Arduino kit using in satellite applications

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2021

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Brief History of satellite Telecommunication

- 1945   Arthur C. Clarke publishes an essay about „Extra Terrestrial Relays".
- 1957 first satellite SPUTNIK.
- 1960   first reflecting communication satellite ECHO.
- 1963 first geostationary satellite SYNCOM.
- 1965 first commercial geostationary satellite „Early Bird"   (INTELSAT I): 240 duplex telephone channels or 1 TV channel, 1.5 years lifetime .
- 1976   three MARISAT satellites for maritime communication.
- 1982 first mobile satellite telephone system INMARSAT-A.
- 1988 first satellite system for mobile phones and data   communication INMARSAT-C.
- 1993   first digital satellite telephone system.
- 1998 global satellite systems for small mobile phones.
- 2000 first cubesat launched to space.

Classification of satellites according to weight

- ❑ The answer of this question is not straightforward due to the fact that there is a wide range of satellites and in this range the variation is quite big!
- ❑ Some references classify satellites according to mass. Once can roughly think that as the mass of a satellite increases, the size also increases.

Class name	Wet Mass	
Large	>1000 kg	
Medium	500-1000 kg	
Mini	100-500 kg	Small
Micro	10-100 kg	
Nano	1-10 kg	
Pico (Cubesat)	0.1-1 kg	
Femto	<100 g	

Classification defined by SSTL

How big and how heavy are satellites?

Mass: about 8210 kg

How big and how heavy are satellites?
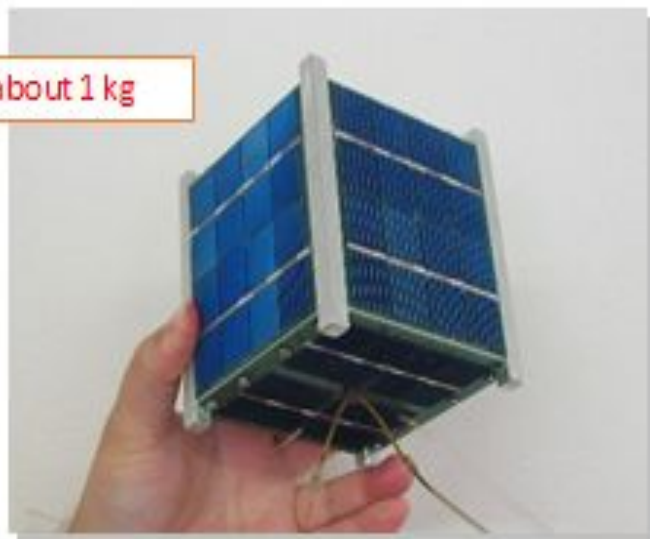

Mass: about 3535 kg

Mass: about 2350 kg

How small and how light are satellites?

❑ Thanks to rapid developing technologies, to make satellite small and light there are many universities have practical satellite programs such as "CubeSat" programs

Mass: about 1 kg

Picosat (CubeSat)

