Space Lab Phase 2 Report
Team Name: TeamCERC
Chosen theme: Life on Earth
Team members' names: Vivek Kommi, Akshith Katuri, Sairam Batchu
Location: Cambridge, UK

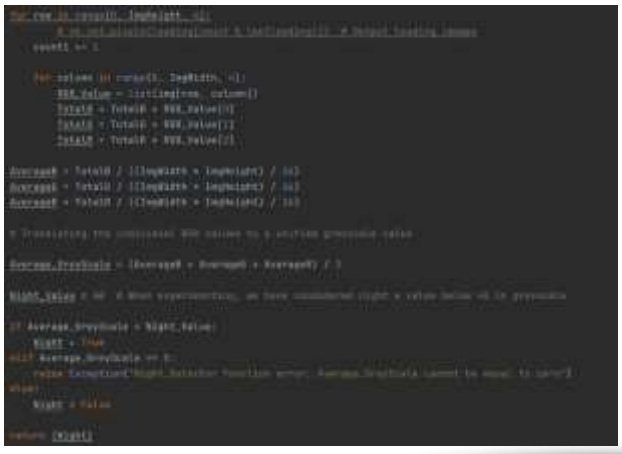
Introduction:

In this project, our goal was to detect the vegetation of the sea, locate Coral reefs and seaweed in the sea. This could help in the field of science because Coral reefs support more species per unit area than any other marine environment, including about 4,000 species of fish, 800 species of hard corals and hundreds of other species. Scientists estimate that there may be millions of undiscovered species of organisms living in and around reefs. According scientists marine vegetation will contribute more than 50% oxygen compared to all other plants on earth. After initial study our team concluded that with the hardware, resources we had available, investigating parameters such as Raster's, Clouds and sensing sea was the best way to gather useful data.

Method:

After reading and analyzing several studies about coral reefs and its importance, we decided to use just the NIR camera on the AstroPi, as it can receive the NDVI data (Normalized Difference Vegetation index) with this we could reach our goal. Our code detects from the image it is night or not, if the picture has sea or not, if the picture is cloudy or not, and to find the vegetation using NDVI. We then stored all this data in a .csv file.

Our Phase1 idea was to find the volume of carbon dioxide or greenhouse gases in the atmosphere. We were planning to detect the gas wavelengths using spectroscopy because it was in infrared range. Wave lengths Co2 was outside the range of AstroPi Izzy NIR camera wavelength range it can detect.



Example code to detect image was dark:

https://github.com/vivek-kommi/Astro-Pi-CERC

We calculated the average greyscale value and then if it was higher than 40 then we know it is night so we can delete the image. We did the same process with finding if the sea was present in the picture or not, but this time we analyzed the blue value.

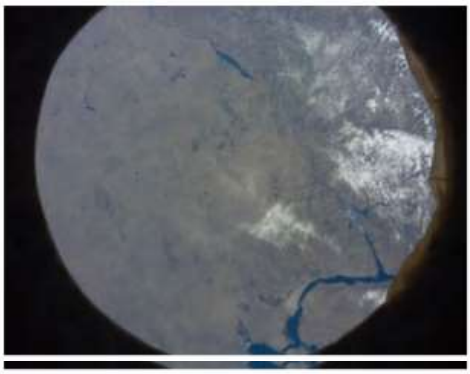
NDVI is used to quantify vegetation greenness and is useful in understanding vegetation density and assessing changes in plant health.

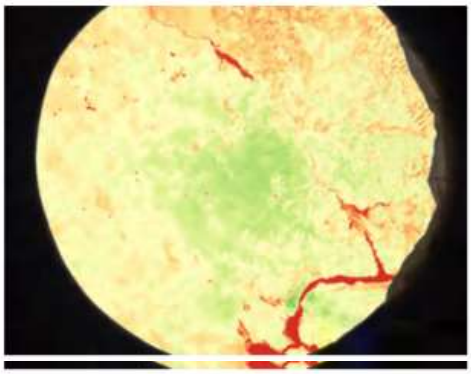
NDVI is calculated as a ratio between the red (R) and near infrared (NIR) values:

(NIR - R) / (NIR + R)

