Fabrication and Database Management of Cubesat

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ABSTRACT

As the trends in technology change day to day life, there is always a need for high-end technologies to be developed for bigger inventions to unveil for mankind survival. The idea of CubeSats from 1999 has enormously decreased the cost of developing satellites and launching them into space with great involvement of several space experiment applications. A Cubesat is a type of miniaturized satellite of sounding rocket payload used to teach space technology. Cubesat is made up by multiples of 10cm*10cm*10cm cubic units and have a weight less than 1.4 kilograms. It is similar to the technology used in satellites. The Antennas is mounted externally, but the diameter can't increase until the Cubesat has left the launch vehicle. Cubesats have the capability to facilitate affordable implementations in coordinated sensing and low-bandwidth communications. Cubesat missions are usually aimed for people to gain hands on experience of a mission planning and execution. The data that is collected by the Cubesat is centrally stored in the XAMMP database management system and acts as a small ground station server.

Keywords— *Cubesat, Sensors, Space, XAMPP Server, Space Outreach.*

I. INTRODUCTION

Satellites are designed to undergo several scientific experiments to improve life and living better. When this comes to launching the heavy satellites into space, the payload satellite plays a crucial role as it determines the type of launch vehicle to be used. Launching these heavy satellites in powerful launch vehicle used to be a huge discussion in terms of cost and their capabilities. Later, these are completely lowered using small satellites which often termed as CubeSats.

The CubeSats are also introduced to promote knowledge in the university students for developing satellites. The idea of miniaturizing the entire satellite into CubeSat undergoes standard scientific research and equipment under time-to-time supervision of respective expertise. The standard instruments such as solar panels for generating electricity with a power backup, communication modules for having a connection with ground stations on earth, the electrical power systems will regulate the flow of power in the CubeSat, the OBC is the brain for CubeSat to function as it gives the whole commands to what to focus on, there are different payloads used for different applications and it holds the superior place among all other instruments and mechanical structure body where all these are placed inside will be designed using aluminum alloys to support space weather conditions. Fabrication of CubeSat is mainly intended to enlighten the students in space technology to give real-time practical experience while working on Small satellites and experience the challenges faced while doing so [1]. The immediate encouragement in privatization of the space sector in India has allowed several space agencies to develop CubeSats on several applications and launch them indigenously.

II. Ease of Use

A. Design

The required original material for fabricating a CubeSat plays an important role in how long the satellite stays in the orbit and its reliability. Commercial equipment is built with deep research and verification process in lot involve huge finance. To minimize this cost, the whole CubeSat structure, materials, electronics, communication module and Intelligence is being designed, the on-board computer, solar panels and payload are an important part of CubeSat, materials, electronic kits were procured from suppliers and customize them according to the needs. The CubeSat structure is 3U standard and has 10 × 10 × 34 cm size. To this hull structure, every electronics and telecommunication systems are installed.

The design process comprises two main aspects: architectural design and detail design. Architectural design entails the identification of software and hardware components, their development, decomposition into processing modules and conceptuals data structures, and specification of interconnections between the components. On the other hand, detail design focuses on the specifics of packaging the processing modules, implementing processing algorithms, data structures, and interconnections among the modules and data structures. During the implementations phase, the software is assembled and installed on the client side. This involves various procedures such as providing documentation to the client, encompassing both fundamental and technical aspects. Additionally, it involves verifying the availability of necessary hardware resources provided by the technology and ensuring proper functionality of the software on the designated machine.

B. System Architecture

A system architecture serves as the abstract framework that outlines the arrangement, functionality, and multiple perspectives of a system. It entails a formal representation and description of the system, structured in a manner that facilitates analysis of its structures and behaviors. The system architecture encompasses system components and sub-systems that are designed to collaborate harmoniously in order to realize the complete system. In order to standardize the depiction of system architectures, there have been endeavors to establish specialized languages known as architecture description languages (ADLs).

I. System Architecture

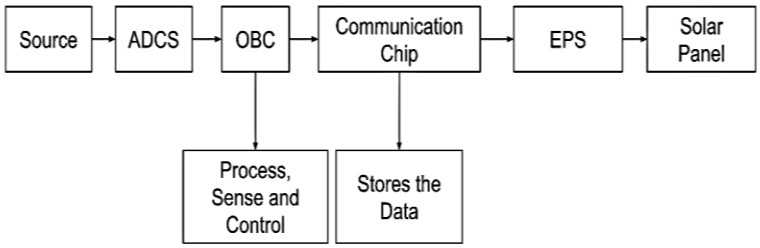

Fig: System Architecture of Cube Satellite

II. Block Diagram

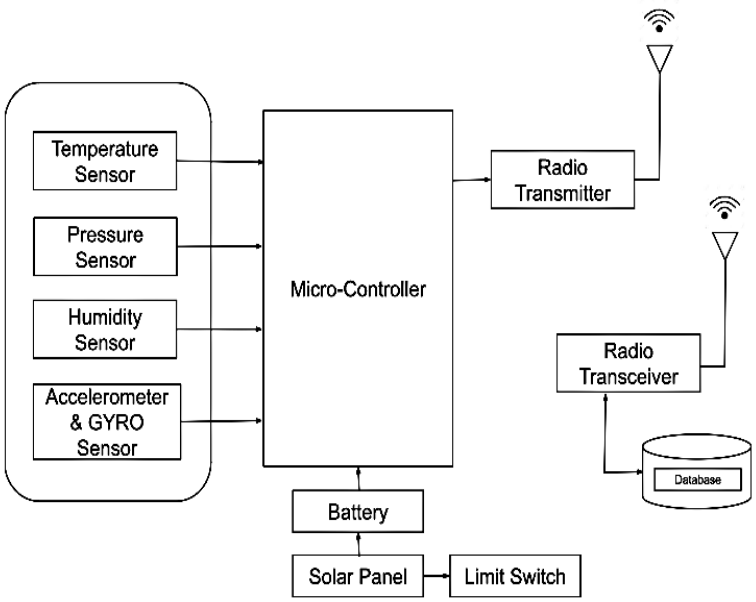

Fig: Block Diagram of Cube Satellite

The block diagram shows the connection of different sensors with microcontroller and output devices. The input unit consists of various sensors which are connected to the microcontroller and the collected data from the sensors is forwards to the local database server by using telemetry process.

