Can-Sat II Launching System Using KNO3/SUGAR Rocket

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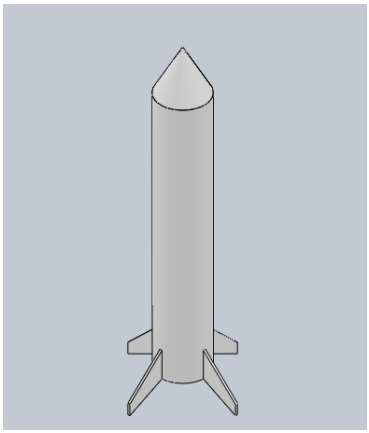
Introduction

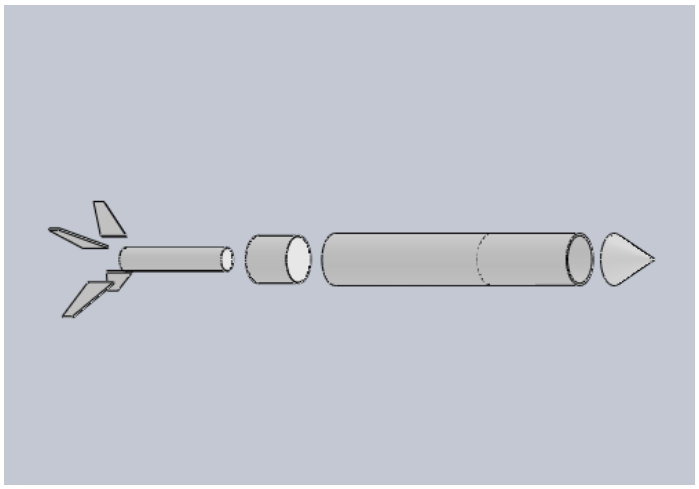
In our launching system, we have worked on four stages which are combustion, parachuting system, satellite shielding and ignition. This proposal will discuss them all.

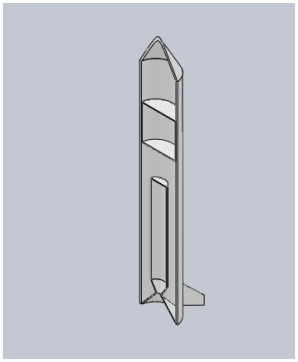
While dropping the satellite with a parachute or a balloon is not professional or efficient at all so we have turned out to use an amateur rocket in the Can-Sat II program using simple available materials. It guarantees a wider range of measurements besides safety. The satellite can descend back to the earth slowly from a really high attitude.

Rocket Body

The body is mainly of PVC. It is highly recommended and suitable for high powered rockets because of its sustain besides being cheap ,light and available .We use a 1 meter PVC pipe with diameter 12 cm, containing the fuel chamber and the can-sat with its parachute. As it shown:







Materials and Chemical Preparations

The rocket engine here is KNO3 with Sugar added. Technically, the KNO3 acts as a fuel and the sugar acts as an oxidizer .First, we add KNO3 and Sugar by weight then pour the mixture into the PVC fuel chamber.


After the fuel cools, coring process is applied to be ready for the igniter as shown:

Combustion

In particular, the nitrate based propellant is very popular. When preparing a Nitrate-based fuel, the components must be dissolved to ensure thorough mixing and a uniform texture throughout the fuel. One of the most efficient nitrate-based propellants is a mixture of potassium nitrate and sugar, commonly referred to as "Rocket Candy." We are going to use nitrates with sorbitol(sugar) which is available, the chemical reaction is described by this equation:

$$5O2 + 4KNO3 + 2C6H4O6 = 12CO2 + 4H2O + 2N2 + 2K2CO3$$

Satellite Shielding

Shielding is simply by forming a small tin with the satellite inside .We care about its components(sensors and etc.) so we easily drill holes in order to perform its mission which is taking measurements.

Safety Considerations

Safety precautions are the most important to be considered in our design due to the chemical repulsion so we preferred this design. The fuel chamber is well isolated with a 40 cm PVC 5 cm of diameter**.** The upper part containing the shielded Can-Sat is separated at a good distance from the chamber so it cannot be damaged or affected some way by the combustion.

Parachuting system

We have a variety of parachute material types; strong cloth, originally silk, and most commonly nylon so our material would be nylon. Depending on the situation, parachute is used with a variety of loads so it is considered to hold the satellite with its components.
The Parachuting system contains the parachute and a control unit which is designed to control the time for releasing the parachute.

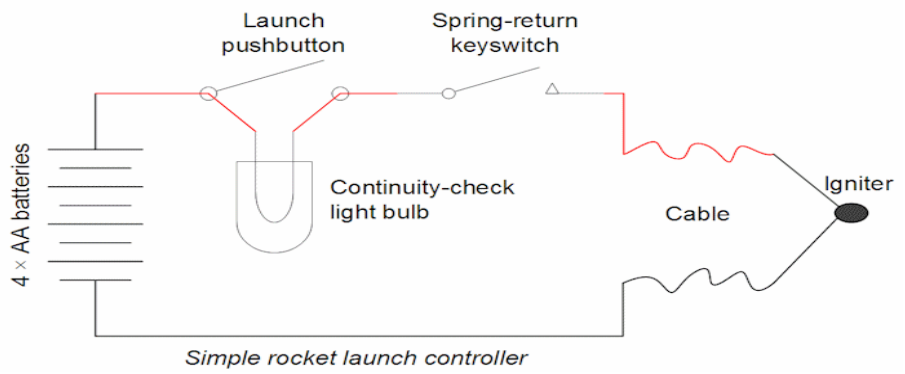
The control will be through the Xbee that connects the Raspberry which sends a signal to a servo motor 360 .The motor is then used to open a gate for the parachute to get out.

As a test we used an Arduino kit. The Arduino code for controlling the servo:

```
include <Servo.h>
int servoPin=9;
 Servo servo;    //Servo
Object
void setup()
{
 servo.attach(servoPin); //Attach Servo
 }
void loop()
{
servo.write(0);
delay(1000);
servo.write(180);
}
```

Ignition Circuit

The purpose of an ignition circuit is to supply power to the igniter to fire the rocket motor. The tip of the igniter consists of a very thin wire (called the "bridge wire") coated with a pyrogen/tungsten (chemical compound that heats up). The thin wire heats up when sufficient electricity flows through it, which causes the pyrogen to combust (catch on fire), which initiates the burning of the solid chemical material. A launch controller is designed using a transistor 2N2222 as a switch and a relay for protection and avoid launch failure.



Simple rocket launch controller

Conclusion:

We aimed to design a rocket with special features in order to simulate the satellite real operations in space. So far, we have the full designed as illustrated. However, it still needs more testing.