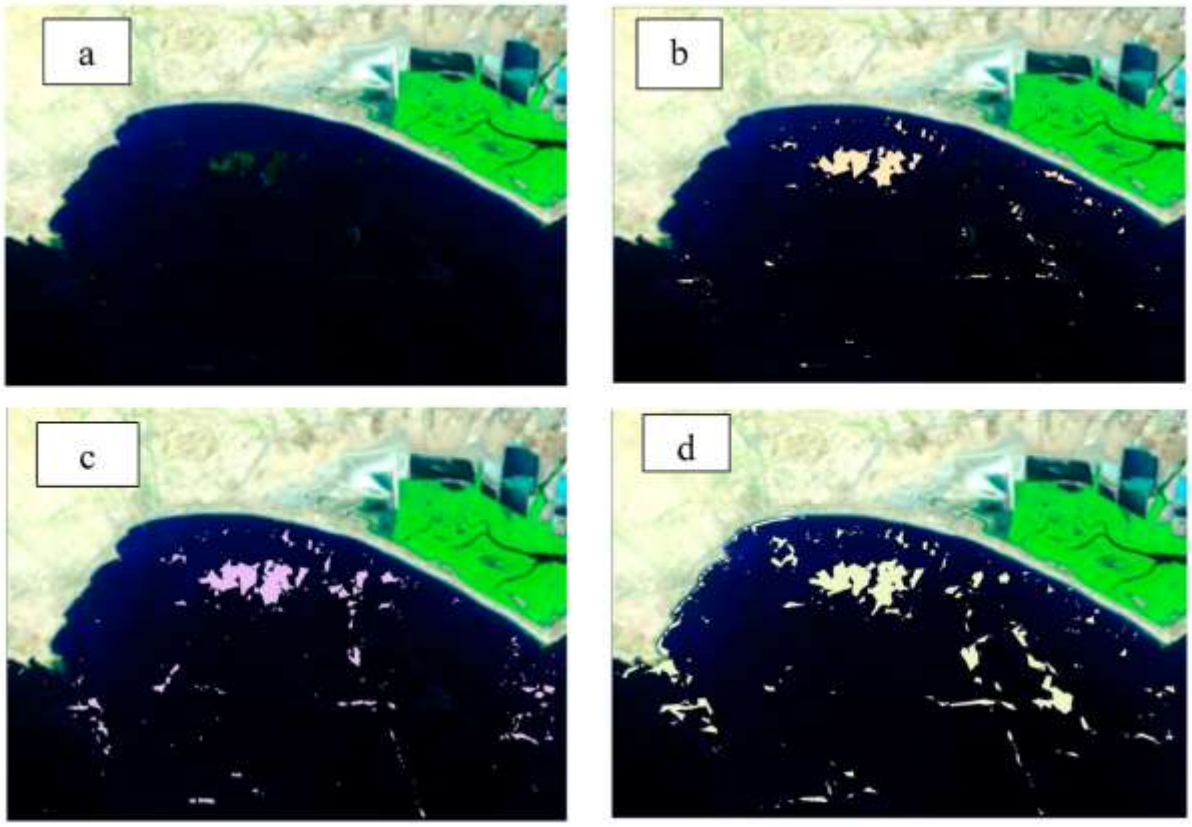
In Landsat 4-7, NDVI = (Band 4 – Band 3) / (Band 4 + Band 3).

In Landsat 8, NDVI = (Band 5 – Band 4) / (Band 5 + Band 4).





Example of experiment on coral reefs and from this data we can see that coral reefs are just off the seaside and can be scattered widely.



https://www.mdpi.com/2072-4292/11/12/1434/htm#

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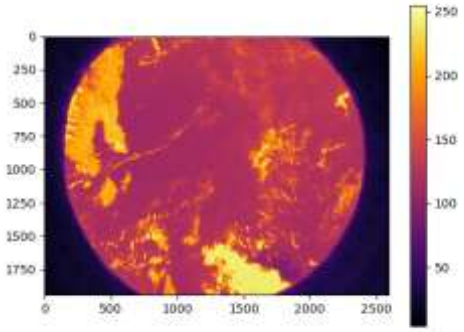

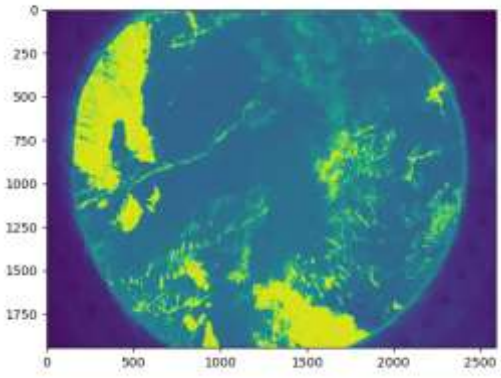

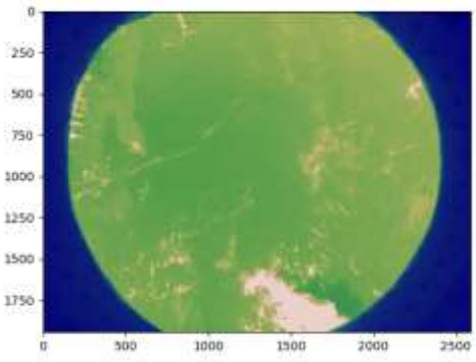

Above first image is supplied by ESA with AstroPi kit shows clearly marine vegetation in sea.

With our NDVI code, the last image has detected bright areas with marine Vegetation.

Conclusion:

With this experiment we have managed to discard night-time photos and distinguish ocean and cloud-covered images.

The next step would be to do a ground survey of this location aiming to verify whether the locations flagged by this experiment really are coral reefs or Marine vegetation exists. This experiment suggests that it is possible to handle existing satellite imagery and data to identify locations that can be investigated in real-time. The main limiting factor in the project is sea reflection. It can be easily remedied by accepting white pixels. Our aspiration is to have an automated system of map of the globe, where each pixel is color coded to indicate its sea vegetation, this is a tool to help scientists discover new species of wildlife.

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Source Repository:

https://github.com/vivek-kommi/Astro-Pi-CERC

References:

https://www.mdpi.com/2072-4292/11/12/1434/htm

https://www.usgs.gov/media/images/landsat-satellite-image-submerged-aquatic-vegetation-alaska

Glowing plants a sign of health - Vegetation - Earth Online - ESA

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