III. Operating Temperature of Cube Satellite Subsystems

S.No.	Cube Satellite Subsystem		
	Subsystem	***T°min (°C)***	***T°max (°C)***
1.	BMP180	-40°C	80°C
2.	MPU6050	-40°C	85°C
3.	DHT22	-40°C	125°C
4.	On-Board Computer	-40°C	90°C
5.	5V Batteries	0°C	90°C

S.No.	Cube Satellite Subsystem		
	Subsystem	***T°min (°C)***	***T°max (°C)***
6.	Radio Transceiver	-40°C	90°C
7.	Electronic Power Systems	-40°C	90°C

Fig: Operating Minimum and Maximum temperatures of cube satellite subsystems

A. Prototype

Fig: Prototype of Cube Satellite Model

B. Results and Discussions

The development of cube satellite functioning well and as execution data is send to the server within minimum amounts of time. With the limited number of resources, this project was developed by using IC chip. The device is powered by a 12V DC power supply. The active infrared sensor emits and receives infrared radiation, which detects the presence of objects.

A precise pre-set control mechanism effectively regulates the flow rate, while accurate timing ensures that the flow can be precisely adjusted to deliver the appropriate quantity required for each specific purpose.

C. Testing

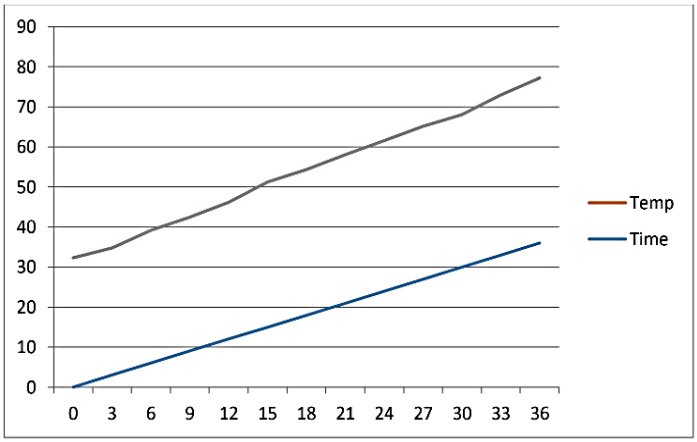

Fig: Variation in temperature (°C) with time (Sec)

The diagram shows the variation of temperature with respect to time. On a time-temperature graph, the vertical y-axis represents temperature, measured in either degrees Celsius (°C) or Kelvin (K), while the horizontal x-axis denotes time, measured in seconds (sec).

There is no relationship between time and temperature. Temperature is the intensity of heat present in an object, while time is the interval between events.

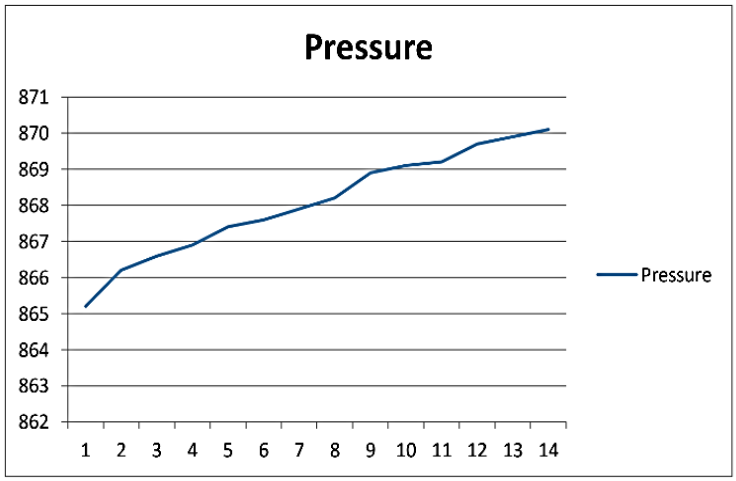

Fig: Variation in atmospheric pressure (Hg) with time (Sec)

The diagram shows the variation of atmospheric pressure with respect to time. In a time-pressure graph, the vertical y-axis represents atmospheric pressure, measured in units of Hg (mercury), while the horizontal x-axis represents time, measured in seconds (sec).

CONCLUSION

The cube satellite projects showcased the potential of small-scale satellite development, empowering individuals and educational institutions to engage in hands-on space exploration. It provided a platform for experimental learning,
Fostered creativity, and inspired future generations of space enthusiasts. The journey from conception to launch underscored the significance of teamwork, innovation, and the pursuit of scientific knowledge.
The cube satellite initiative stands as a testament to the spirit of exploration and the democratization of space. It serves as a blueprint for others interested in embarking on their own satellite projects, encouraging continued innovation and discovery in the realm of space exploration.

ACKNOWLEDGEMENT

I express my sincere gratitude to Prof. Mr. V. Deva Sekhar, the Head of Department of Computer Science Engineering, and Prof. Dr. S.V. Ranganayakulu, the Dean of Research and Development at the Center for Non- Destructive Evaluation, located within Guru Nanak Institutions Technical Campus in Hyderabad, India.

I am grateful and Thankful to my Father Hari Kumar Khulal for his unconditional support and suggestions.

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