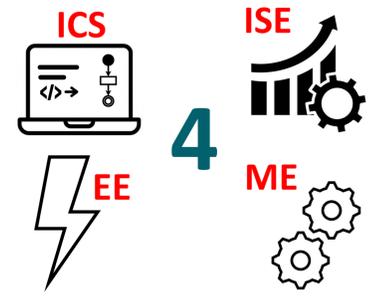


# GeoVision: Remotely Controlled Ai-Powered Ground Penetrating Radar System to Detect and Classify Subsurface Objects

Abdulaziz Alamoudi, Abdulmalek Gadi , Ahmad Al Jamalullayel, Alqasem Alojayan, Osama Assiri, Faisal Alsulami  
Coach: Dr. Moayad Alnammi



## Background

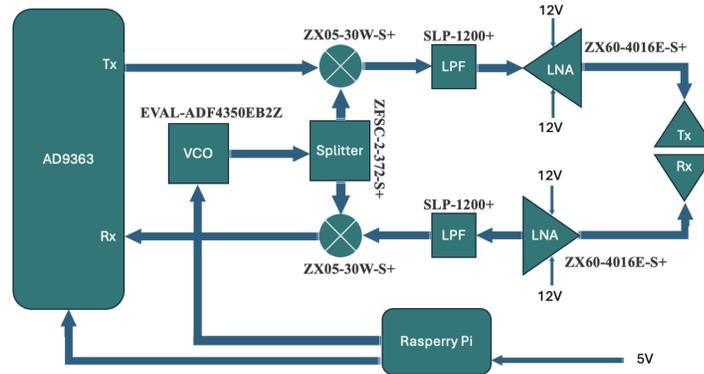
**• Abstract:**  
GeoVision is an advanced Ground Penetrating Radar system that improves subsurface exploration by offering a remotely controlled system with advanced machine learning algorithms to detect and classify the buried objects.

**• Problem Statement:**  
Traditional GPR systems rely on manual operation and lack modern technological integration, limiting their effectiveness in subsurface exploration. There is a need for an automated, AI-enhanced GPR system for better detection and classification of buried objects.

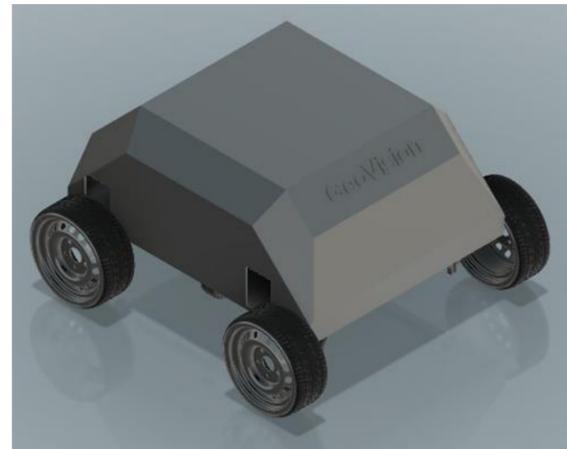
## Specifications

Detection Depth > 6 ft	Vehicle speed <= 0.5 m/s
12V, 10000mAh Battery	128*128 image size
System Weight < 15 Kg	Area Of Coverage >50m <sup>2</sup> /h
Real time delay of <1sec	10 frames/sec
Transmission Efficiency > 85%	Travel distance ≥ 7km

## Prototype Design



Ground Penetrating Radar Circuit Block Diagram



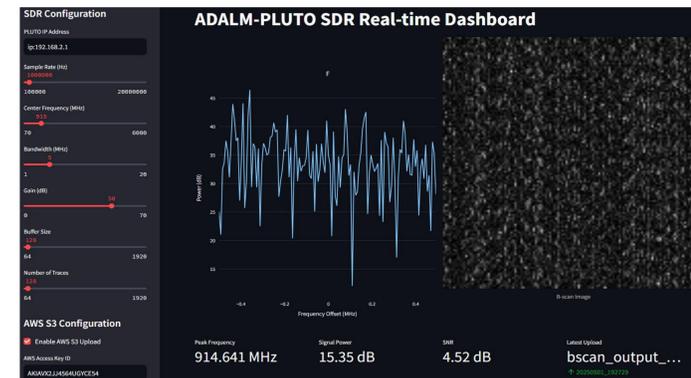
Fully Assembled Prototype 3D-Model

## Constrains

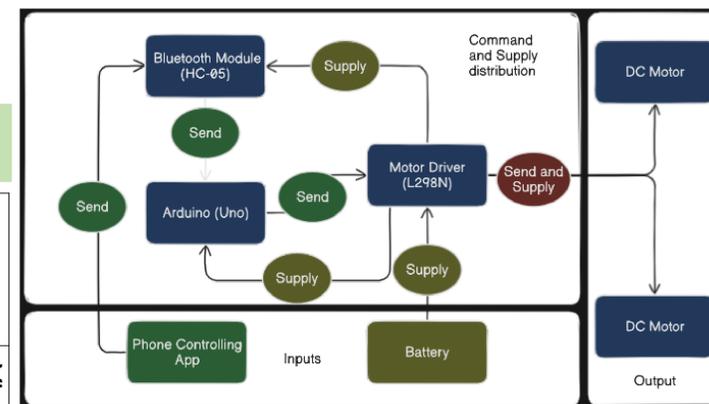
Antenna Frequency Selection 400-1600 MHz	Limited Processing Power 2.4GHz
The delay in real-time data transmission.	Working hours ≤ 2 Hours

## Validation

- Example of generated images, between each image 0.5 to 1 sec delay
- Each image consist of 128 frame
- Each image is of size 128\*128(see the buffer and trace size in the dashboard image).
- Frequency of 914.64MHz
- $P_{Moving} = \frac{6.28*1.22}{0.97*9.01} = 0.88$
- Vehicle Weight is 14.5kg



The System Dashboard



Controlling Block Diagram

## Performance

OR Model: Maximizing the Covered Area Max

$$Z = 3600 * V * T$$

Subject to:

$(E_v + E_g + E_r + E_o) * T \leq 290*0.8$	$2 \leq T \leq 5$ Hours
$V \leq 0.5$ M/S	$E_v = 22 WH + 1.5V$
$E_g = 17.335 + V$	$E_r = 1.7335 + 0.8*V$
$E_o = 6.934 + 0.4*V$	$V \geq 0, T \geq 0$

Decision Variables and Attributes:

- I. V: Speed of the vehicle (in m/s)
- II. T: Total working time (in hours)
- III.  $E_v, E_g, E_r, E_o$ : Energy consumed by GPR, Raspberry Pi, and others.

## Conclusion

This project deploys a remotely controlled, autonomous data management GPR system that scans up to 2 m deep at 0.5 m/s, reducing operator workload and risk. Its automated detection, classification, and georeferenced mapping streamline data processing and archive results for future use, advancing efficient and safe subsurface exploration.