YUVAAN ASTROBIOLOGY EXPEDITION (AbEx) REPORT

This report presents a comprehensive analysis and final findings of the AbEx mission. The rover has been specifically modified to meet the mission's requirements, incorporating an auger drill for soil sample extraction, beakers with chemical reagents for analysis, an onboard camera, and a suite of sensors for environmental data acquisition. The report is structured into the following sections: Rover Configuration, Data Collection Mechanism, and Experimental Findings.

ROVER CONFIGURATION

DRILL MECHANISM AND SOIL COLLECTION

Our soil extraction system employs an auger drill bit and a linear actuator for efficient collection. The process includes:

- **Drilling:** A linear actuator drives the drill vertically to penetrate the soil.
- **Lifting:** Drill retracts without rotation, retaining soil on the bit.
- **Discharge:** Drill rotates upon retraction, releasing soil tangentially.
- **Collection:** Discharged soil is funnelled into designated containers.

This method ensures efficient soil retrieval and controlled sample collection.

TESTING MECHANISM

The testing mechanism comprises a platform holding five beakers containing chemical reagents for analysis, along with a sensor array designed to evaluate the soil's potential to support life.

Sample Detection Tests:

Detection of life chances is determined by the presence of some major organic compounds such as proteins, lipids and nitro compounds which are present in most living organisms.

- **Nessler's Reagent:** Nitrogen presence: Brown Ammonia Fumes
- **Hydrogen Peroxide Test:** Presence of Organic matter: Oxygen bubbles
- **Epsom Salt:** Presence of Magnesium: White Precipitate
- **Phenol Red**: pH indicator.
- **Bromocresol Green:** pH indicator

These tests combined help to determine the presence of life or the chances of survival of living organisms by detecting the compounds mentioned above.

Sensors:

pH Sensor	**BME 280 Sensor**	**Spectrometer**	**MQ2/8/9 A Gas Sensors**
MH-Z19C (CO2 sensor)	**Soil Moisture Sensor**	**NPK Sensor**	

DATA COLLECTION

Chemical tests are monitored using onboard cameras, with the captured data transmitted to the base station. Sensors are integrated with the onboard Jetson module, which processes and stores all collected data in text files. These files are subsequently sent to the base station for further analysis and visualization.

SENSOR DATA

Sensor	Data Retrieval
NPK	Soil penetrated; Reading: ionised voltage differences
MQ2/8/9	Open to environment Gas sensor; metal oxides semiconductor adsorption-based detection

Colour sensor	Visible spectroscopy based detection

EXPEREMENTAL FINDINGS

TERRAIN:

1. Rocky loose Terrain
2. Low traction
3. Red colour soil
4. Recent artificial rock formation

SOIL:

1. Soil Moisture: 4.2%
2. NPK: (32, 63, 45) mg/kg

ENVIRONMENT:

1. Temperature: 32 deg Celcius
2. Humidity: 72%
3. Methane (MQ2): 7
4. Hydrogen (MQ8): 112
5. Carbon Monoxide (MQ9): 700
6. Carbon Dioxide: TRUE