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Payload for Sounding Rocket

Prof. A.V. Sutar, Deven Satam, Surya Reddy, Anusha Shetty, Aniket Patil
Department of Electronics and Telecommunication,
Bharati Vidyapeeth College of Engineering, Navi-Mumbai, India

Abstract:

Every aircraft or launch vehicle has a payload system of its own which includes scientific instruments or other equipment. This project aims to build a payload system for a Sounding rocket that specializes in carrying scientific equipment and taking measurements in its sub-orbital flight. Also, to construct a compact & cost-efficient Payload system for a designed sounding rocket which will be sent a few desired ranges above the ground level for performing scientific measurements. These rockets are designed to conduct various experiments in the Earth's tropospheric range, which consist of various scientific equipment that are being carried by the payload.

Keywords: Payload, Instrument, Data, Sounding Rocket.

1. INTRODUCTION

A rocket is a vehicle that launches payloads into the orbital and suborbital zones. A sounding rocket is a small-scale rocket that is launched to conduct experiments while in suborbital flight. These rockets usually travel to a height of 30-150 kms. As per the requirement of the sounding rocket, this payload consists of three sections. The first part would be to determine the sensors. The next part is transmission which includes the oscillator, modulator and a patch antenna to transmit the data gathered. The last part would be detection of the signals at the ground level with the help of a demodulator. Since the height of the flight is less than 15 kilometres from the ground, only a small battery source is sufficient. In case of future expansion solar panels is an option for longer travel distance. This being the main objective of the payload system, it will be used to gather atmospheric and weather conditions with the launch vehicle making it cost-efficient.

1.1 PROBLEM STATEMENT

In some countries they use drone and gas balloons for weather forecasting. Balloon have some advantages like they are easy to make and assemble, balloon part is easily available but they have disadvantages. What is the best alternative to weather balloons for reliable forecasting at higher altitudes? 'Weather Forecast Using Sounding Rockets'.

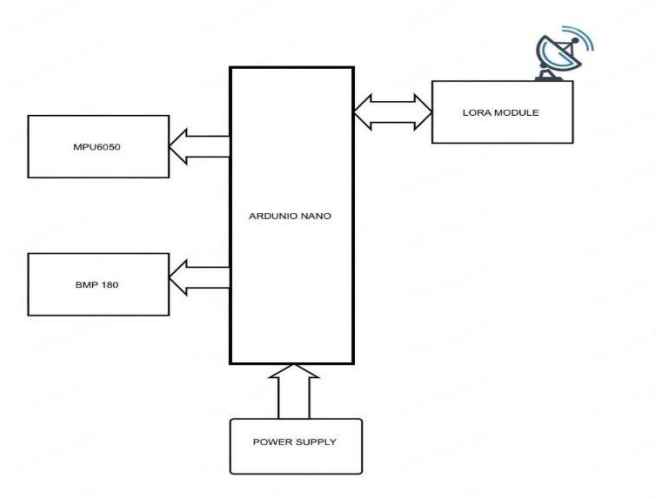
1.2 OBJECTIVE

The aim behind choosing this project is to gather data for the meteorological department. The objective of the payload system, it will be used to gather atmospheric and weather conditions with the launch vehicle making it cost efficient and accurate. It makes the launch vehicle more accessible to students and test their prototype.

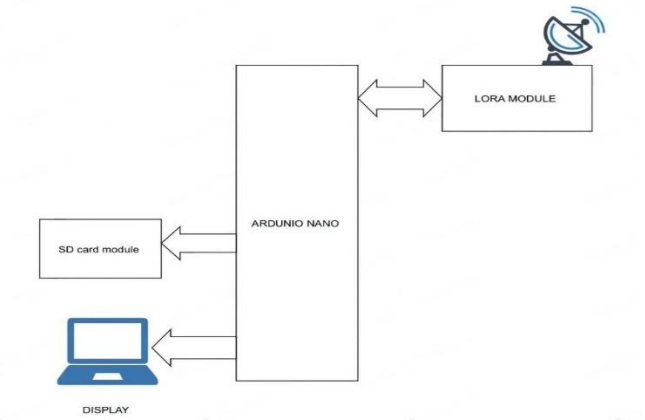
2. PROPOSED SYSTEM

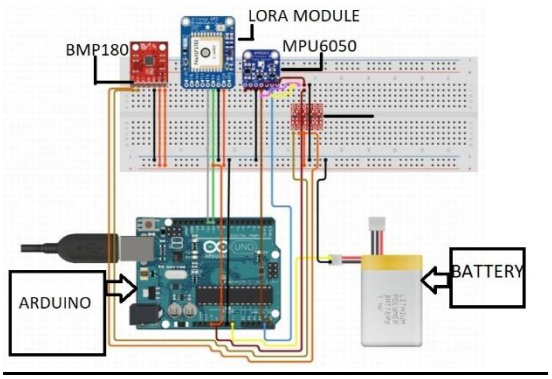
The payload system will consist of two sections, the transmitting and the receiving section. The transmitting part will include the sensors- bmp180 and mpu6050 that will gather the required atmospheric data. The data is then retrieved by the Arduino nano and transmitted to the ground/receiving section using the LoRa module.
The receiving section will consist of Arduino and LoRa module to receive the live transmitted data and it also includes a Sd card module to store the data for further analysis.

- Transmitting section



- Receiving Section





3. SYSTEM DESCRIPTION

3.1 **LoRa sx-1278**

LoRa is a 'Long Range' low power wireless standard designed for giving a cellular style low data rate communications network. Lora1278 integrates RF transceiver chip SX1278, which adopts LoRa TM Spread Spectrum modulation frequency hopping technique. The features of long-distance and high sensitivity makes this module operate better than FSK and GFSK module. This module is 100mW and ultra small size, widely used in AMR , remote industrial control field.

3.2 **Arduino nano**

The Arduino Nano consists of 30 male I/O headers, which includes DIP-30-like configuration, which can be programmed using Arduino integrated development environment (IDE), this IDE is common to all Arduino boards and running both online and offline. The board can be powered through a type-B mini-USB cable or from a 9 V battery.

3.3 **MPU 6050**

MPU6050 is a Micro Electro-mechanical system, it includes a three-axis accelerometer and three-axis gyroscope. It helps us to calculate velocity, acceleration, displacement and other motion like features in the system in which it is installed. MPU6050 consists of a 16-bit analog to digital converter hardware. Due to this feature, it is capable of capturing three-dimension motion at the same time.

3.4 **BMP 180**

The BMP180 is the new digital barometric pressure sensor with a very high performance, which enables applications in advanced mobile devices, such as smartphones, PCs. It follows the BMP085 and brings many improvements, like the smaller size and the expansion of digital interfaces. The BMP180 is a sensor based on piezo-resistive technology for EMC robustness and high quality standards. The dies of the BMP180 are protected by a stable and thin package with a metal lid.

The package has seven optimized pins. The BMP180 can communicate directly with a microcontroller in the device through I2C or SPI as a variant.

3.5 **Sd card module**

SD Card Module is a breakout board used for SD card processes such as reading and writing with a microcontroller. It has compatibility with microcontroller systems like Arduino. A standard SD card can be directly inserted into the board, but to use microSD cards, you need to use an adapter.

4. CONCLUSION

The final system is developed and executed successfully. This project has been mounted on a PCB wherein the transmission and reception is being controlled by LoRa and Arduino nano modules on both ends. The bmp280 and mpu6050 sensors collects the required atmospheric da ta. The collected data is observed live as well as being recorded in a micro Sd card. The system is powered by a battery. The end result system can be deployed in a sounding rocket.

5. ACKNOWLEDGEMENT

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