# Metal and Deleterious Gas Detecting Rover using RF Controller and Zigbee Transceiver

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***Abstract :*** Many advanced technologies have undergone for the space missions and also geographical locations in space. Earlier humans had to move manually to space for the research but it was risky and resulting in loss of life. Hence in present and the future technology everything is operated and controlled through robots, this device deals with the prototype rover which can move anywhere in the space surface. This rover is built with ARM controller interfaced with Gas and Metal detector sensor. This Rover also contains Zigbee module on the rover which transmits the result obtained on the site to the receiver section present with the user displaying the result on LCD. The rover is operated through RF controlled remote for reaching the checkpoint as per the user commands.

***IndexTerms* - Zigbee; ARM (Advance RISK Machine); RF (Radio Frequency); LCD (Liquid Crystal Display).**

## I. INTRODUCTION

This prototype deals with the controlled automation of the robot can be moved anywhere on the space surface. This robot is built with ARM controller interfaced with gas and metal detector sensor. Controller switches are interfaced to the RF transmitter through RF Encoder so as to control the movements of rover.

The built prototype uses LPC2148 MCU as its controller. Using Colpitts oscillator principle, a high sensitive induction type metal detector is designed and it is fixed to the robot. Wireless technology i.e RF module is used to control the movements of the Rover. The detectors are interfaced with the controller, when there is slight change in the voltage the buzzer alarms displaying the result on LCD and transmits the same onto the receiver site using Zigbee Module. The built prototype works on 12V supply. As the controller alone can't drive the rover, it uses help of H-bridge for extra drive force and also for forward and backward movement of rover. This prototype is useful for metal detection and surveillance applications.

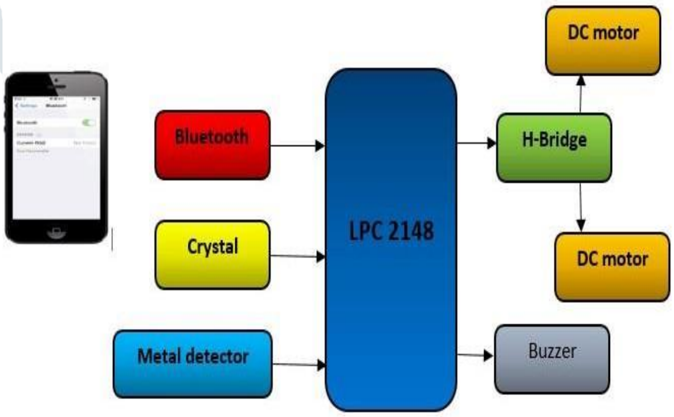


Fig 1 Block Diagram

## II. LIMITATION OF THE CURRENT WORK

Hand gestures were used to carefully guide the approach of the object. When object nears chassis, metal detector gets activated and triggered. Mobile jammer was mounted on it and an attempt was made to connect to the object by means of telecommunication but it failed [1]. Because of more complexity it is difficult to operate and its cost is high to be used of demining [2]. Interference occurs due to communication devices using similar frequency interfere with transmission. Lack of security exists on transmission since signals are spread out rather than confined to a wire [3].

## III. Objectives

This device deals with continuous automation of the robot which is designed to be a prototype for mining on Mars by ISRO. And on Earth it can be sent to places for detecting metal and deleterious gas.

## IV. IMPLEMENTATION

Hardware design:

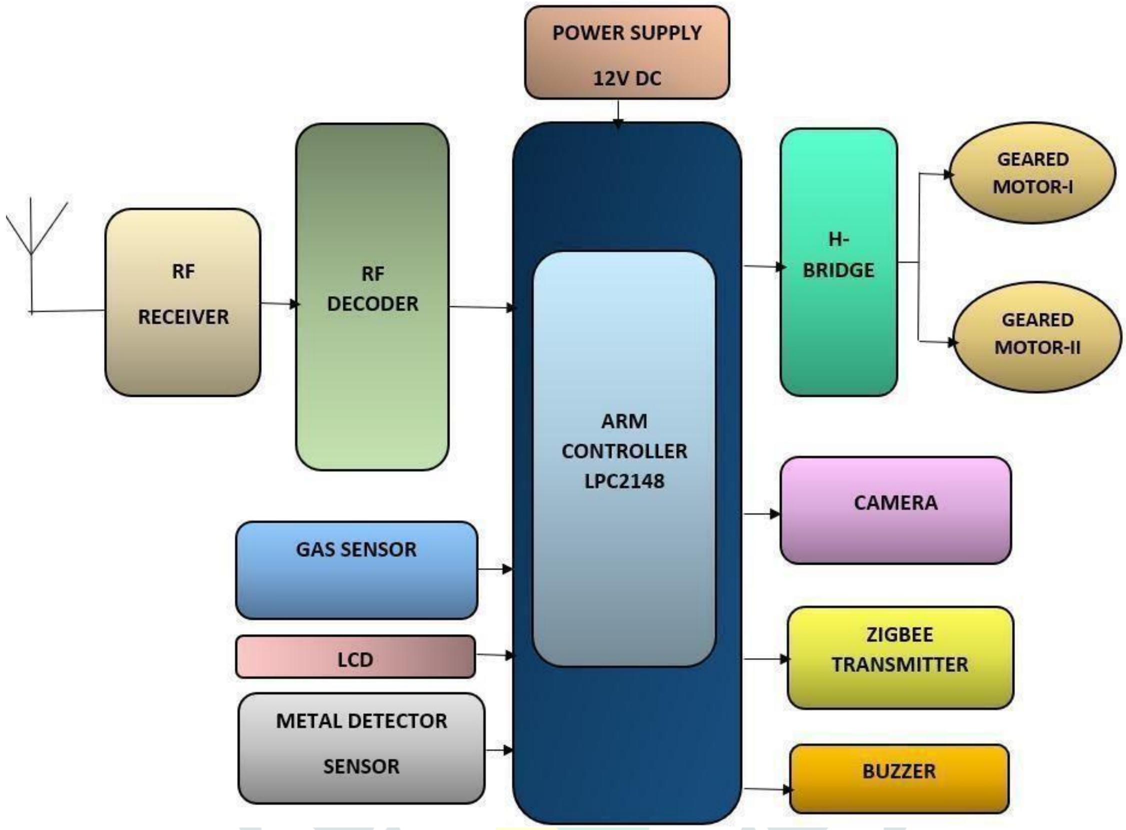


Fig 2(a) Rover Block diagram of the proposed system

Implementation: The rover consists of ARM processor, RF module transceiver, sensors such as metal detector, MQ-2(gas sensor), driver IC, RS 232connector,2 LCD's, camera, display, buzzer, Zigbee, motor, sensor and RF receiver. The circuit is supplied with 12V regulated power supply. RF transmitter and receiver module are interfaced with ARM LPC2148 on rover and made as switch on the control board. The inputs are fed in for movement of rover and this input is transmitted over by using RF transmitter. The transmitted signal is received by the RF receiver interfaced on the rover. The signal is then fed to the Hbridge for movement of the rover. The Camera is mounted on the rover, it is a wireless camera which is powered by 9V battery. This camera is used for live streaming, using which the rover can be operated. Live streaming is displayed on the LCD display. Due to help of live streaming, we can observe the display and control the movement of rover. If any object is detected, it can be seen through the camera and we can route the rover in a different direction. The Zigbee module is used to communicate between the rover and the receiver part, where the detected information is transmitted over on to the receiver. It is interfaced with ARM7 LPC2148 on rover by using RS232 cable. The output is displayed on rover LCD is also displayed on the receiver LCD and this is done with the help of Zigbee.

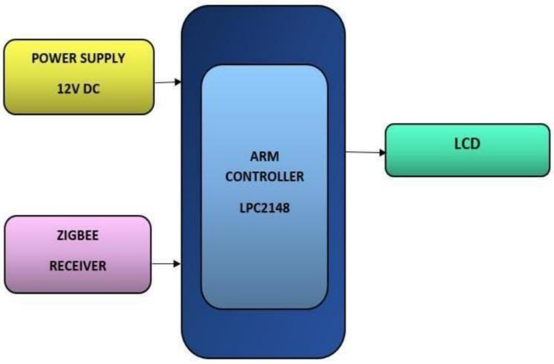


Fig 2(b) Receiver

Gas sensor (MQ-2) is interfaced with LPC2148 microprocessor which is programmed using Keil software. When the rover moves along the mining area as it detects a gas, it is displayed on the LCD and the buzzer rings sounding alarm that there is presence of poisonous gas. The sensitivity of gas is varied by connecting a potentiometer to it. The metal detecting sensor is connected to the microprocessor which is programmed using Keil software. When the rover detects a metal in the mining area it displayed on LCD and the buzzer beeps indicating detection of metal. Two 16x2 LCD's are used for displaying the detected output. The first LCD is present on the rover, if any metal or gas gets detected then it is displayed on the LCD. The same output is then also displayed on the LCD placed on the receiver block, so that the person operating the rover will be notified if any metal or gas is detected in its path

