Project On: Disaster Managing Surveillance Rover

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Project on:

Disaster Managing Surveillance Rover

About the Project:

As time passes humanity has been able to ease their difficulties through depending on technology. No matter how hard or how difficult the problem is, it has been always possible for us to solve them unitedly and using modern technology. One of the biggest and the most obstructing cause for our advancement are natural disasters. Since we cannot control nature and some disasters occur without warning, the best we can do is to face the aftermath of the disaster so the loss can be reduced.

The following project focuses on a disaster managing rover which acts as a surveillance device in any area which is prone to natural disasters especially Tropical Cyclone, Flood, Wildfire and other disasters. The main use of the rover is to explore and collect data regarding the disaster its encountering and upload those data to a server for worldwide access. This will help the user to have a better knowledge of the disaster which is taking place without any human intervention.

Every year due to several natural calamities, thousands of people consisting both civilians & rescuers die. Most of these deaths are caused due to lack of preparation, proper management, less awareness or systematic faults. Since the information those are provided during these disasters are only an approximation and the actual condition can only be known unless someone experience these disasters close at hand.

So, using a remote device such as this rover to observe, analyze and report the natural disasters is much safer and convenient than a living person walking right into it.

Hardwares for the project:

1) **Sensors:**
    i. BMP-180 Barometer Sensor
    ii. Analog Steam Sensor.
    iii. Analog UV Sensor.
    iv. DHT11 Humidity Sensor.
    v. Ultrasound Sensor.
    vi. Gas Sensor MQ-2.
    vii. Gas Sensor MQ-8.
    viii. Gas Sensor MQ-135.
    ix. Flame Sensor.
    x. GPS Module

2) Brains for the Rover:
    i. Two Arduino Mega (For Rover receiver and sensor data transmitter)
    ii. Two Arduino Nano (For Remote transmitter and sensor data receiver)

3) Motors:
    i. Four 12 Volt 300 RPM Gear motor.
    ii. Nine Servo Motors.

4) ESP32 Camera Module
5) Four NRF24LO1+PA+LNA Communication Module
6) Bluetooth HC-05 Module
7) Two 12 Channel Servo Power Supply
8) Two Motor Drivers
9) 16 Lithium-ion Cells

Software Segment of the project:

a) Programming the Hardware:

Program written in Arduino IDE(C++)

b) Android App:

Constructed using MIT APP Inventor. Saving the sensor data in Google Sheet is done using App Script (JavaScript)
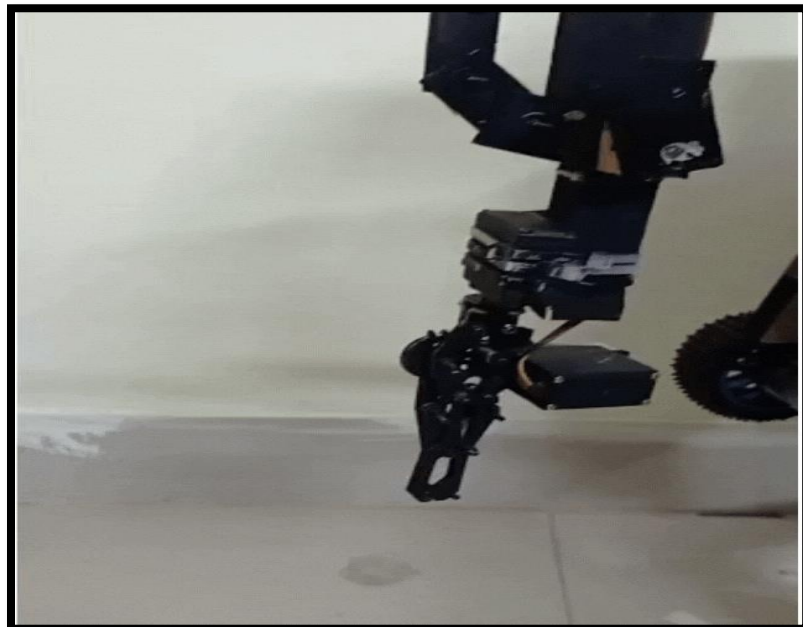
Obtainable Readings:

    i)   Atmospheric Pressure.
    ii)   Temperature.
    iii)   Altitude.
    iv)   Flood Checker.
    v)   Ultra Violet Sensor.
    vi)   Air Humidity.
    vii) Distance from a targeted object.
    viii) Presence of Smoke, Carbon Mono-Oxide and air quality.
    ix)   Detects nearby flame.
    x)   Rovers position based on Latitude & Longitude
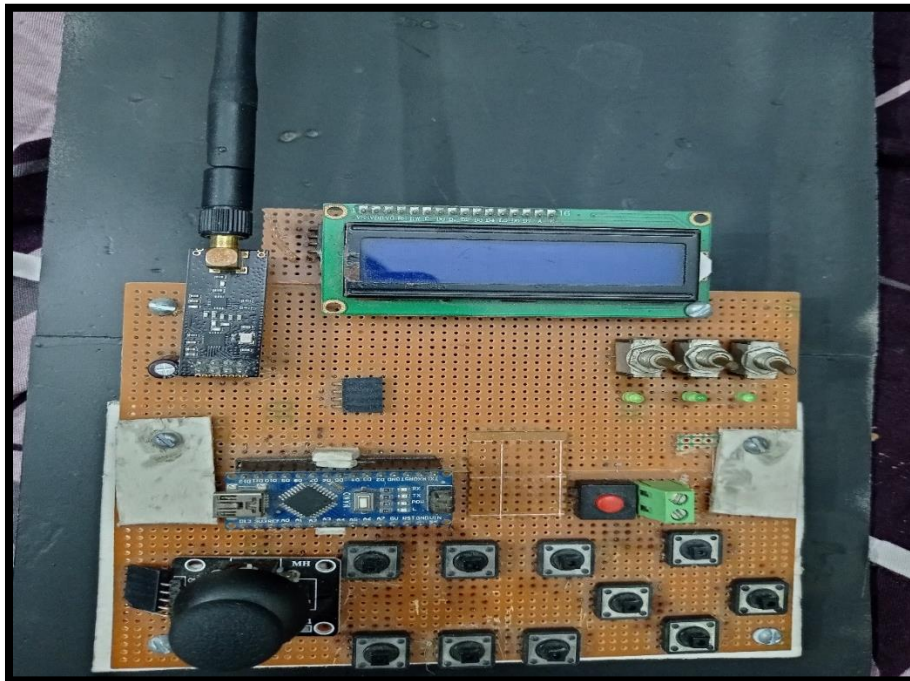
Main Structures:

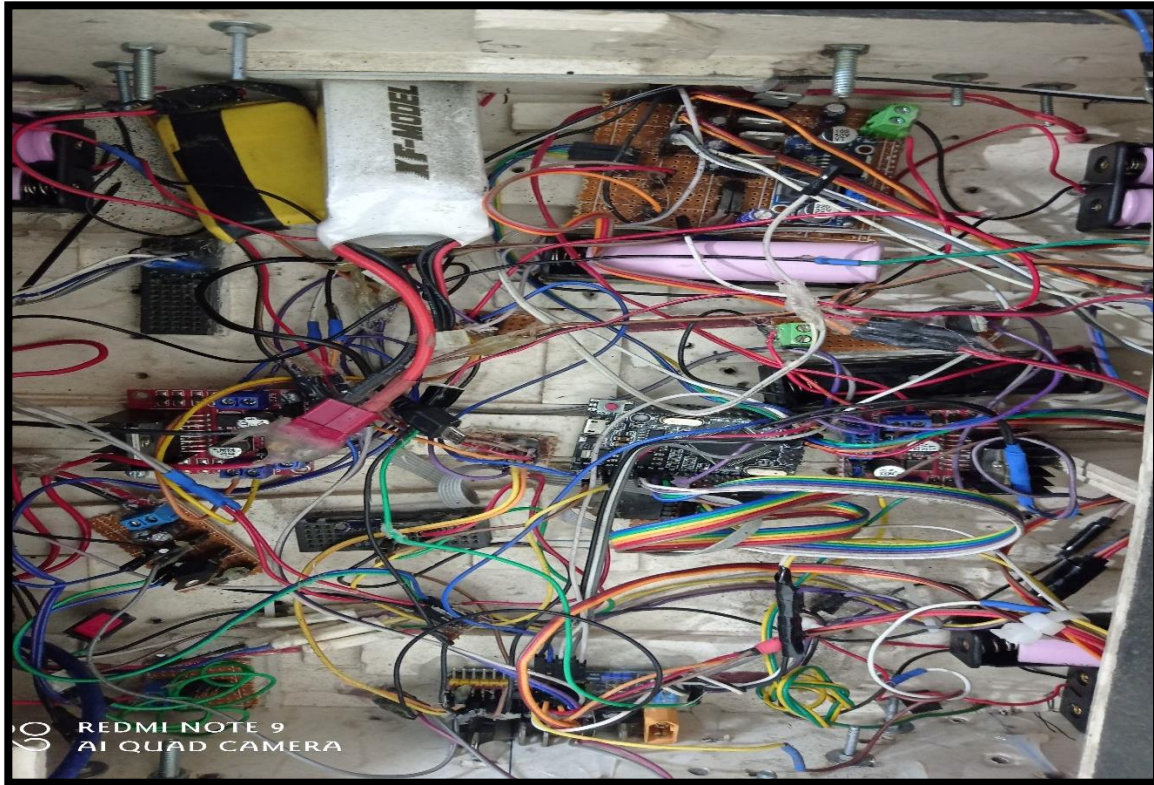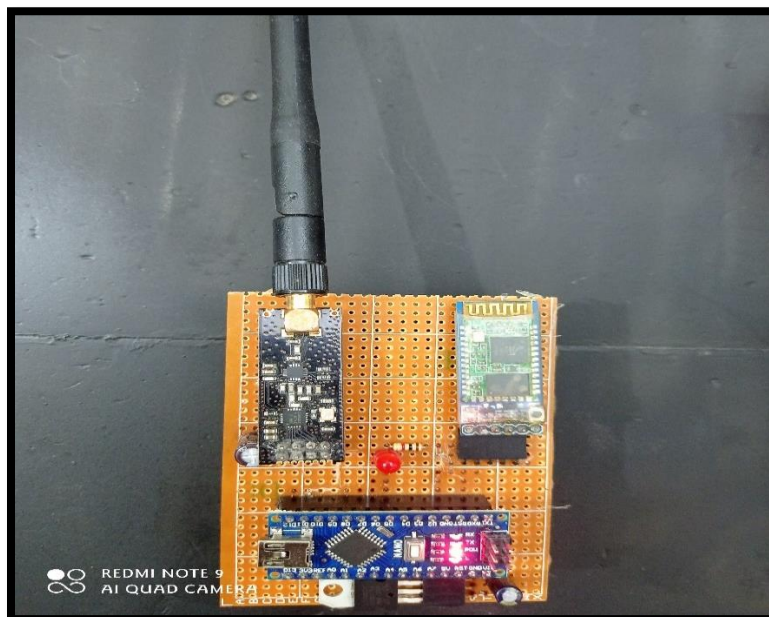## A) Head