The CubeSat origin lies with Prof. Twiggs of Stanford University and was proposed as a vehicle to support hands-on university-level space education and opportunities for low-cost space access. At its most fundamental level, the CubeSat can be defined as a discrete but scalable 1 kg1 100 x 100 x 100 mm cuboid spacecraft unit; this is now commonly referred to as a 1U(nit) CubeSat. Figure shows a Pumpkin CubeSat Structure, with Clyde Space Solar Panels attached. The CubeSat definition is scalable, and so CubeSat units may be combined to produce larger mass and volume systems (up to 3 U CubeSats have been demonstrated in-orbit, and 6 U systems are proposed).
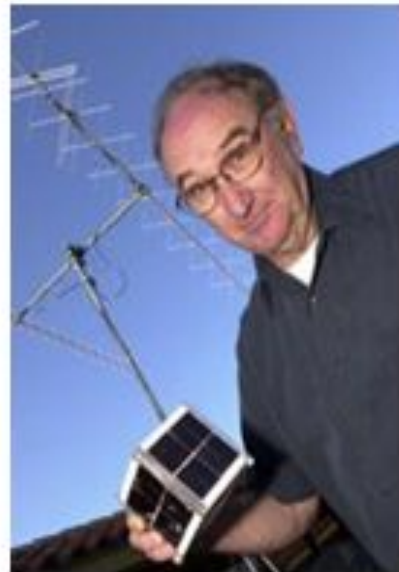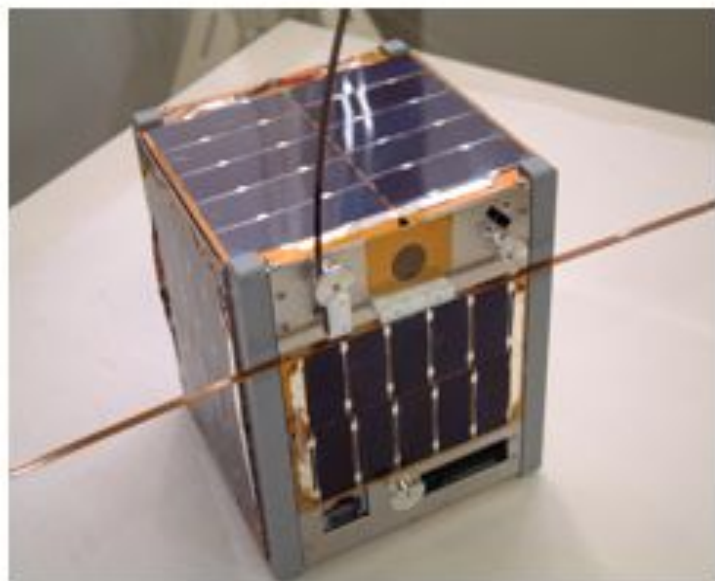

Prof. Twiggs

CubeSat Application

- Development of CubeSat technology
- Earth remote sensing
- Space tether
- Scientific Research
- GPS

