Unmanned Ground Vehicle

ROBOTIC HARDWARE SYSTEM

HISTORY OF THE ROBOT

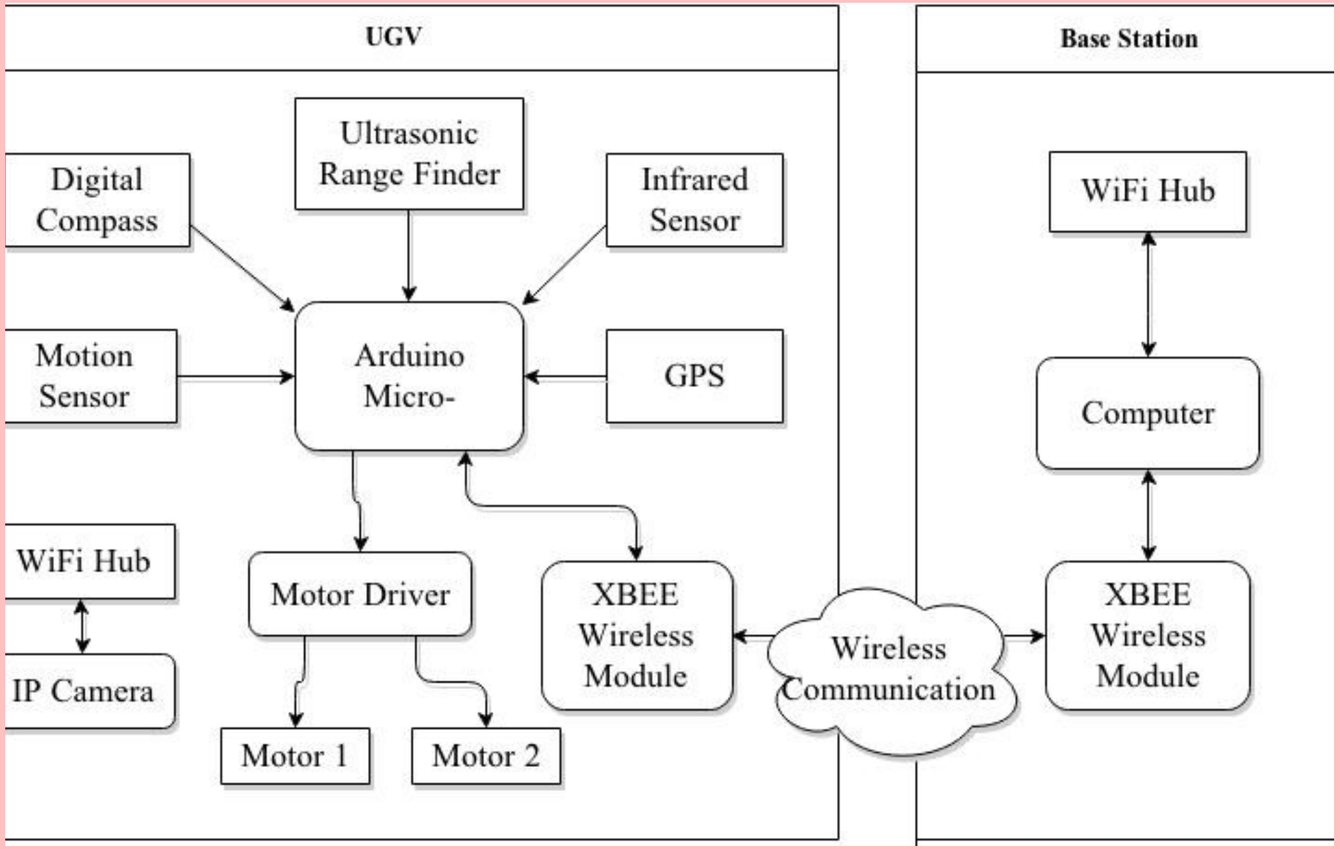
Unmanned Ground Vehicle

- A working remote controlled car was reported in the October 1921 issue of RCA's World Wide Wireless magazine. The car was unmanned and controlled wirelessly via radio; it was thought the technology could someday be adapted to tanks.In the 1930s, the USSR developed Teletanks, a machine gun-armed tank remotely controlled by radio from another tank. These were used in the Winter War (1939-1940) against Finland and at the start of the Eastern Front after Germany invaded the USSR in 1941. During World War II, the British developed a radio control version of their Matilda II infantry tank in 1941. Known as "Black Prince", it would have been used for drawing the fire of concealed anti-tank guns, or for demolition missions. Due to the costs of converting the transmission system of the tank to Wilson type gearboxes, an order for 60 tanks was cancelled.

