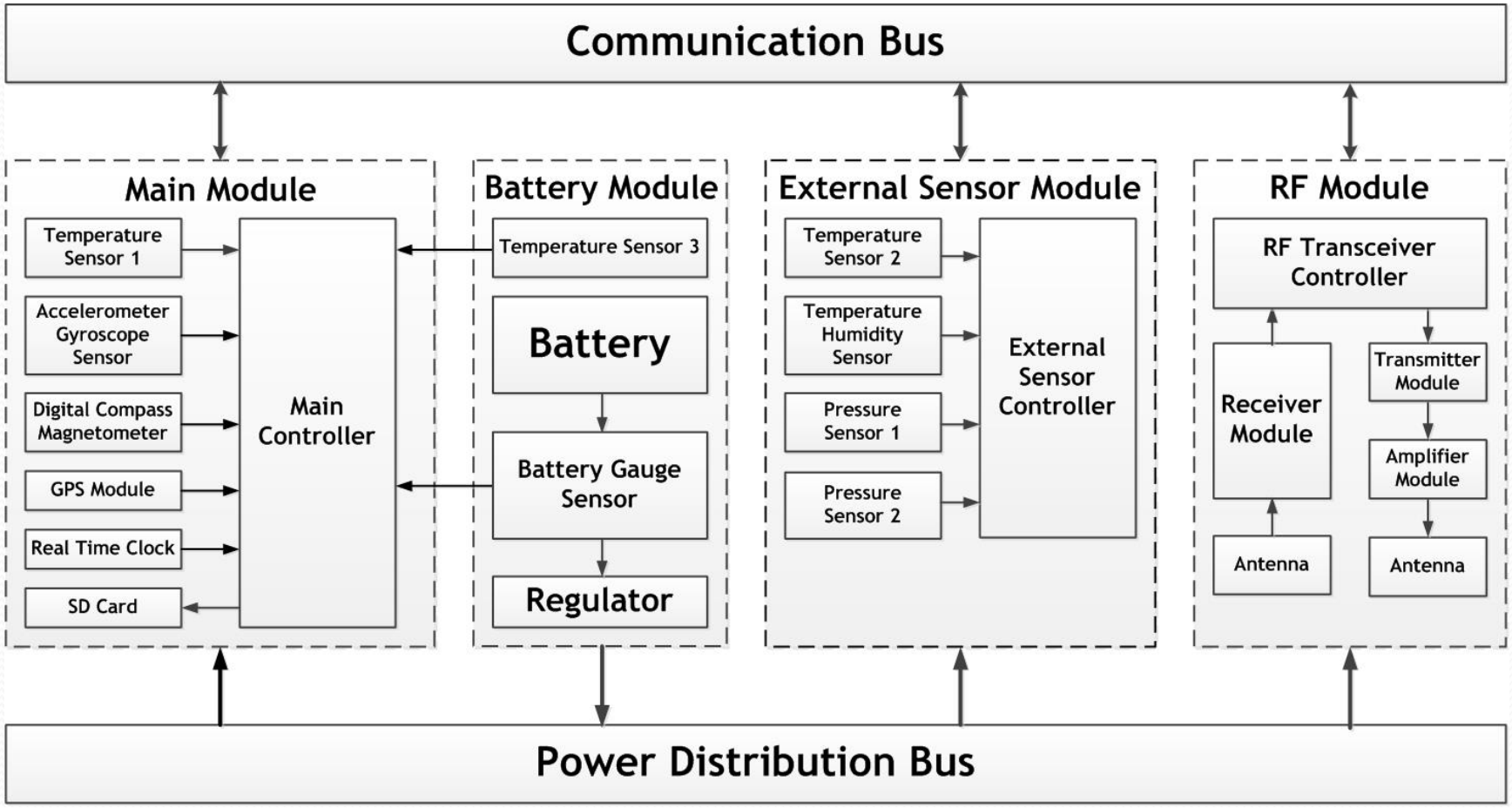
CONCEPT

Block Diagram



CONCEPT

Block Diagram



TECHNICAL SPECS

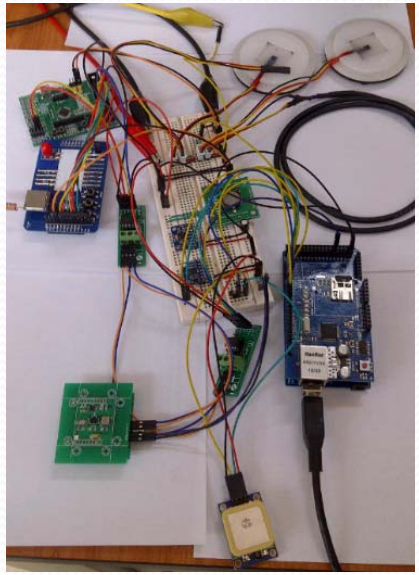
- **Size satelite: 100 mm x 100 mm x 100 mm**
- **Power: 1- 2 Watt. (By solar cells and Battery)**
- **Weight: 1 Kg.**
- **Planning for Orbital duration is 2 years**
- **Height orbital is 650 km**
- **Ground stations system**
- **Communication:**
- UHF band 420 - 460 Mhz
- Full Duplex (separate frequency channel for Tx and Rx)
- 40 Channels Frequency (1Mhz separation)
- 9600bps RF transmission using GFSK, 2GFSK, 4GFSK
- x : +20dB Rx : -127dB
- Support up to 250 nodes ID
- Custom protocol and Encrypted..
- **Orbit target: Equatorial.**
- **Control Station: Surya University.**

Results

Engineering Model of Nano Satellite

- Size: 10cmx10cmx10cm
- Weight: 1-2 Kg.
