Basic Details of the Team and Problem Statement

Ministry/Organization Name: State Ministry

PS Code: SIH1519

Problem Statement Title: Generation of Hazard Map

Team Name: Valtreyak Sprryzen

Team Leader Name: Rahul Kumar Singh

Institute Code (AISHE): U-0954

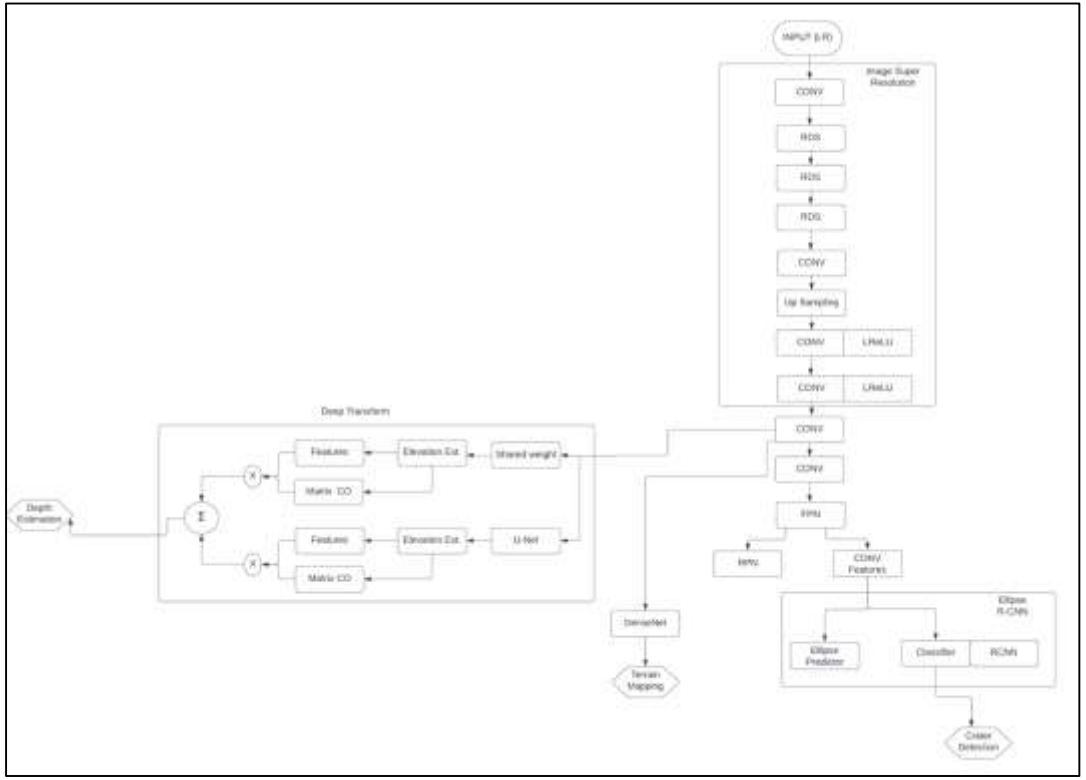
Institute Name: Indian Institute of Information Technology, Surat

Theme Name: Space Technology (Software)

Idea/Approach Details

Describe your idea/Solution/Prototype here:

- Aim: To provide create hazard map (crater detector)
- Reasons: To help with safe navigation of lander.
- Solutions:
  - Super Resolution: To upscale the image resolution for further processing.
  - Crater Detection: To detect crater help in securing a safe route avoiding the craters.
  - Terrain Mapping : To map the terrain and get all the geographical information about the moon.
  - Hazard Map: Creation of Hazard map using the results from Crater Detection and Terrain Relative Navigation.
  - Crater Mapping: To identify the pattern in the craters to provide faster crater recognition.
  - Terrain Classification: It is useful for route planning and obstacle avoidance.
  - Depth Estimation: Pix2Pix - GANs are used for depth estimation of moon's surface from the relative position at which the image was captured.



Describe your Technology stack here:

- Python → Foundation for the given models.
- Ellipse R-CNN → Used for Crater Detection..
- GANS → Used for Super Resolution and Depth Estimation.
- OpenCV → For using pre-trained Computer Vision Models.
- DenseNet → Terrain Classification
- Keras → Used for Deep Feature Extraction

Idea/Approach Details

Describe your Use Cases here

- Identifying Lunar Surface Features like craters depth, boulder, rifts, slope to help avoid hazards during lunar navigation.
- Image Super Resolution: To upscale and improve the quality of low resolution images taken by terrain mapping cameras
- Crater Detection: To Identify crater rim from the high resolution images (from ISR).
- Elliptical R-CNN includes two components - Mask R-CNN for elliptical Object retrieval and U-Net Semantic Segmentation) for learning different occlusion patterns
- Terrain Classification: DenseNet is used to segregate the images into different segments based on CNN.
- Depth Estimation: Pix2Pix and GANs are used for depth estimation of moon's surface

Describe your Dependencies / Show stopper here

Task Dependencies:

- ML models (Deep Learning Models).
- Computational Resources.
- Fine tuning of Generative models.
- Image Processing.

Show Stopper:

- Feature-based transform is harder to train, and require some hyperparameter tuning and loss balancing
- Lighting Conditions: Moon's surface has areas of permanent shadow or of strong sunlight.
- Regular Updates: Due to the dynamic environment of the moon.
- To improve the resolution of the images from terrain relative cameras.