HISTORY OF THE ROBOT

Unmanned Ground Vehicle

- From 1942, the Germans used the Goliath tracked mine for remote demolition work. The Goliath was a small tracked vehicle carrying 60 kg of explosive charge directed through a control cable. Their inspiration was a miniature French tracked vehicle found after France was defeated in 1940. The combination of cost, low speed, reliance on a cable for control, and poor protection against weapons meant it was not considered a success.
- The first major mobile robot development effort named Shakey was created during the 1960s as a research study for the Defense Advanced Research Projects Agency (DARPA). Shakey was a wheeled platform that had a TV camera, sensors, and a computer to help guide its navigational tasks of picking up wooden blocks and placing them in certain areas based on commands. DARPA subsequently developed a series of autonomous and semi-autonomous ground robots, often in conjunction with the U.S. Army. As part of the Strategic Computing Initiative, DARPA demonstrated the Autonomous Land Vehicle, the first UGV that could navigate completely autonomously on and off roads at useful speeds



Basic System Architecture UGV

	COMPLETE SYSTEM ARCHITECTURE	**System Connectivity, Wiring Diagram (Power/Data)**
	ROBOTICS HARDWARE COMPONENTS	
1	Robot Body Design vs Tasks	Body shapes and materials use for different application (Underwater, Ground, Air, Space). Regulation, Certification and Compliant Needed?
2	Actuators/Locomotions	Types of actuator. To move the main body of the robot (Tires, motors, rotor, drivers n etc). Add on accesories to the robot (Manipulator, End Effector, Custom/Specific task, Servo, Dyanmixal Servo, DC/AC Motor, Hydraulics, Pneumatic, Linear actuator etc). Bearing, Sliders, Gears, Pulley System, Slip Ring, Linear etc)
3	Navigation System & Controller	Types of sensors/controller for perception and navigation. (Types of Computer (Edge AI, Industrial PC, PC104, DAQ, Controller) Sensor (LIDAR, Camera IR/Color/Thermal, Depth Camera, Radar, Ultrasonic, Laser, Bumper Sensor, Magnetic Guide, IMU, Encoder etc)
4	Data Collection	Types of Instruments for data collections. (Remote Sensing, Mapping, Surveillance, etc)
5	Data Transmission	Types of communication devices and protocols. Cables (Digital vs Analog, RS232/485/422, BUS, CAN, HARP, I2C, ISP, Ethernet, OPTIC etc) vs Wireless (IR, Bluetooth, WIFI, BLE, RF, Satellite, Telco 4G/5G, GPRS & etc)
6	Power System Management	Types of power supply. AC, DC cables. Batteries. Engin. Renewable Energy.

1)Robot design vs Task

Summary of JRP Weight Classes

Small (Light) 31 to 400 lbs	 MATILDA 40 lbs	 PackBot 40 lbs	 ODIS 40 lbs	 TALON 80 lbs	 T3 110 lbs	 EOD MTRS 145 lbs
Small (Medium) 401 to 2500 lbs	 RONS 600 lbs	 SARGE 650 lbs	 REDCAR 1000 lbs	 GLADIATOR 1600 lbs	 Mini-Flail 2500 lbs	
Small (Heavy) 2501 to 20K lbs	 MDARS 2640 lbs	 DEMO III XUV 3000 lbs	 MULE 5000 lbs	 ARTS 8100 lbs	 RCSS 11,220 lbs	 Smoke HMMWV-CRS 11,500 lbs
Large Over 30K lbs	 DEUCE-CRS 18 tons	 D7G-CRS 28 tons	 A-AOE 34 tons	 Panther-CRS 40 tons	 Abrams Panther-CRS 43 tons	

*No systems currently exist in the Micro (<8 lbs), Miniature (8-30 lbs), or Medium (20K-30K lbs) classes.