- Power Consumtion: < 0.5W (kondisi normal)
- RF Power: 1-3W
- Payload: GPS, Battery, Enviroment Sensor.
- Sensors: GPS, sun sensors, temperature, humidity, pressure, compass, 6-axis motion
- Have been tested used High Altitude Balloon ~32km.

Results

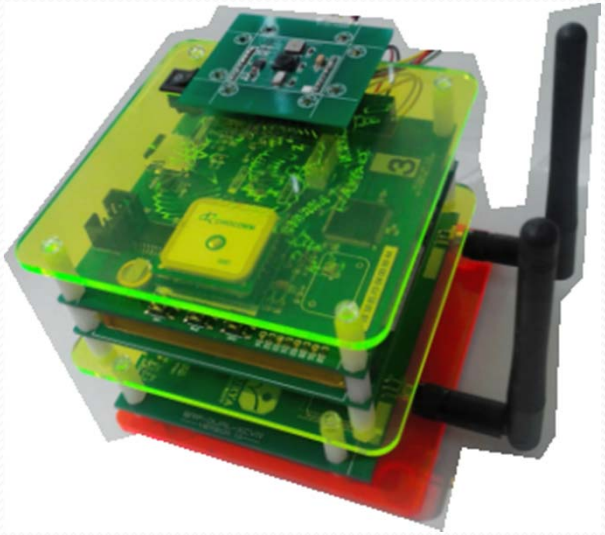


Communication Board

- UHF band 420 - 460 Mhz
- Full Duplex (separate frequency channel for Tx and Rx)
- 40 Channels Frequency (1Mhz separation)
- 9600bps RF transmission using GFSK, 2GFSK, 4GFSK
- Tx : +20dB Rx : -127dB
- Support up to 250 nodes ID

- **Ground Station:**
- UHF band 420 - 460 Mhz
- Full Duplex (separate frequency channel for Tx and Rx)
- 40 Channels Frequency (1Mhz separation)
- 9600bps RF transmission using GFSK, 2GFSK, 4GFSK
- Tx : +20dB Rx : -127dB
- Average Transmission range 4km LOS
- Support up to 250 nodes ID
- Direct USB powered

