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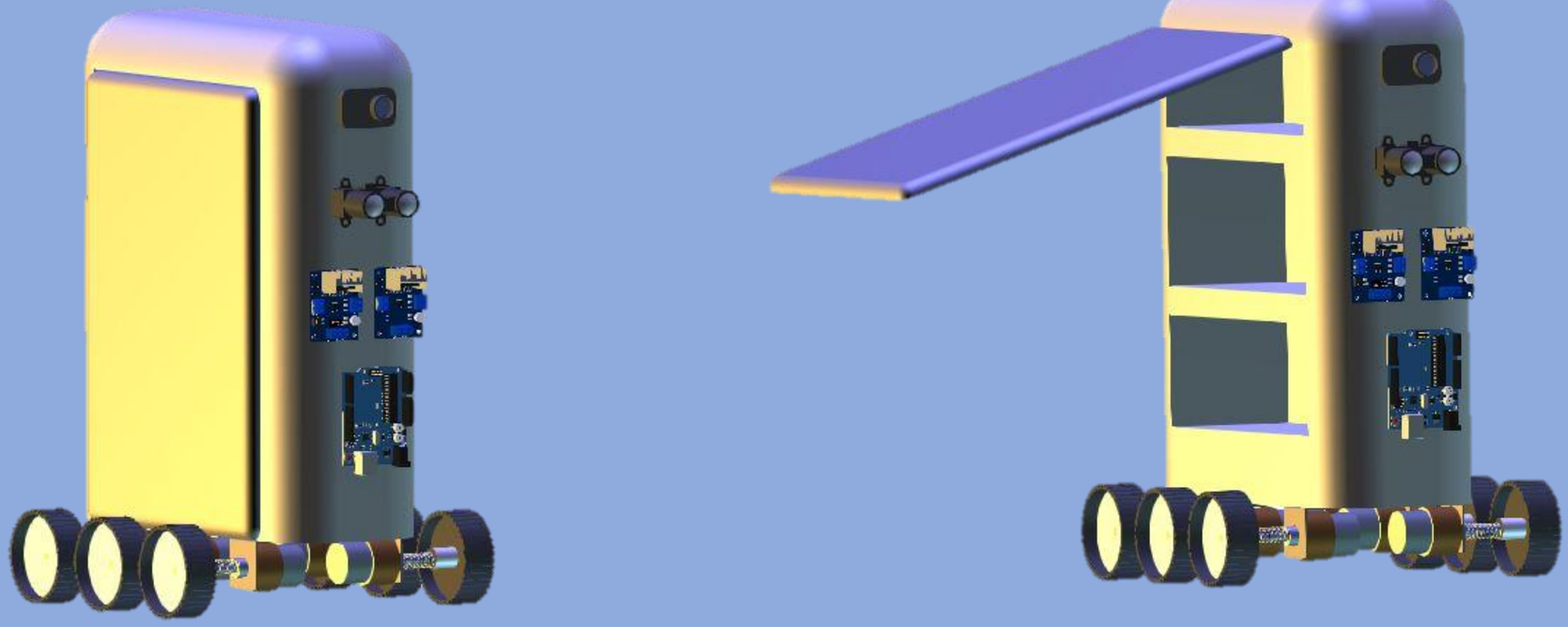
Unmanned Soldier Assistance Vehicle



Team ID :- DRUSE-TH03-161

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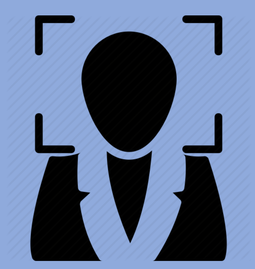
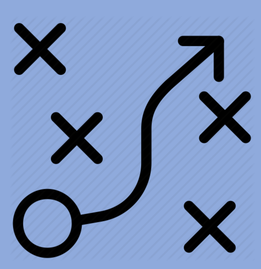
Aim :- A group of soldiers are sent on a route march carrying stores and ammunition for three days (payload weight approx. 200kg). An unmanned vehicle is to be conceptualized which shall be capable to follow the group and carry their stores. The UV shall be autonomously following the group like a buddy. The platform may be remotely piloted when required. The UV shall have the feature for autonomous return to base.

