IEEE UAE SECTION

ZERO OHM
Zero Ohm Electronics زيـرو اوم للإلكترونيات

11th IEEE UAE STUDENT DAY

Saturday May 21st, 2016

Industrial Design Project (IDP) Competition

CanSat – A Can Sized Satellite

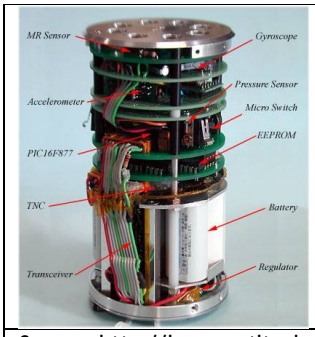
General Information

- Each team shall comprise a maximum of 5 IEEE student members.
- Project cost must not exceed AED 2000

Projection Definition

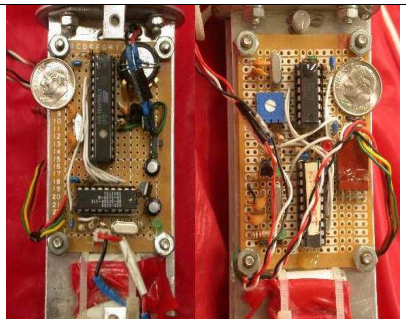
Background

A CanSat is a type of sounding rocket payload used to teach introductory space technology similar to the technology used in miniaturized satellites. No CanSat has ever left the atmosphere or even orbited earth. The main purpose of building such satellites is to introduce the students into space technology due to the inexpensive cost. Figure 1 below shows a variety of basic and sophisticated CanSats.



Source: http://lss.mes.titech.ac.jp

Source: http://www.satellitetoday.com



Source: http://courses.ae.utexas.edu/

Figure 1 – A variety of CanSats

Competition Description

The goal of this project is to design a CanSat that is suitable for performing a basic mission followed by safe landing on a predetermined location. The CanSat has to be designed and built by the students. The CanSat will be launched using a certain launching mechanism which will be provided by Zero Ohm Electronics. The launch is usually achieved by rockets. However, there are several other methods such as drones, and hot air balloons. For the purpose of this competition, a drone (quadcopter) will be used as a launcher.

Figure 2 – CanSat Launcher

At an altitude of 90 meters, the launcher will release the CanSat which will start descending. The CanSat shall power up, only at this point of time, and after 2 seconds, activate the recovery system (parachute control), and then start to control the CanSat landing. The CanSat's Descent Control System must (Autonomously) land the CanSat within a specified target point and time limit.

Note: The CanSat must remain powered off until released from the launcher. A "kill-switch" could be achieved by a microswitch as shown below:

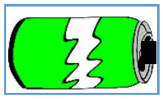
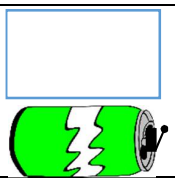
	
During Launch Kill Switch is activated, the CanSat is powered OFF	After Release Kill Switch is deactivated, the CanSat is powered ON

Figure 3 – Kill Switch concept

Note: The target landing location (landing pad) is specified by a GPS location and will be marked on the ground as below, the GPS location will be provided prior to the competition:

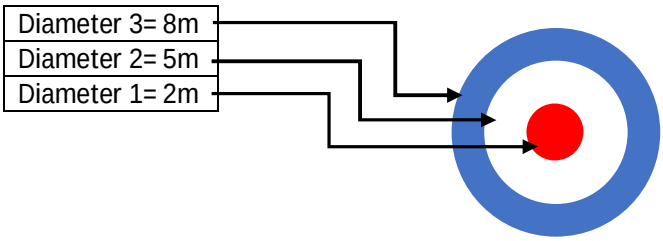


Figure 4 – Landing Pad

During the descent flight, the CanSat should transmit in-flight telemetry data which will be received by a ground station and will be displayed on an HMI (Human Machine Interface). The ground station is provided by Zero Ohm Electronics. The telemetry should be transmitted at a rate of 1Hz in the following format:

*	SN	,	Time Stamp "YYYY-MM-DD_hh:mm:ss"	,	Battery Charge State (%)	,	Altitude (m)	,	Ambient Temperature (deg C)	#

Note: The transmitted data will be received by a ground station. The ground station utilises an XBee S2 module which is configured as a coordinator. In order to pair two modules, a PAN ID is required. This will be provided for each team separately during the competition to avoid interference.

Note: SN is a sequentially incrementing number used to identify each packet.