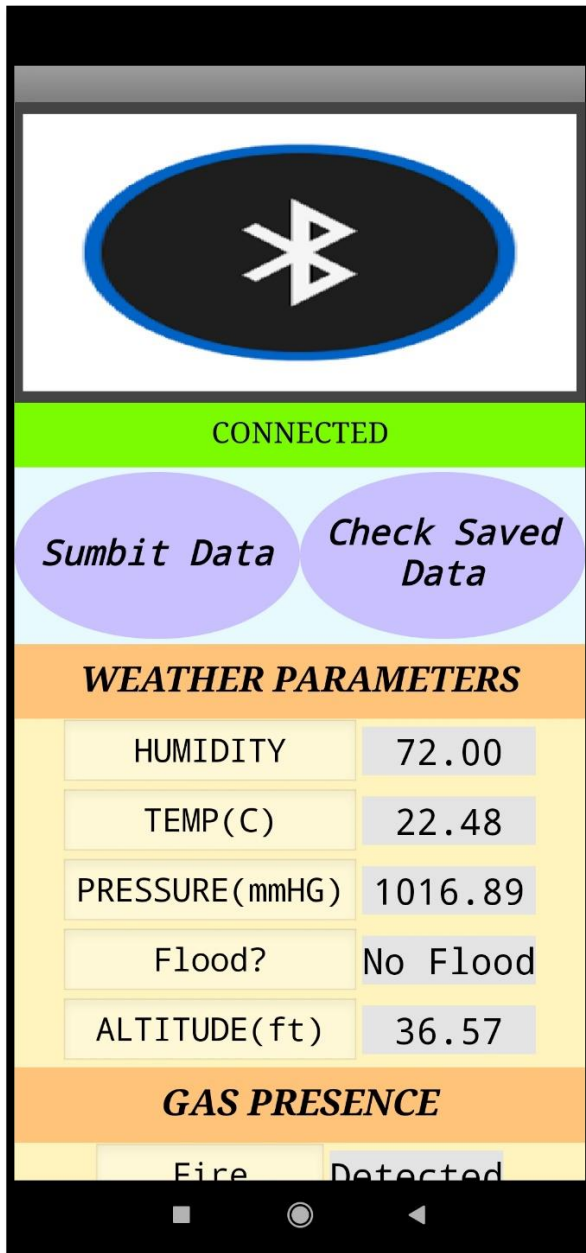## B) Arm

C)Body:

D) Remote:

E) Internal Circuit Connection:
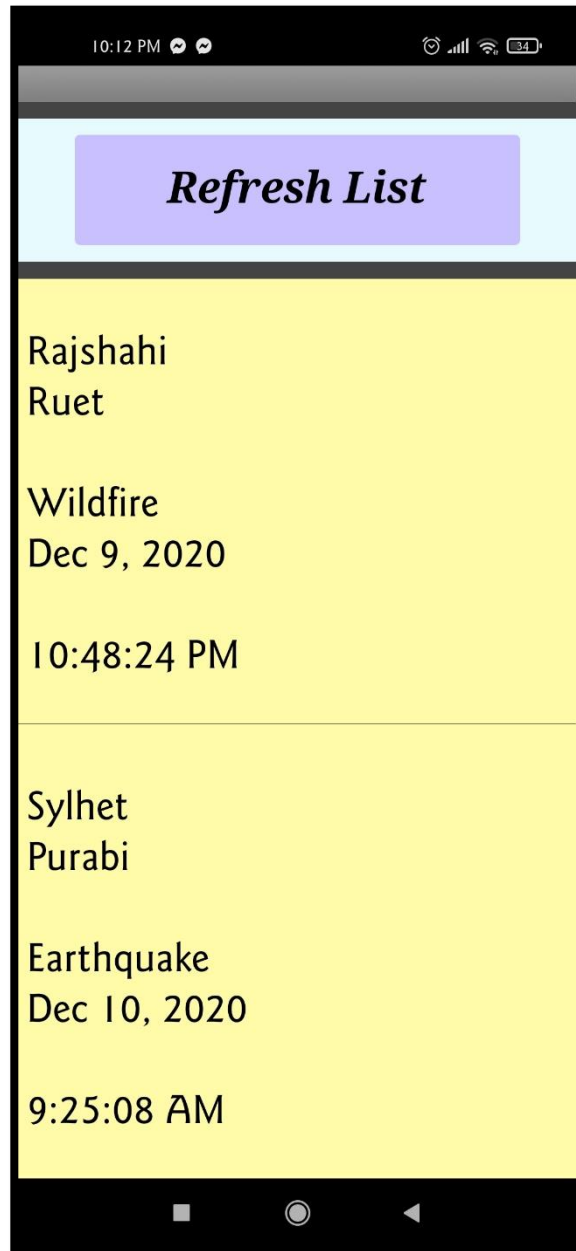

F) Sensor Receiver:

G) Android App:

a) Displayed data

b) Stored data

Working Method of the Project:

Basic functions:

The back two wheels will act as a steering mechanism for the rover. The main body of the rover will be considerably higher from the surface. So, it can move also in water. For detecting the water level, there will be a water level sensor attached to one of its legs, allowing the user to know the water level. The rover will consist of a 3 degrees of freedom (DoF) robotic arm which will not only be able to pick and lift up items but also clear any obstruction in its path by moving them aside. It will also assist in doing things like opening a drawer, pressing buttons, rotate valves. The rover will have multiple sensors in it, mainly for knowing the weather parameters. Now these sensor data can be obtained by the user using a mobile app only used for displaying and storing the sensor data obtained from the rover wirelessly using radio frequency. The head of the rover will consist of a WIFI Camera with a high gain antenna which will give live footage of the rover surroundings by moving the head both horizontally and vertically. It can also detect flame presence of its surrounding. A GPS Module through which we can locate it in map. Now this information will be sent constantly to the user.

