



# 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

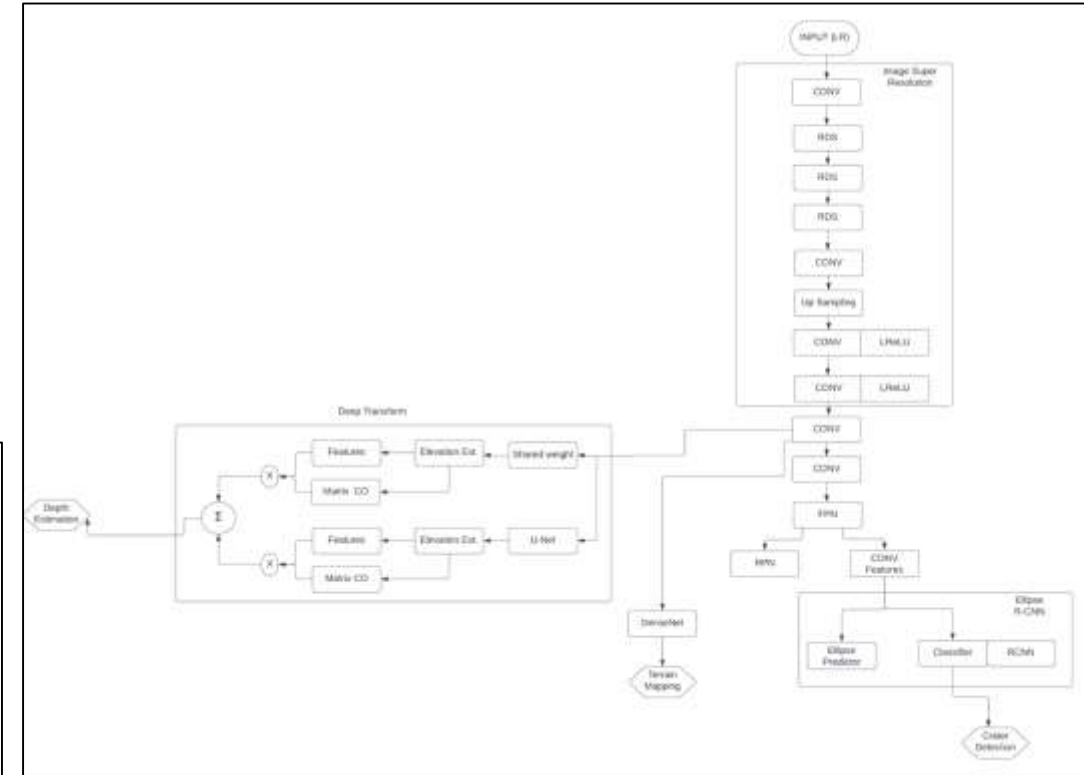
**Theme Name:** Space Technology (Software)

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# 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.

# Team Member Details

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**Team Leader Name: Rahul Kumar Singh**

Branch : B.Tech

Stream : CSE

Year : III

**Team Member 1 Name: Vipin Sharma**

Branch : B.Tech

Stream : CSE

Year : III

**Team Member 2 Name: Hamesh Kumar Puniya**

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**Team Member 3 Name: Sushant Matnani**

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Year : III

**Team Member 4 Name: Rohit Raj**

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Stream : ECE

Year : III

**Team Member 5 Name: Anjali**

Branch : B.Tech

Stream : CSE

Year : I

**Team Mentor 1 Name: Rajesh K. Ahir**

Category : Academic

Expertise : ML

Domain Experience : 4 years