



## MODERN WAY TO COLLECT DATA ON THE MOON WITH THE HELP OF SMART ROVER (INTELLIGENT LUNAR DUST COMBATING ROVER)

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### Abstract

The satellites are launched into the space; they are being damaged by lunar dust particles and miserably failing to send the defined data due to which assigned task is left unfinished.To clobber this dust particles. A rover has been developed which is capable of crushing the dust particles and collects data from moon like soil, humidity and temperature. With the help of camera module photos are captured and image processing is applied.

**Keywords-** Rover, Satellite, Camera Module, Lunar Dust, Image Processing.

### I. Introduction

The outer part of rover acts as a protective layer which is termed as "Hard rover" [1]. It is made by doping aluminium with titanium and woven fibre which covered with a material called "wolverine"[2] it is also called as self-healing material. In space if the system is damaged it automatically gets healed without any support and there is another rover inside like a baby in a womb which is used to collect data called as "soft rover" or "baby rover". Which is placed. On the top of rover, a sprinkler is installed which is a replica of mini drone. A ferromagnetic material is doped with aluminium with help of nuclear fission method composition is made. By sprinkling this material lunar dust[3] can be killed which helps the rover to overcome the attack of particles.

In this paper we are going to present the prototype for lunar dust combating rover with a working model in the following way-Components used are two Arduino boards, raspberry pi, soil sensor, humidity and temperature sensor, motor driver module, 100rpm motors and 12V battery., Arduino cable.

### II. Prototype

The prototype design is segregated as exterior and interior parts respectively. Exterior part is replica of "Hard rover" and interior part is replica of "soft rover". External part of prototype is made-up of C-PVC pipes. Two PVC sheets are mounted on the top and below of hard rover. On the top raspberry-pi is installed along with the camera module. raspberry-pi zero has been used.[4]. In between pvc sheets a robot car has been placed which is also known as "soft rover". Robot car is made up of glass chasel. An Arduino board is mounted upon the body of soft rover. Basic genuino uno board has been used. [5]

Soil and humidity - temperature (DHT11) sensors are connected to the Arduino board.[6]

A motor driver(L289N) module is connected with motors and batteries which is connected to another Arduino board along with a Bluetooth module [7].

### The connections of prototype are as follows

Firstly, C-PVC pipes are fixed with screws. After accomplishing the exterior part two sheets are placed followed by a glass chasel to which small wheels are fixed which will be placed in the middle of two sheets. As discussed above raspberry pi is placed on top which acts as Eye to the rover connected to computer (Server). An Arduino board is placed connected to motordriver module and Bluetooth module acts as remote control. It will be controlled by mobile phone(client). Another Arduino board is placed on soft rover to which soil sensor and DHT11 sensor are connected. This Arduino board is connected to system(server)

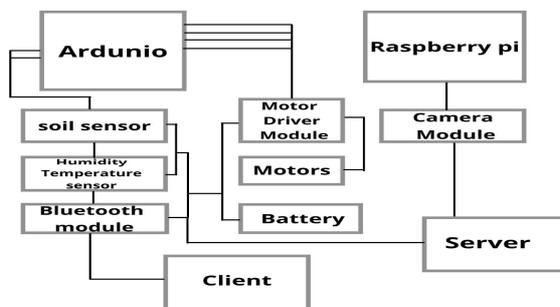


Figure2.1Circuit diagram

### III. Prototype Working

After connecting all the components as shown in circuit diagram, they have to be interfaced by following order in series which will generate the desired results. Functioning of prototype is as follows-

A) one Arduino board is connected to soil sensor which is used for soil detecting and DHT11 is used for detecting humidity & temperature. it is connected to the system which acts as server which will show readings on serial monitor in Arduino software and another Arduino board is connected with a Bluetooth module and motor driver module followed by batteries and motors. It is controlled with a mobile phone which plays the role of client. There is an app for Arduino controlling using that this prototype can be controlled. By using C language, programs have been executed for Arduino microcontroller. Bluetooth sensor uses “flag” module respectively. For special case “serial state” module is used for which Bluetooth module is not required can be controlled by server itself.

B) Raspberry-pi is used for image processing. A camera module is connected with help of the camera live recording and processing can be viewed in system(server)

Python language and open cv [8] module are used to execute this process. IDE tool used here is Spyder.

