

# AstroPi

*Student: Florea Vlad Răzvan  
Supervisor: Coțop Carmen Viorica  
Nicolae Bălcescu High School, Cluj-Napoca, Romania*

## The purpose of the investigation

Our main purpose was to detect human presence in a room and determining the distance between the International Space Station (ISS) and Earth, using the measurement of the gravitational acceleration.

## Method of the investigation

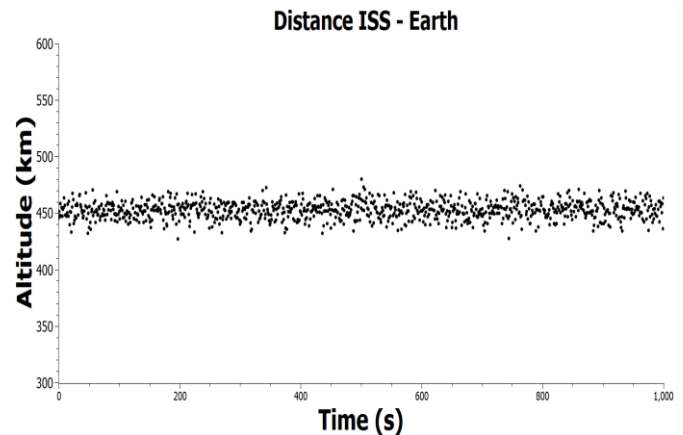


In order to reach our objectives we used a kit we got from ESA at the beginning of AstroPi competition, which contained a Raspberry Pi, two cameras and a “sensor hat”. The kit was used to build an “AstroPi”, which is a robot, a copy of one robot which already is on the ISS.

After we built the robot, we started coding it, but not before to make some research on how exactly we could determine what we wanted, using only the sensors we had. So, we found out that a good method of detecting human presence is measuring the humidity of the air in that room, a growth in the humidity meaning human presence. This method is based on chemical reactions that happen in our body when we breathe. The sugar in our organism reacts with oxygen, resulting carbon dioxide and water, elements which are considered “waste” products of our respiration.

For calculating the distance between the Earth and the ISS we must first know the gravitational acceleration on the Station. To do that, we used the accelerometer to measure the resultant acceleration there. We considered that  $g_0 = 9.889 \frac{m}{s^2}$  (the gravitational acceleration on Earth), the speed of ISS being  $v = 7668.055 \frac{m}{s}$  and the radius of Earth  $R = 6471$  km. Using these values and using a formula we determined the gravitational

acceleration on the ISS being  $8.633 \frac{m}{s^2}$ , which is pretty close to the one found in literature ( about  $g = 8.73 \frac{m}{s^2}$  ). The average distance between the ISS and the Earth we obtained is 454.7272 km with the following formula:



$$g = \frac{R_p^2 * g_0}{(h + R_p^2)^2}$$

Where  $g$  represents the gravitational acceleration we calculated,  $R_p$  the radius of Earth and  $h$  is the distance we want to calculate.

## Results of the experiment

The results we obtained after running our code on the ISS, were sent to us on email in a file. We took those values and analysed them, using SciDavis program.

## Conclusion

In conclusion, AstroPi is a good way to learn about robotics and we are thrilled that we could have our code run on the ISS and that we could get and analyse some physical parameters from space.

## Literature

<https://www.nasa.gov/audience/forstudents/5-8/features/nasa-knows/what-is-microgravity-58.html>

