Low-Cost Cubesat Attitude Determination

Datasheet

SORBONNE UNIVERSITÉ

ACADÉMIE SPATIALE D'ILE DE FRANCE

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1 Introduction

1.1 Project Overview

This project focuses on the development of an attitude determination system for a CubeSat operating in low Earth orbit. The system utilizes data from an onboard magnetometer and a sun sensor (6 Solar panels), to estimate the satellite's orientation relative to the Earth. The core processing and control algorithms are implemented on an ESP32 microcontroller, enabling real-time sensor data acquisition, processing, and attitude estimation.

2 Applications

The system is designed for low-budget missions (e.g., university projects, academic missions, research laboratories).

3 Project Scope

- Designing and simulating an attitude determination system using magnetometer and sun sensor data
- Validating the system using test data
- Hardware implementation
- Documenting the methodology, results, and potential improvements
- Providing recommendations for future hardware implementation and integration

4 System Design

4.1 Overall Architecture

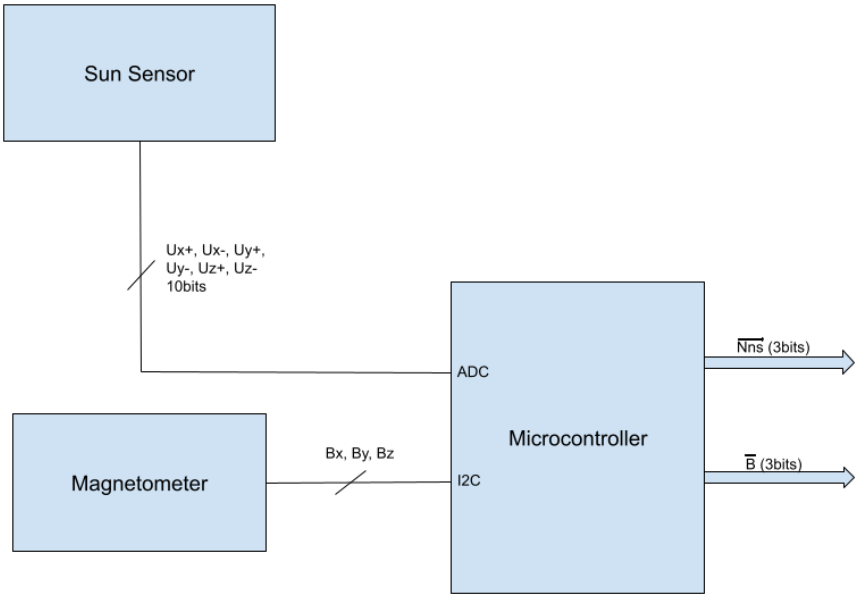

Figure 1: System architecture

4.2 System Schematic

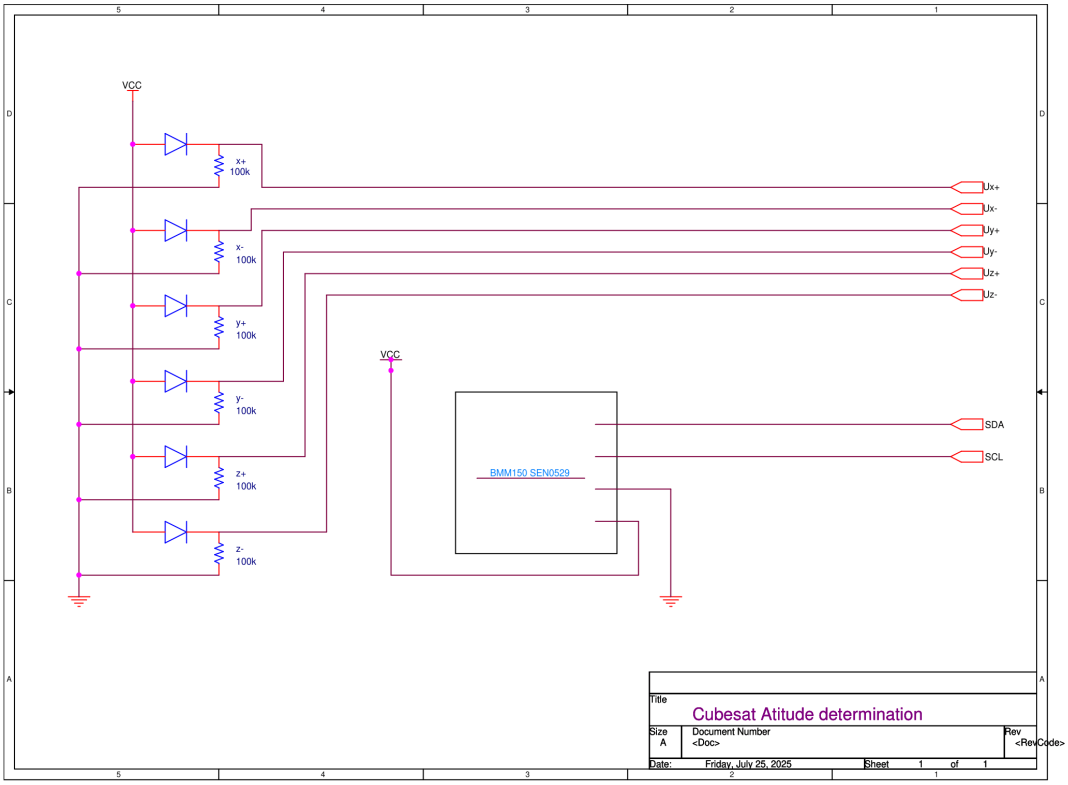

Figure 2: System Schematic

4.3 Hardware

Solar Panel
The main function of the solar panel is to acquire data about the light intensity on each side of the CubeSat in order to calculate the sun-satellite vector.

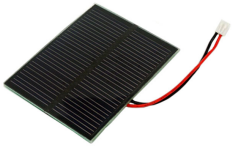

Figure 3: Solar Panel 0.5W

Magnetometer
The magnetometer's role is to measure the magnetic field vector in the satellite's frame.

Figure 4: Magnetometer 3 axis BMM150 SEN0529

Microcontroller
The microcontroller combines the data issued from the two sensors in order to determine the attitude of the CubeSat.

Figure 5: Microcontroller ESP32

4.4 Software