SAR Report - Life Sciences

Three methods are being employed to look for signs of extinct, extant, and nonexistent life. A deep learning model capable of real-time rock detection has been developed. The rover has a module where the supplies are kept for the Biuret and SYBR safe dye assays, which are used to determine whether proteins and nucleic acids are detectable. In the first step, SYBR safe dye test is used to detect either for Proteins or Nucleic Acids. In determining the difference between proteins and nucleic acids, Biuret assays are used in the second step. The mechanism is designed such that it enables us to carry out the two tests on four different test locations. The mechanism is designed in a way to ensure it is spill proof and avoids cross contamination. Soil is collected and mixed in a separate container and the soft soil solution is passed to the test tubes containing the test solutions with the help of electronic solenoid valves. A customised gripper is used to collect the soil and deposit it inside the rover's life science module before performing the tests on the samples of soil. To determine the colour of the solution, we used a CMOS camera.

The soil NPK sensor is used to monitor the precise levels of Nitrogen, Phosphorus, and Potassium in the soil. These elements, as among the most essential components for life support, are essential in our mission to detect life. Sensors are used to detect temperature, humidity and moisture in the atmosphere and soil respectively because temperature and humidity balance is critical for soil life support. If the temperature is too high, it can cause evaporation of soil moisture and reduce the activity of beneficial soil organisms. A low temperature can slow down biological processes and reduce plant growth. Similarly, too much or too little moisture in the soil can limit nutrient availability and negatively impact plant growth and survival.

High UV concentrations reduce population. The UV Detector informs us about the possibility of life in that area. The pH of soil is an important factor in determining the health and productivity of soil and the organisms that thrive in it. The pH of the soil impacts nutrient availability, microorganism activity, and plant growth. The pH sensor is used to detect the soil's acidity or basicity which provides more information about the life form. The soil moisture sensor measures the moisture content of the soil. Microbe growth is inhibited by extremely low moisture levels. Gas sensors detect gases like carbon dioxide, oxygen, ozone, and ammonia since presence of these gases are very essential for survival. Moreover, wind speed is measured using an anemometer, which aids in comprehending the larger environmental context in which life can exist.

Endoliths are organisms that live inside rocks or in mineral grain pores. The presence of microorganisms beneath or on the surface of rocks indicates that life may exist, whereas the presence of fossil fuel indicates that life is extinct. A digital microscope is being used to look for endoliths. It also provides information about the environment's early life. Rocks provide information regarding minerals in a particular region. A rock detecting deep learning model is built which detects different kinds of rocks. The model is built using loading of custom-dataset on an algorithm based on Convolutional Neural Network. The process involves collecting a large dataset of images on different classes such as Igneous, Sedimentary and Metamorphic. Next step is to annotate the images and train them on the YOLOv5 algorithm which is based on the Convolutional Neural Network. This model gives high accuracy and detects the rock in real-time.