Software: processing data from sensors

There were 4 sensors implemented on the rover, each of which had a void subfunction to be executed when detecting the corresponding signal.

The first subfunction detected the magnetic field. It read value directly from analogue input A4, and would (increase/decrease) if approaching an upward magnetic field, and vice versa.

Both the modulation radio signal and infrared signal required counting for frequencies of their input: digital square signals, and they were realised in a similar way. The function for example, would allow the program to measure the time of a continuous HIGH input from the pin called . And the last coefficient, 20000, was aiming to limit the waiting time to 20 milliseconds, so that the program would not waste too much time waiting for the signal, as in some cases there were none. After measuring the HIGH input time, the program would also measure for the LOW time, and add the 2 together so as to have the total period. Then it would divide the period by 1 second to get the frequency in Hz. The detected frequency would be nearly 0 when far away from a signal source, so the program considered the radio signal as 151 Hz when the calculated frequency was in the range of 100-200 Hz, and 240 Hz when the input was 200-300 Hz. The infrared sensor would give a result of 353 Hz with a range of 200-500 Hz, and 571 Hz with range 500-700 Hz. The sensors themselves worked accurately enough, but the program was made in a way to avoid as much noise effect as possible.

The last sub function worked for the acoustic signal. Because the ultrasonic wave was only 40 kHz or nothing, this sensor’s input frequency did not have to be counted. So, it was connected to an analogue input port A0 and would only provide an increase in flag number if the input voltage went above (?) mV.

In the Arduino program, all 4 void sub functions were called one after another for 20 times, in order to get rid of any effect of anomalies, which might be caused by the environmental noise. As mentioned earlier, in order to change the coil’s tuning frequency, another set of capacitors would be connected to the circuit when a switch was turned on. The switch had a resistance which allowed a large enough base current to saturate the BJT when a high voltage output, 3.3V was applied to the base. So, in the program, the loop was processing the sub function of detecting for the radio frequency 10 times with the switch opened and then 10 times with the switch closed.

Every time the sensors detect a signal, the corresponding sensor flag would increase by 1. At the end of 20 times of detection, the program would go through the conditions for all of the rocks one by one, with every signal considered as received if it had a flag number of more than 10, and for radio the threshold was 7 as each carrier frequency was detected 10 times only.