1) **Communication between Rover and Remote (Radio Frequency Communication):**
   The remote provides all the necessary commands to the rover. Physical Functions like moving the rover. Operating the arm, moving the rover head are done in this part.

2) **Communication between Rover and Sensor receiver (Radio Frequency Communication):**
   The sensors which are provided within the rover measures several parameters and send them to the receiver using long range communication module.

3) **Communication between Sensor Receiver and android app (Bluetooth Communication & WEB based Communication):**
   Once the receiver is provided with sensor data, the Bluetooth module in it connects to the android app and the sensor readings are displayed in it. The sensor data can be saved on google sheets later.
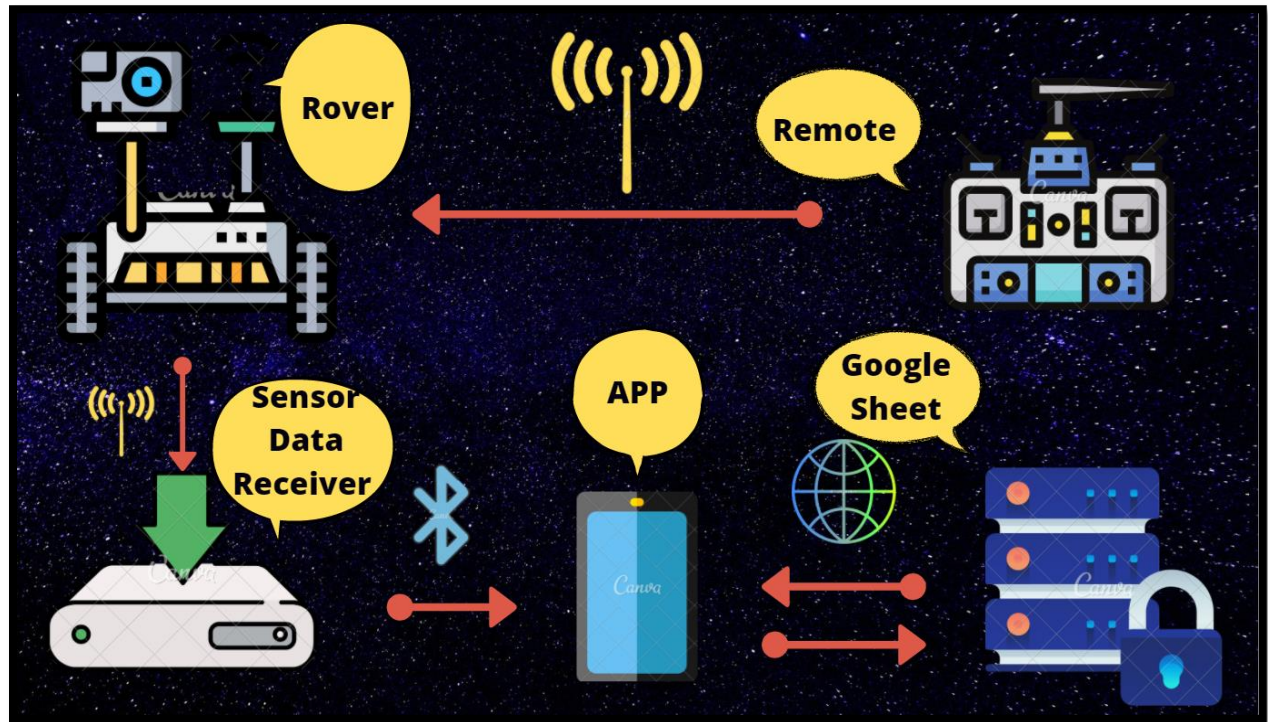
Working Principle in Diagram:

Fig: Complete Operation in a diagram

Discussion:

The presented project is just a prototype only, comprising of the basic idea and operations. For complete functionality, it will require more sophisticated and high-quality hardware materials.

For further development in the future, the rover will be provided with the ability to process image frame by frame from the video it captures for more accurate surveillance properties. Modification of the hardware parts will also be considered for more accurate physical functions.