Key Features :-



Face Recognition

Human Following



Path Planning

Wireless Functionality

High Load Capabilities

Off road Mobility

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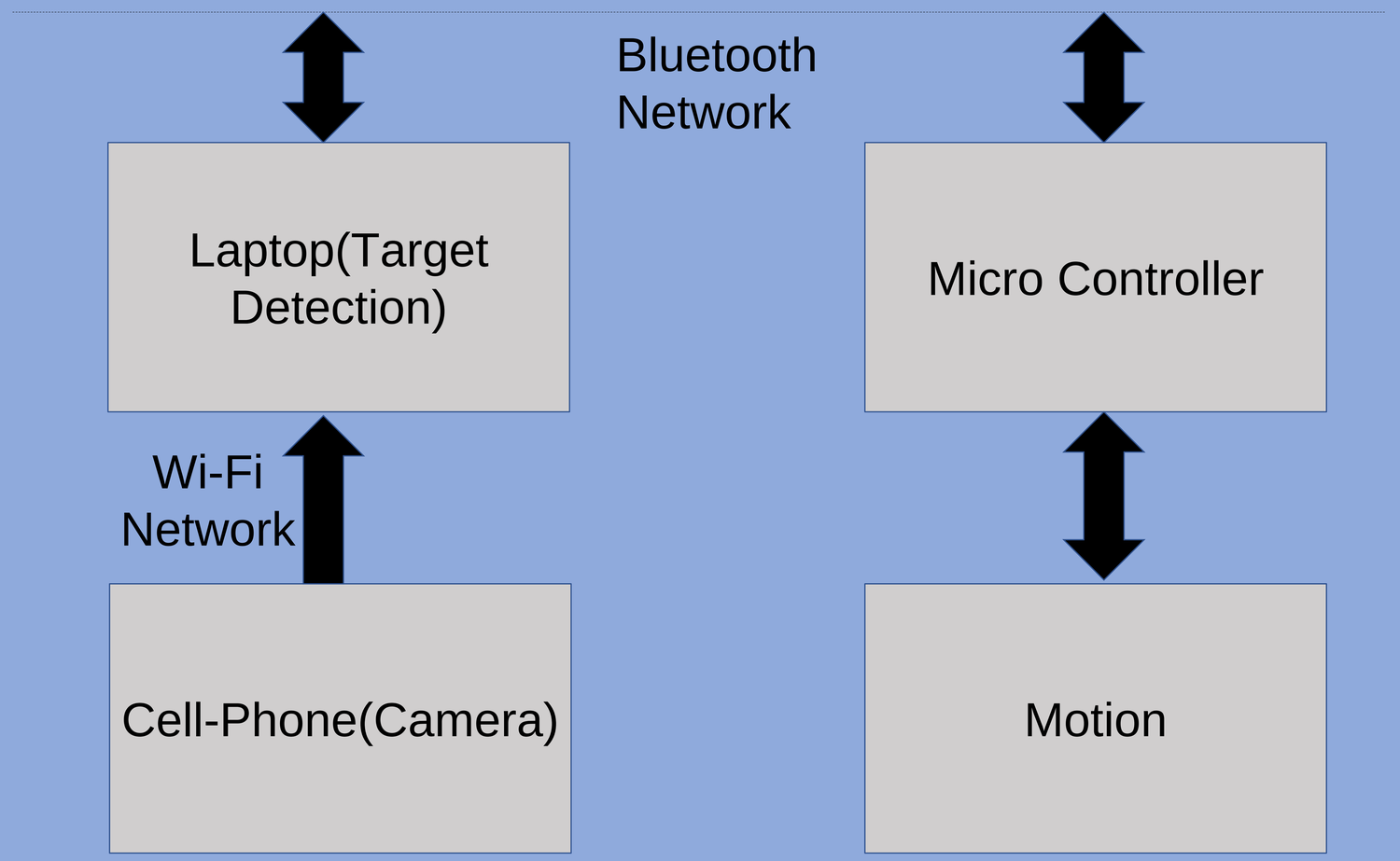
Demo Bot