Some of the CubeSat parts
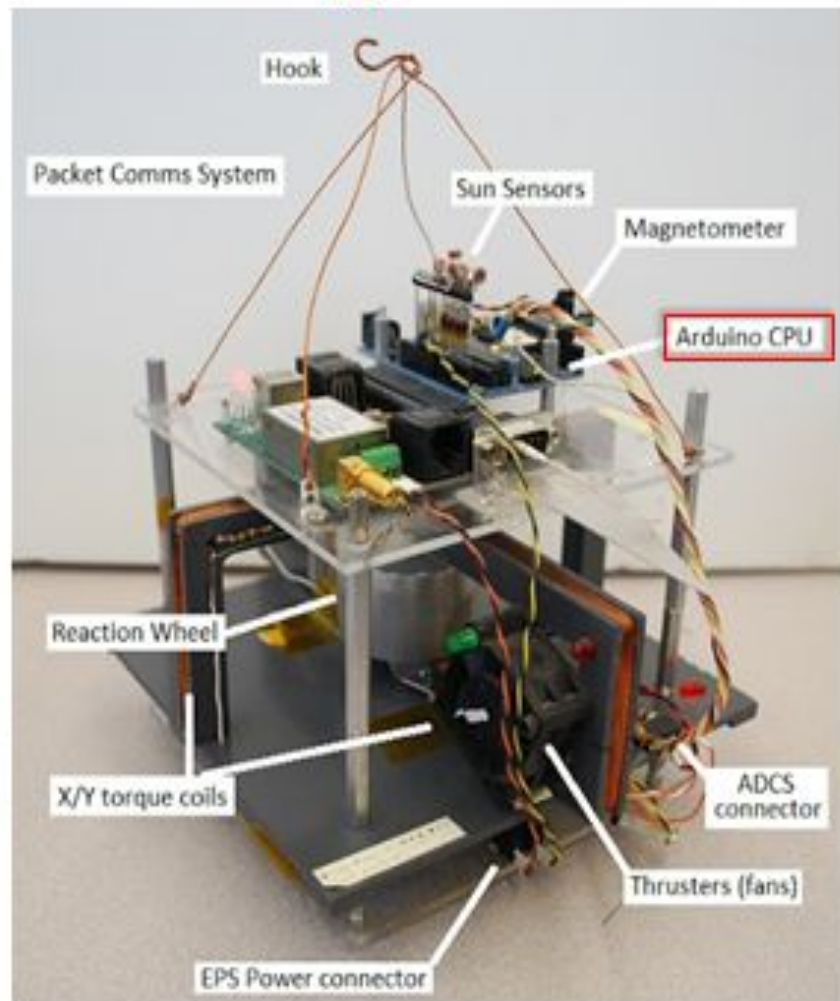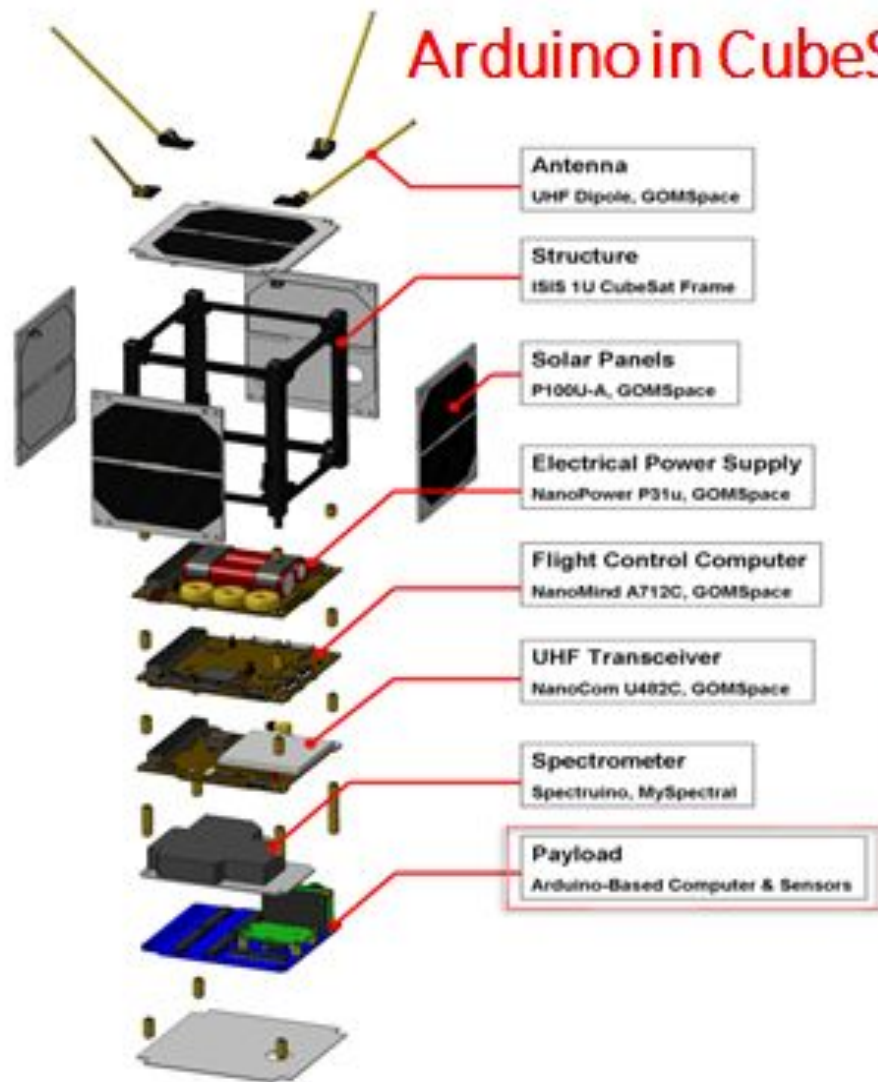

The Highly Successful 1 Kg University Of Tokyo XI-V Cubesat.