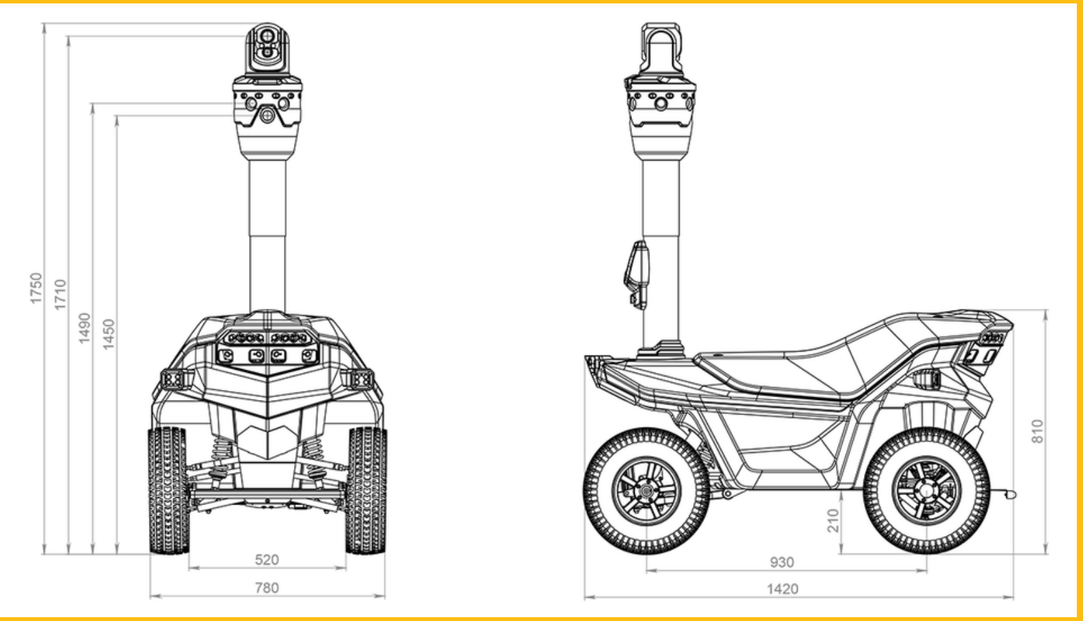
1)Robot design vs Task

Types of UGV:

- Autonomous Ground Vehicles
- UGV Locomotion
- Small UGVs
- Unmanned Vehicle Communication
- Commercial UGVs
- UGV Military

Technical specifications S series robots 2021

Cruising range at +5°C (41°F), up to	24 km	15 miles
Accuracy of check-point drive-through circle radius	0.8 m	2.5'
Minimum illumination for visual navigation	6 lux	
Minimum illumination for obstacle avoided systems	0 lux	
Speed while traveling autonomously	4 – 6 km/h	2.5 – 4 mph
Width of patrol route path, min	0.9 m	3.0'
Turning radius, min	5 m	16.4'
Ground Clearance	14 cm	5.5"
Climbing Angle	15°	
Dimension	1420 x 780 x 1750mm	56" x 31" x 52"
Weight (with batteries)	110 kg	240 lb
Waterproof and dustproof level	IP65	
Operating temperature range	-20°C ... +45°C	-4°F ... 113°F