Example: ***1,2016-05-21_10:00:00,95,70,35#*1,2016-05-21_10:00:01,95,65,35#.....**

Constrains and Requirements

- **IMPORTANT:** The CanSat must be fitted with a ring for safe recovery, refer appendix A
- The CanSat must fit in a box of (Width/Depth = 85mm, Height = 160mm) ±1mm.
- The CanSat total weight (including the parachute) shall not exceed 500 grams.
- The CanSat must remain powered off until released by the launcher.
- The CanSat must not actuate any external mechanism until 2 seconds after being released (to avoid interference with the launcher).
- The CanSat must land within 60 seconds after being released by the launcher.
- Violating the above constrains will disqualify the entry.

Mission Overview

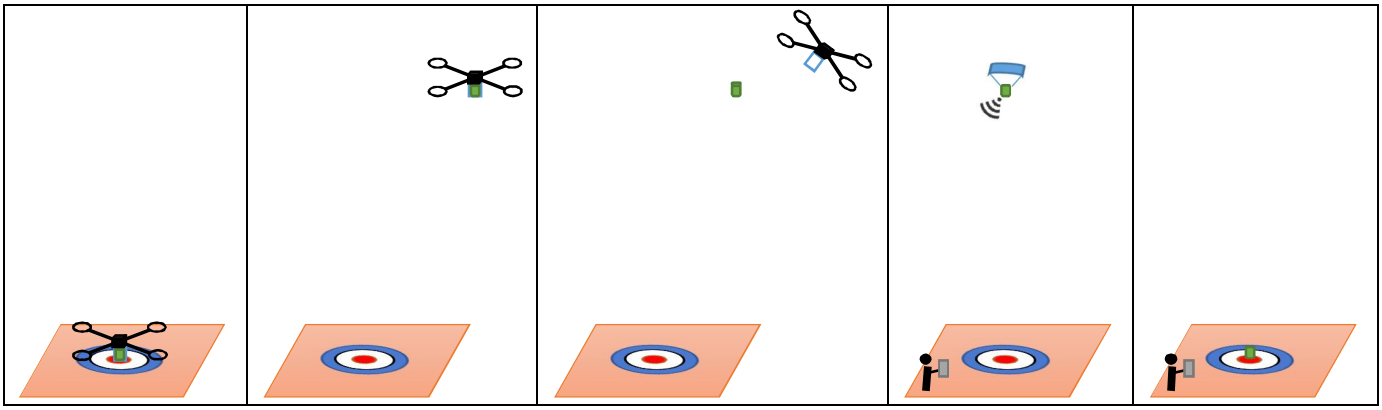


Figure 5 – Mission Overview

Evaluation Criteria

SN	Evaluation Criteria	Score
1	**Presentation + Poster** * Information is clear and logical in the poster = 5 Points * Comprehensive presentation within 5 minutes = 5 Points	10
2	**Project Management** * Documentation = 5 Points * On Budget (Show cost breakdown) = 5 Points * On Time (Show Project schedule)= 5 Points	15
3	**Telemetry Data** * Data is according to the defined protocol = 5 Points * Data is realistic = 5 Points * Data Reception = 10 – (Data loss percentage * 10) Points	20
4	**Landing Safely** * Device Functional (after landing) = 15 Points * Device not Functional (after landing) = 0 Points	15
5	**Landing on Target** * D1 = 30 Points * D2 = 20 Points * D3 = 10 Points * Outside D3 = 0 Points	30
6	**Additional Features** * Demonstration of significant additional features = 10 Points * Demonstration of minor additional features = 5 Points * No additional features = 0 Points	10

Appendix A – CanSat Recovery

- Each CanSat must be fitted with a ring hook (5-10mm), it must be firmly fixed to the CanSat body:

- All the CanSat internal parts must be fixed firmly to the body of the CanSat, this will be tested as follows:
    - The CanSat will be tied to a fixed platform using the ring hook using a short string.
    - The CanSat will be dropped from an altitude of ~2 meters.
    - Accordingly, the CanSat will be subjected to a sudden jerk.
    - Any physical failure (detachment/loosening of the hook, detachment/loosening of an internal part) **will cause the entry to be disqualified**.

- During the descent flight, in case the CanSat goes beyond the campus field, it will be safely recovered to the ground station using a recovery system which will be attached on the above mentioned safety “ring hook”. In this case, evaluation criteria 4, and 5 scores will be “0”.