- Execution Flowchart



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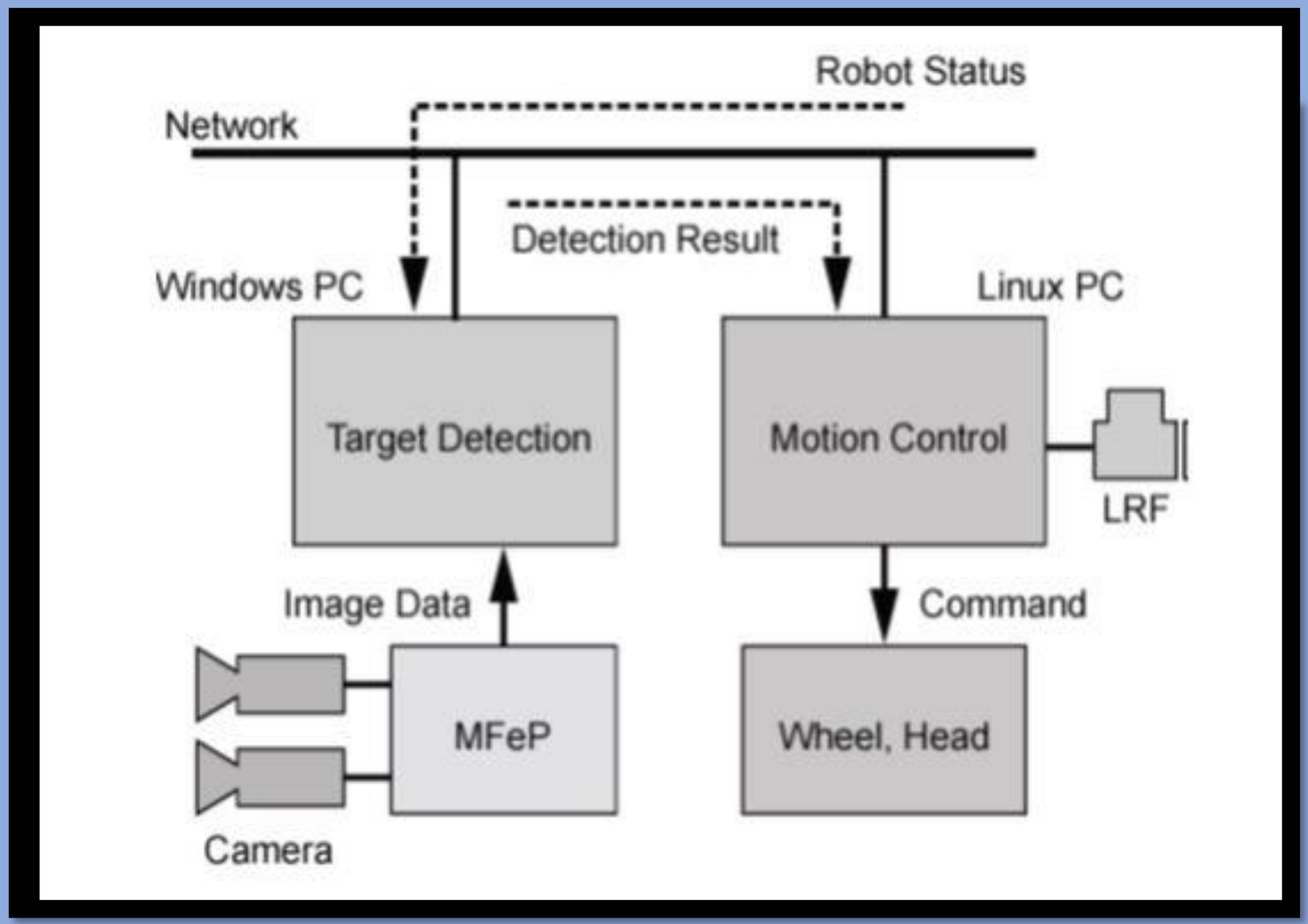
Tracking and following