Open cv2 module is used for image processing and haarcascade library files are used for detecting faces and features on faces like eyes, nose respectively.

For soil detection and to identify other features pre – loaded classifiers are used respectively.

C) A mini drone is placed at the top of model which is replica of ferromagnetic material sprinkler. The drone can be controlled by remote.

The functioning of prototype is represented by an architecture which shows the connections in a clear way and also shows the components used to implement this prototype

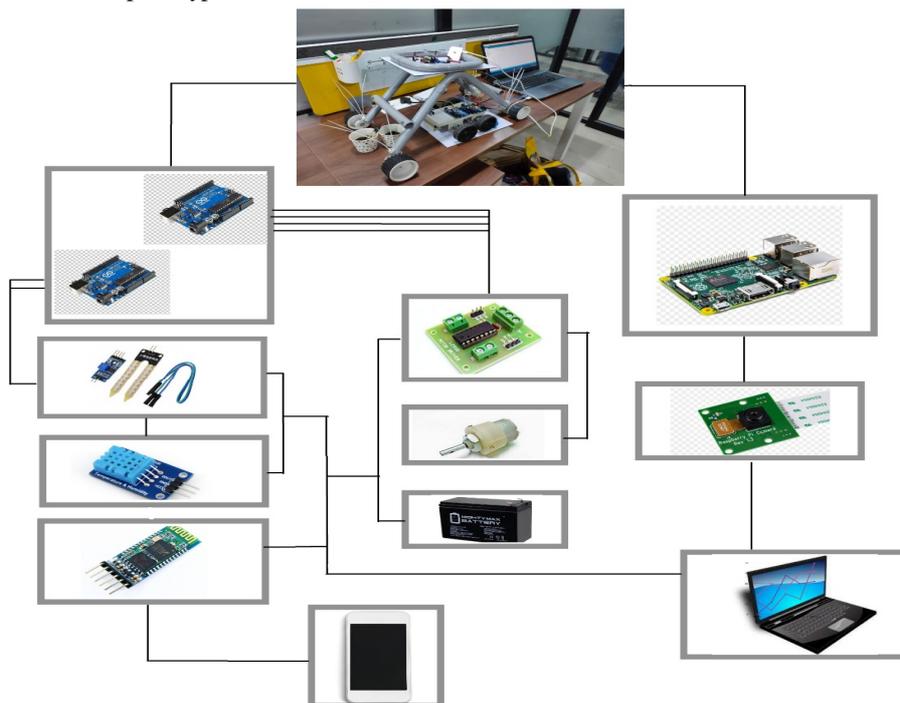


figure-3.1- Architecture of prototype for lunar dust combating rover is given below

### IV. Applications

There is a lot of demand for new tools and technologies in the same way our prototype model is also useful in many areas. The following are the various applications of our model.

A) This prototype can be customised and used by farmers for collection of data like soil. It will be much more efficient and easier to use.

B) This prototype can be used in Army base camps to do the surveillance from camp office only. It can also be customised according to requirement of military to use in war possibly.



C) This prototype can be used in mines also to do the surveillance and can be sent to deep under mines where big machineries or humans cannot reach.

D) camera module is attached to a rover which is interfaced with a mobile.

- I) Live streaming can be seen on mobile which is shot by camera.
- II) An augmented reality background is created (Lunar background) where virtual reality is interfaced with augmented reality
- III) This will make user to have feel of being on moon

E) This prototype can be used as case study and reference purpose for future projects based upon Internet of things & Image processing.

F) **Financial benefits –**

- a). Prototype model can be kept as reference to make real rover
- b). Capturing images at mines
- c). VR game leads to the inclination of the annual growth rate.
- d). EPS of company who took this game will have a rapid growth in the market.
- e) This prototype can be used in Tourism sectors which gives exhilarating experience to tourists by projecting spot in an interesting manner.
- f) Modified version of this prototype can be used as remote-controlled Toy which has a huge market respectively.

### Conclusion

As we know there is a lot of demand for rovers in the space.its because the satellites are launched into the space; they are being damaged by lunar dust particles and miserably failing to send the data. In our prototype we developed a rover. Which is capable of crushing the dust particles and collects data from moon which is related to soil, humidity and temperature conditions.

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