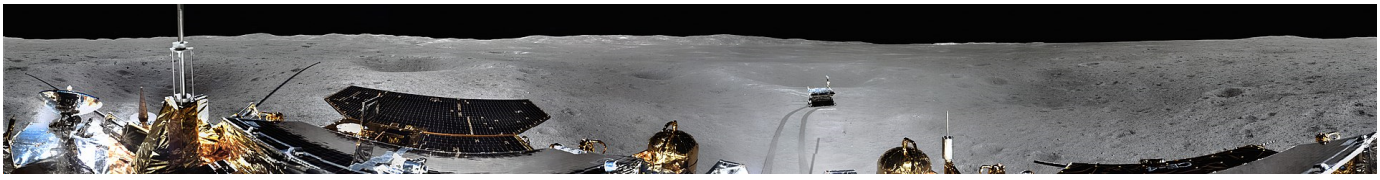
Assignment 2

LanderNUS

Objectives

After completing assignment 2, students will:

- be able to apply system design approaches, such as using flowcharts, to design embedded applications
- understand the interfaces between microcontrollers and peripherals
- have the ability to develop C embedded programming controller based applications



The first panorama from the far side of the Moon, taken by Chang'e 4.

Background

As a result of the tidal locking effect, the moon's revolution cycle is the same as its rotation cycle, and the same side of the Moon always faces Earth. On 3 January 2019, after orbiting the Moon for 18 days, China's Chang'e-4 probe achieved the first-ever soft landing on Moon's far side, becoming the first spacecraft soft-landing on the Moon's uncharted side never visible from Earth.

Direct communication with Earth is impossible on the far side of the Moon, since transmissions are blocked by the Moon. Communications must go through a communications relay satellite (Queqiao), which is placed at a halo orbit around the Earth–Moon L2 point, so that the satellite has a clear view of both the landing site and the Earth.

Overview

In this assignment, we will be looking at a Moon exploring system. We shall refer to this system as **LanderNUS**. This satellite sends and receives data periodically from NUSLander is known as **SatelliteNUS**.

LanderNUS has three modes of operation: Orbiting, Landing and Exploring modes, and will be transmitting to **SatelliteNUS** if certain conditions are met. Additionally, other device interfacing is required for **LanderNUS**, which shall be described in the following pages. The Orbiting mode is the mode in which **LanderNUS** is started, modelling the situation when **LanderNUS** is orbiting the Moon before landing. Landing mode is modelling the process when **LanderNUS** is approaching to the Moon. Exploring mode of **LanderNUS** is the mode in which **LanderNUS** is working on the Moon for scientific data collection.

It is assumed that the base board is a smaller prototype version of **LanderNUS**, with several output devices to help in the debugging during development. The XBee RF module is assumed to be a low powered wireless communication device that sends collected data to **SatelliteNUS**.

Students are required to interface with various devices on the Base Board for data capture and data transmission. The reasons behind the use of the three main sensors are indicated in the table below.

Sensor	Usage and Potential Implementations
Accelerometer	Accelerometer has an extremely wide range of applications. For **LanderNUS**, the accelerometer is assumed to be mounted on the system to detect the orientation of **LanderNUS**.
Light Sensor	Light sensor is used for **LanderNUS** as a Radar mounted at the bottom of system. The light sensor monitors the reflected light intensity to estimate the height of **LanderNUS.**
Temperature Sensor	The temperature module on **LanderNUS** is used to monitor and collect the ambient temperature of the Moon.