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Tracking and following

- The human recognition and following system basically consists face recognition using feature points defined as per face recognition algorithm.
- Features of all soldiers is matched with database that was earlier fed to system.
- A follower robot has to distinguish the target object from other objects and recognize it. The robot has to get the information of the target position, and continue following it quickly so as not to get left behind.
- A stereo system of two or more cameras is used which provides the target's distance. In addition to this, we use a tracking system that uses highly accurate measurement information by operating in combination with LRF (Laser Range Finder).

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Tracking and following

- Two camera images of the target person including cluttered backgrounds are captured concurrently by the original versatile multimedia frontend processing board named MFeP and sent to the Target Detection Module.
- At the Target Detection Module, the target person is detected by the newly developed image processing algorithm, and the result (distance and direction data of the target person from the robot) is sent to the Motion Control Module which consists of two parts, the Body Motion Control Module (BMCM) and the Head Motion Control Module (HMCM).
- The robot body is controlled by the BMCM to change its direction to the same direction as the head module, and at the same time, to move its position to keep the distance to the target person constant. In turn the head module changes it’s direction to keep the target at the sensor’s center.

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Tracking and following

- When an obstacle on the robot's trajectory is found by the ultrasonic sensor, the robot starts to avoid the obstacle, and tries to continue following the person by the vision sensor. The avoidance control system is constructed by means of obstacle map written by occupancy grid map and the velocity potential method.
- To select the most suitable feature parameter for detecting the target person reliably during the motion, a method for dynamically switching the feature parameters are used. It uses two kinds of feature parameters, distance from the robot and movement speed, for detecting the person's region, and other feature parameters, color and texture, for specifying the target person.

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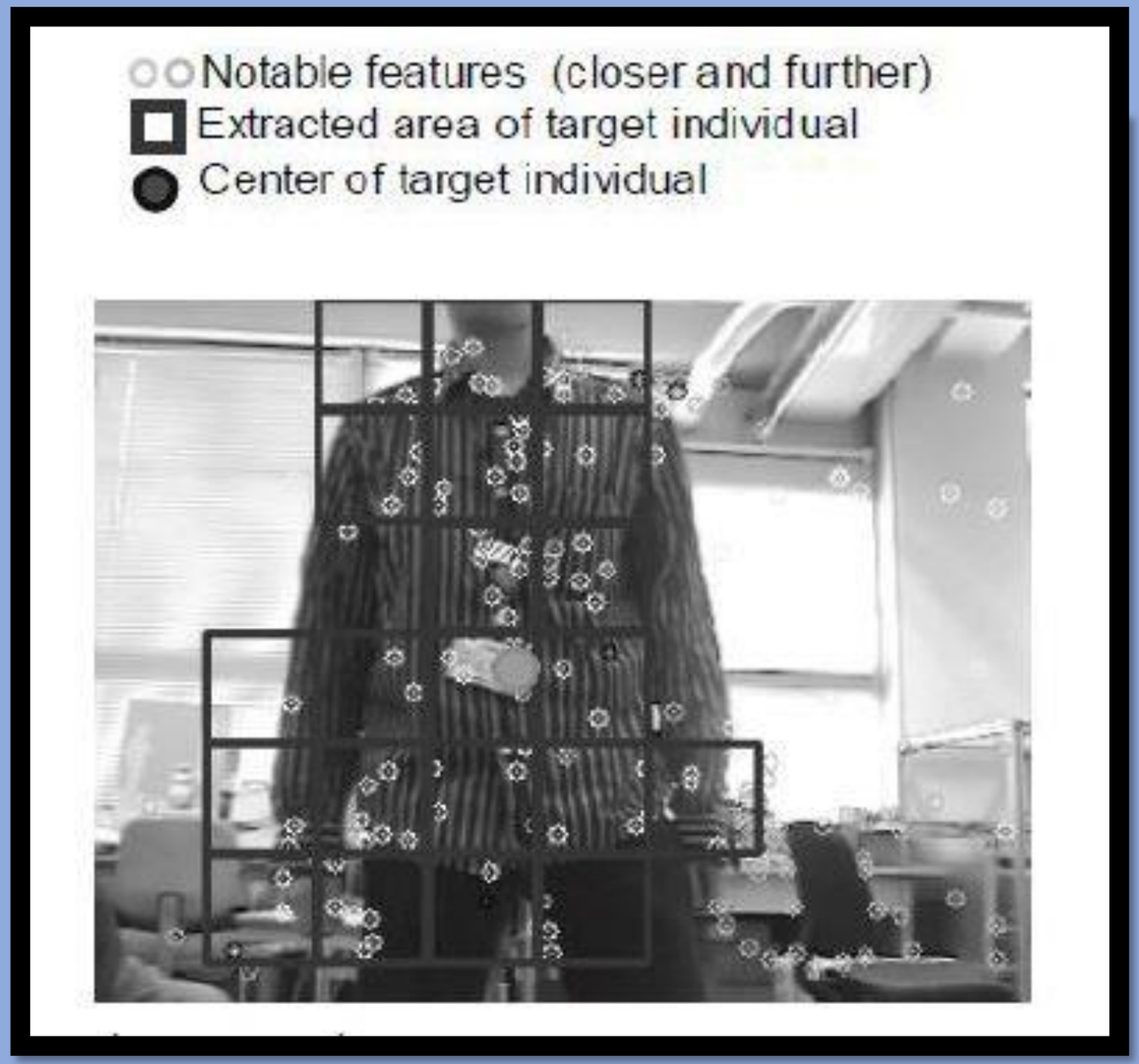
Tracking and following