Arduino in CubeSat Technology

Antenna
UHF Dipole, GOMSpace

Structure
ISIS 1U CubeSat Frame

Solar Panels
P100U-A, GOMSpace

Electrical Power Supply
NanoPower P31u, GOMSpace

Flight Control Computer
NanoMind A712C, GOMSpace

UHF Transceiver
NanoCom U482C, GOMSpace

Spectrometer
Spectruino, MySpectral

Payload
Arduino-Based Computer & Sensors

Hook

Packet Comms System

Sun Sensors

Magnetometer

Arduino CPU

Reaction Wheel

X/Y torque coils

ADCS connector

Thrusters (fans)

EPS Power connector

Arduino in GPS Technology

GPS Module

NEO-6M GPS module is a well-performing complete GPS receiver with a built-in 25 x 25 x 4mm ceramic antenna, which provides a strong satellite search capability. With the power and signal indicators, it can be monitored the status of the module.

GSM Module

The GSM modem is a specialized type of modem which accepts a SIM card operates on a subscriber's mobile number over a network, just like a cellular phone.

Arduino

Arduino Uno is a microcontroller board based on 8-bit ATmega328P microcontroller. Along with ATmega328P, it consists other components such as crystal oscillator, serial communication, voltage regulator, etc. to support the microcontroller. Arduino Uno has 14 digital input/output pins (out of which 6 can be used as PWM outputs), 6 analogue input pins, a USB connection, A Power barrel jack, an ICSP header and a reset button.

Arduino in GPS Technology (cont.)

1. Arduino Board (Arduino Uno R3): Used as microcontroller to control all the system.
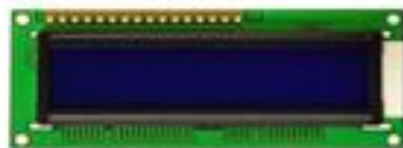
4. LCD (16*2 LCD): Used to get feedback from the system and also to display latitude and longitude of the vehicle.

2. GSM Module (SIM900 GPS/GPRS Module): Used to send and receive SMSs.

5. AC/DC Adapter (12 V , 2 A Adapter): To supply power to the system.

3. GPS Module (Ublox NEO-6m GPS Module): Used to calculate the device's geographical position.

6. Voltage Regulator (7809 Voltage Regulator): Used to automatically maintain a constant voltage level of Arduino to 9V.
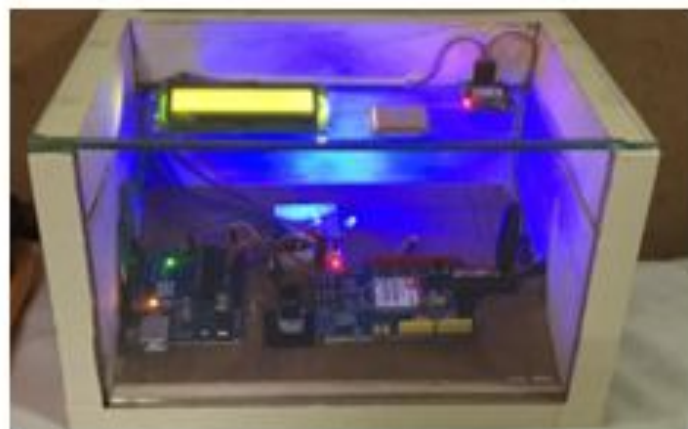
Design and place in Vehicle

The hardware components of project should be hidden and can be placed it under the hoods as example or beside car engine, two ways to provide hardware components with power first by using external battery or by connect to car battery directly.

Thank you