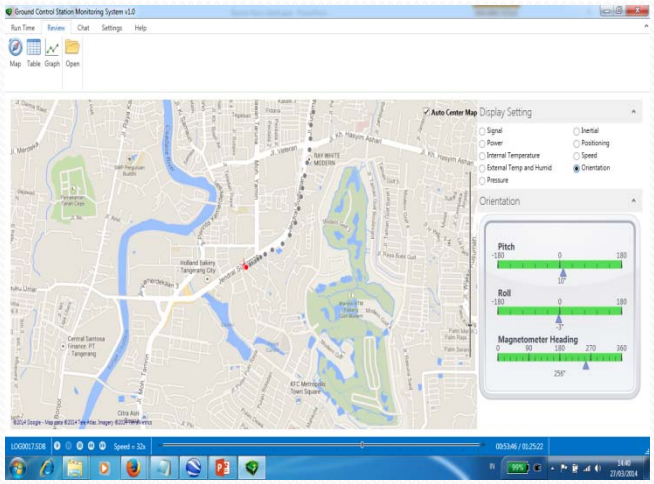
Results



Payload for Balloon

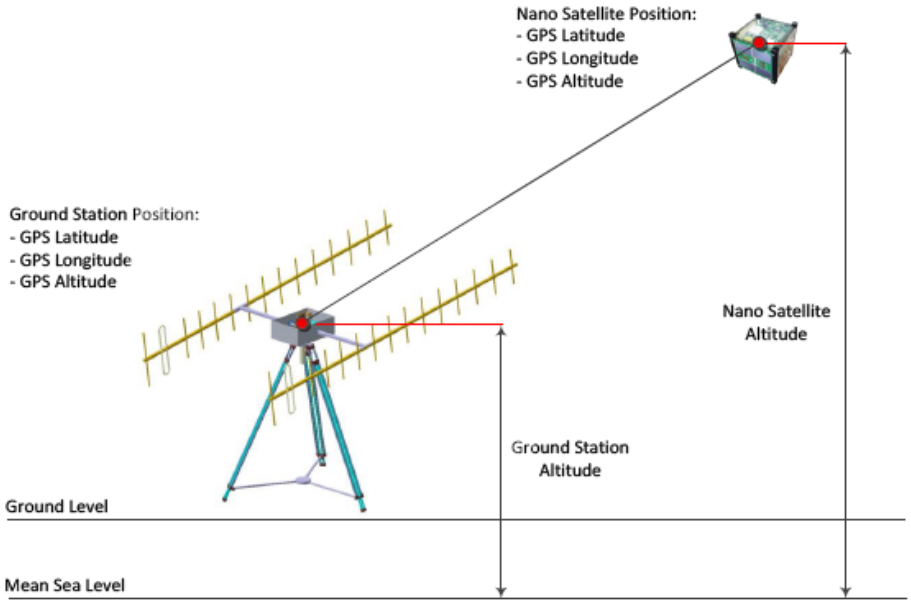
GUI Software

- A. Map View for position tracking & Location (Customised parameters)
- B. Table list View for detail each parameters of the payload
- C. Chart View for data analysis, plotting & comparing
- D. Automatic channel search and setting
- E. Relayed Chatting features to information exchange between ground stations , Logs & Replay feature for history & data analysis.

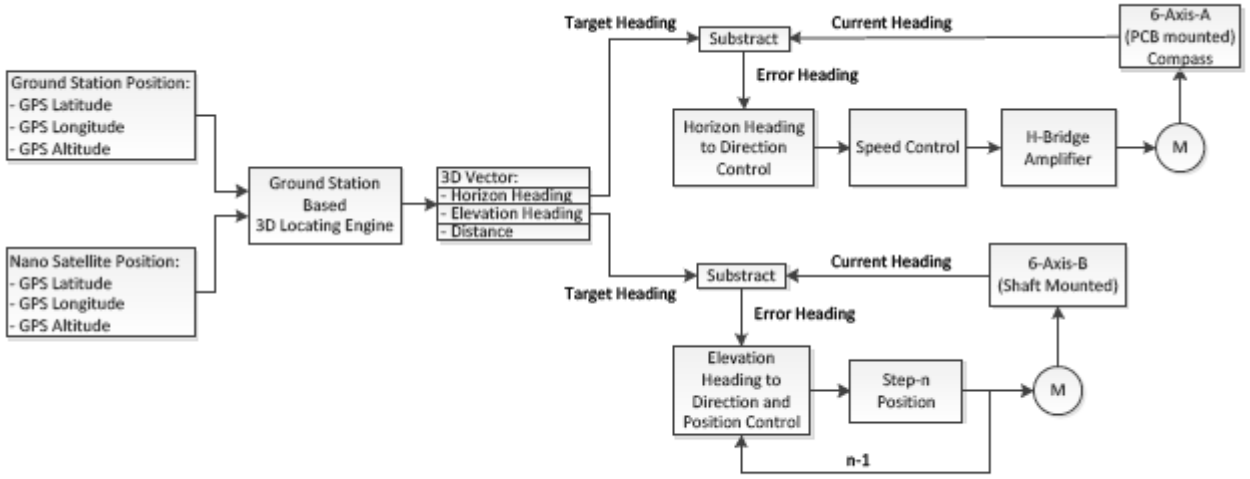


Results

Antenna Tracker for HAB Experiment



Antenna Tracking Algorithm – Concept Illustration



Antenna Tracking Algorithm – System Flow

Launching Plan

Surya University – LAPAN – JAXA - ORARI

Prototype
2014

Flight Model
2016

Rocket JAXA

Launching & Operation
2017

Conclusion

1. Using provided modules and a combination of self-designed payloads will initiate students to become creative and practicing an engineering environment system as well as the components connection of a nano satellite. The process of this project has been done through basic design and Engineering model.
2. A flat form of nano satellite for education has been designed and tested use High Altitude Balloon, and the results shows the payload and module work successfully.