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Localization and Planning

- Localization is a technique used to determine the position of robot with respect to some surroundings and also to obtain the orientation of robot in the same surroundings.
- Dead Reckoning is a technique used to find the distance moved by the robot or how far the robot moves using odometry like encoder.
- The data from dead reckoning is complimented by real-time mapping of the surrounding using a SLAM module and live tracking of the robot’s path through GPS.
- Simultaneous Localization And Mapping (SLAM) constructs or updates a map of an unknown environment while simultaneously keeping track of an agent's location within it.
- It is used to find the position and orientation of robot in real time. Its task is to recover the camera pose and map structures.

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Localization and Planning

- Light Detection And Ranging (LIDAR) is a remote sensing device that uses light in the form of a pulsed laser to measure ranges (variable distances) to the surrounding. It works on the principle similar to the RADAR.
- Both these systems would in turn be complimented by was GPS tracking module.
- The environmental reconstructions and the path maps would be superimposed on wide scale area map and any deviation from any subsystem would be rectified by superimposing and smoothening of information from all the systems.
- This would provide us with a reliable path for the unassisted return of the robot to the base even if it gets lost or if the team requires to sent it back for resupply.

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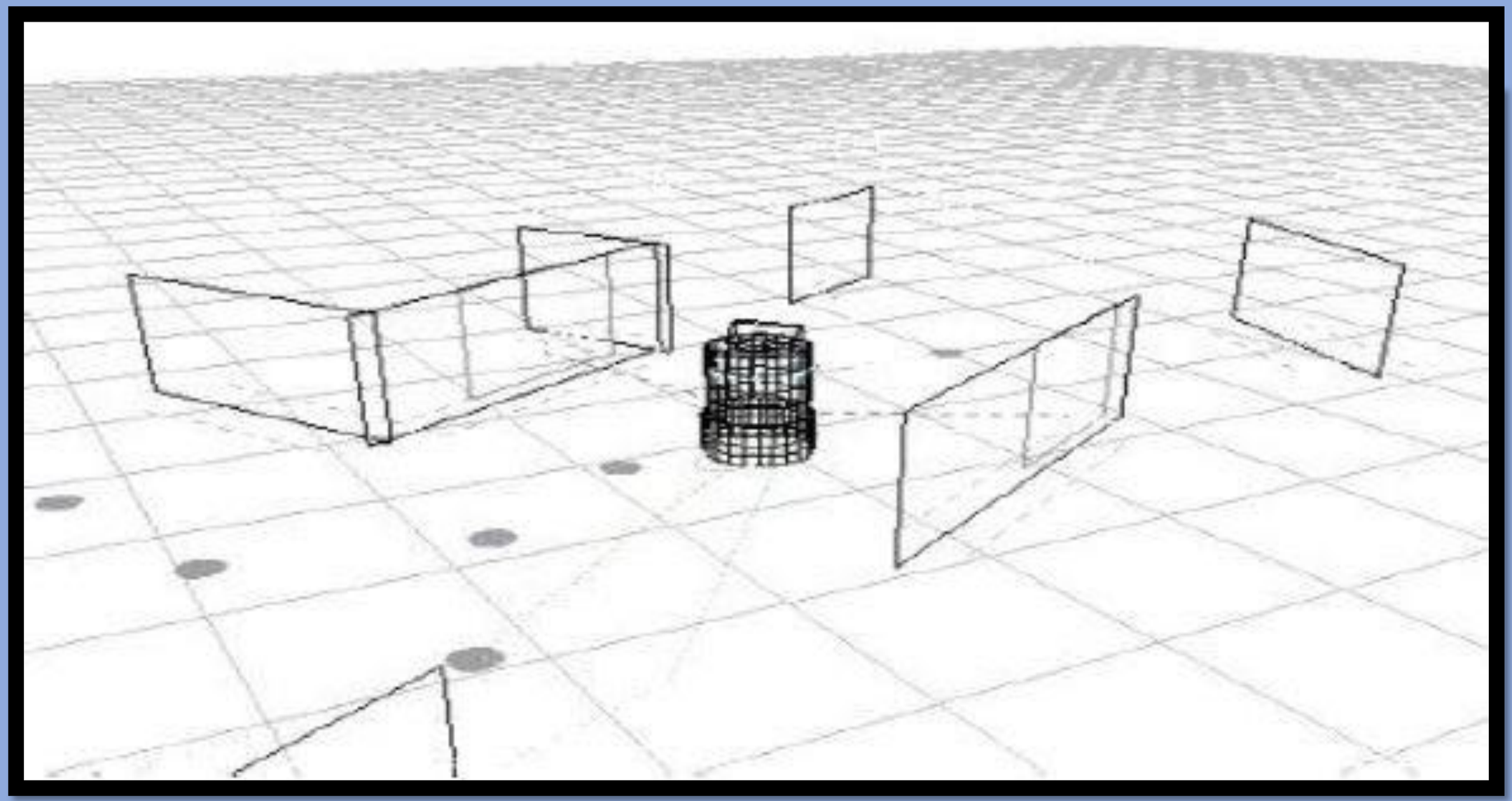
Localization and Planning



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Remote Control

- **Cellular Transmission**: It can be used to transmit the commands from base to the robot. It can be operated via the Internet using a cellular data signal. In this the commands can be fetched from the military cloud if our robot is connected to an Internet. Base can also access the sensor data and live video from the robot by accessing the IP.

- **Radio Transmission**: It can be used to transmit the commands from the marching team leader to the robot. It consists of two parts one is transmitter and another is receiver. One transmitter is paired with one receiver using n bits Encoder and Decoder, where n is number of bits. The data (commands) can be transmitted serially using transmitter which can be received by our robot and it performs accordingly.

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Vehicle Construction

- **A 6x6 Wheel base.**

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Vehicle Construction

- Our design of robot has 6 wheels and each of the 6 wheels is being driven individually.
- The robot should have shocker based suspension system (shocker should be connected to each wheel) which facilitates the robot to climb over obstacles.
- Each wheel has 2 degree of freedom. A 6-wheel drive provides more stability as the load on the robot would be considerable.

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Thanks for your time!