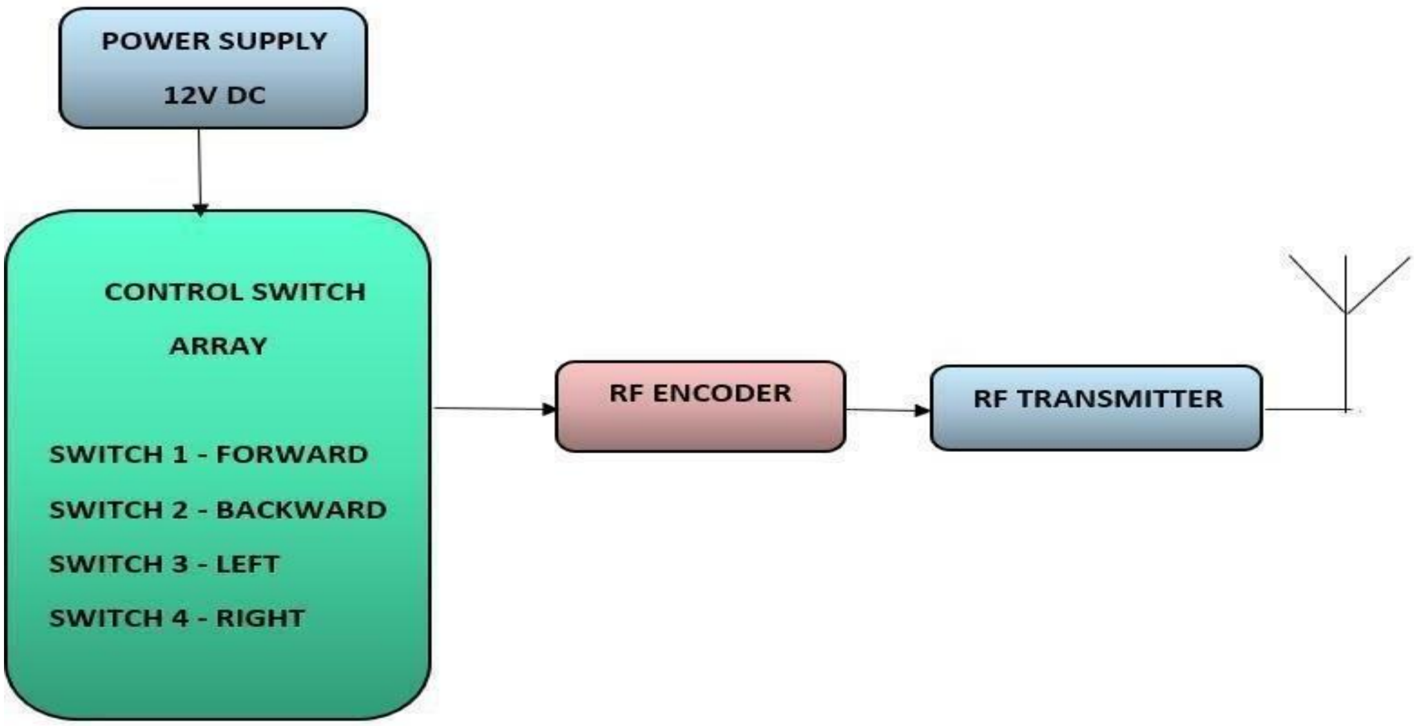


Fig (2c) Control Switch

## V. FUTURE SCOPE

This device is designed as a major prototype for performing mining on mars using rovers by ISRO. The following upgrades can be done to this device:

1) This prototype can be upgraded with AI (Artificial Intelligence) where the rover moves automatically detecting obstacles.
2) In our present model, the rover does not move with live streaming video, in future upgrades, the camera can be interfaced with the controller and it can act as electronic eye and guide the rover for detecting.
3) The rover can be provided with an additional equipment that collects samples too.
4) A better processor can be used which can have more interfaces to it and it can work on IOT and big data in future.

## VI. RESULTS AND DISCUSSION

So here are images of results obtained. The first figure 3(a) displays the output on LCD which is on rover, it says smoke is detected and then the buzzer beeps. The same is then displayed on the receiver side, as shown in figure 3(c). The same repeats when Metal is detected and also when both are detected together. When the buzzer beeps, it means one of the components is detected. The user on the receiver side will also get the display on the LCD present on the receiver side too, indicating the components is detected and then the user will get to know the presence of smoke or metal in the area.


Fig 3(a) Smoke and Metal not detected


Fig 3(b) Metal Detected


Fig 3(c) Smoke Detected


Fig 3(d) Smoke and Metal Detected

## VII. CONCLUSION

This prototype presents a remotely controlled unmanned rover with gas sensor, metal detector sensor and buzzer, using RF and Zigbee communication with wireless live video streaming and it is designed and implemented with ARM LPC2148 MCU. This prototype is used for the space mining missions for sensing the metal and gas using the detectors. The rover moves in parallel with live streaming and the video can be seen on the HD LCD display. Experimental work has been carried out carefully. The result shows that higher efficiency is indeed achieved using the embedded system. The proposed system is verified to be highly beneficial for the space operation.

## VIII. REFERENCES

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