2)Locomotions and Actuators

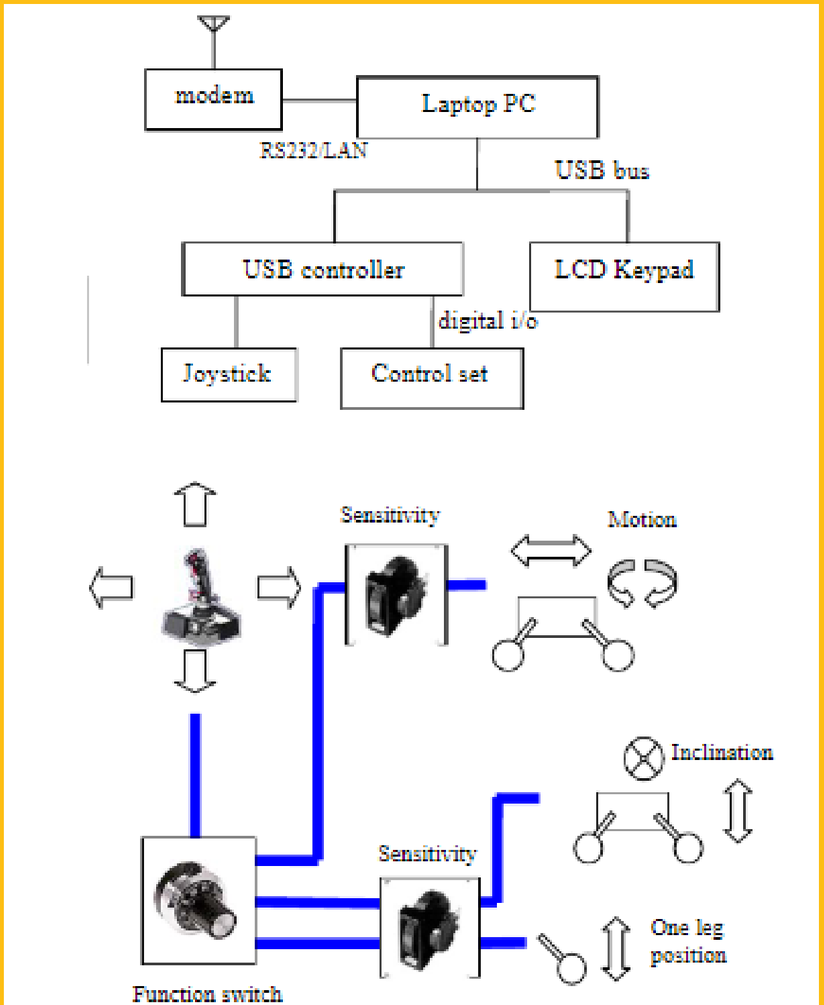
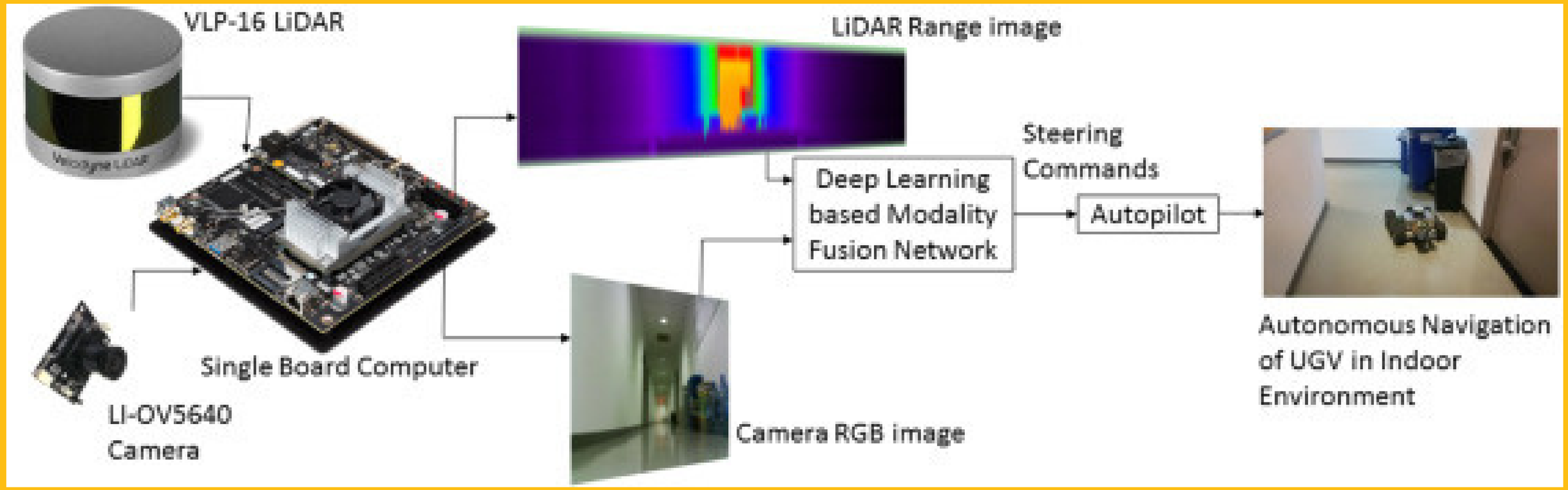
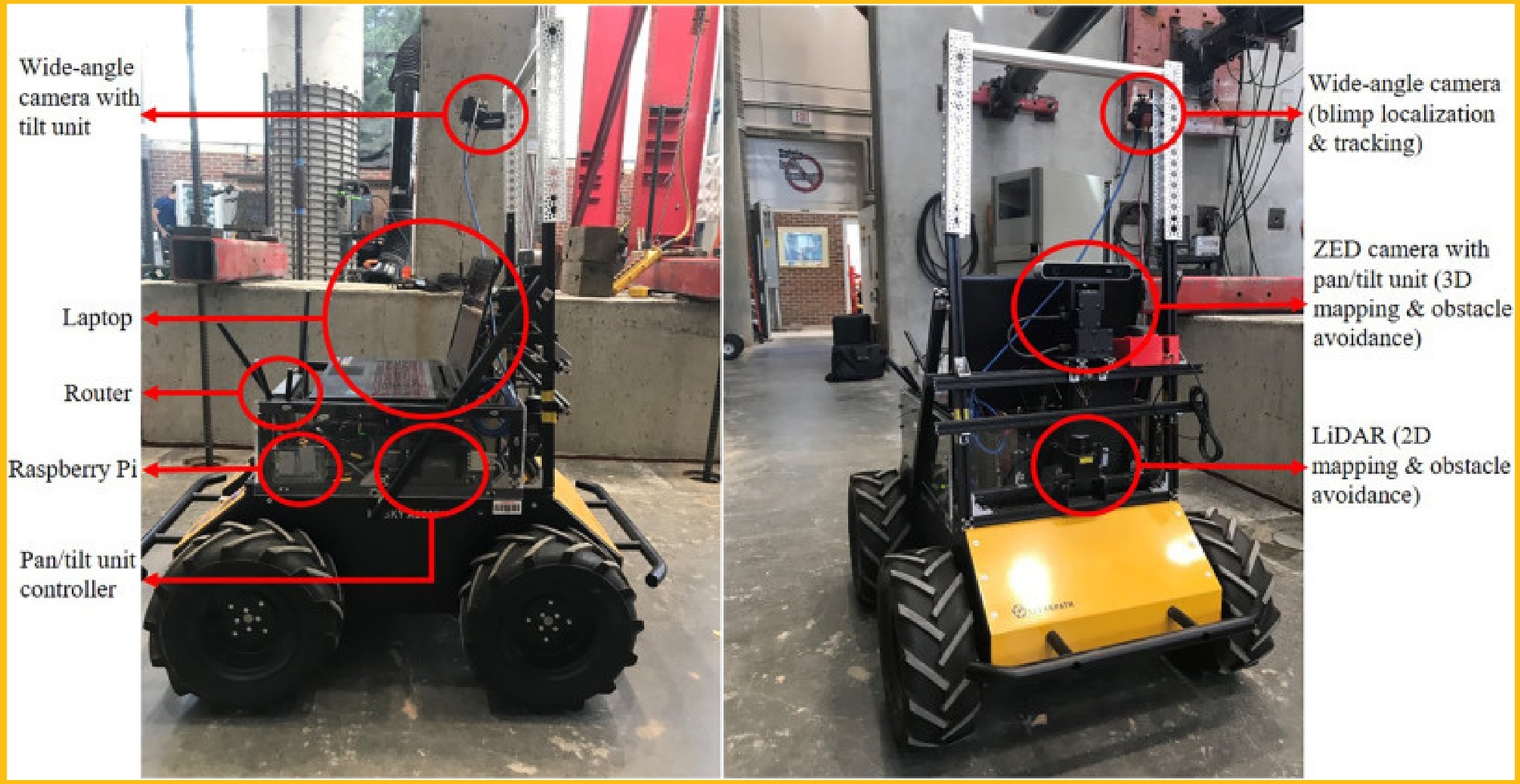


Fig. 4 . Locomotion control unit scheme

3)Navigation system and controller



4)Data Collections



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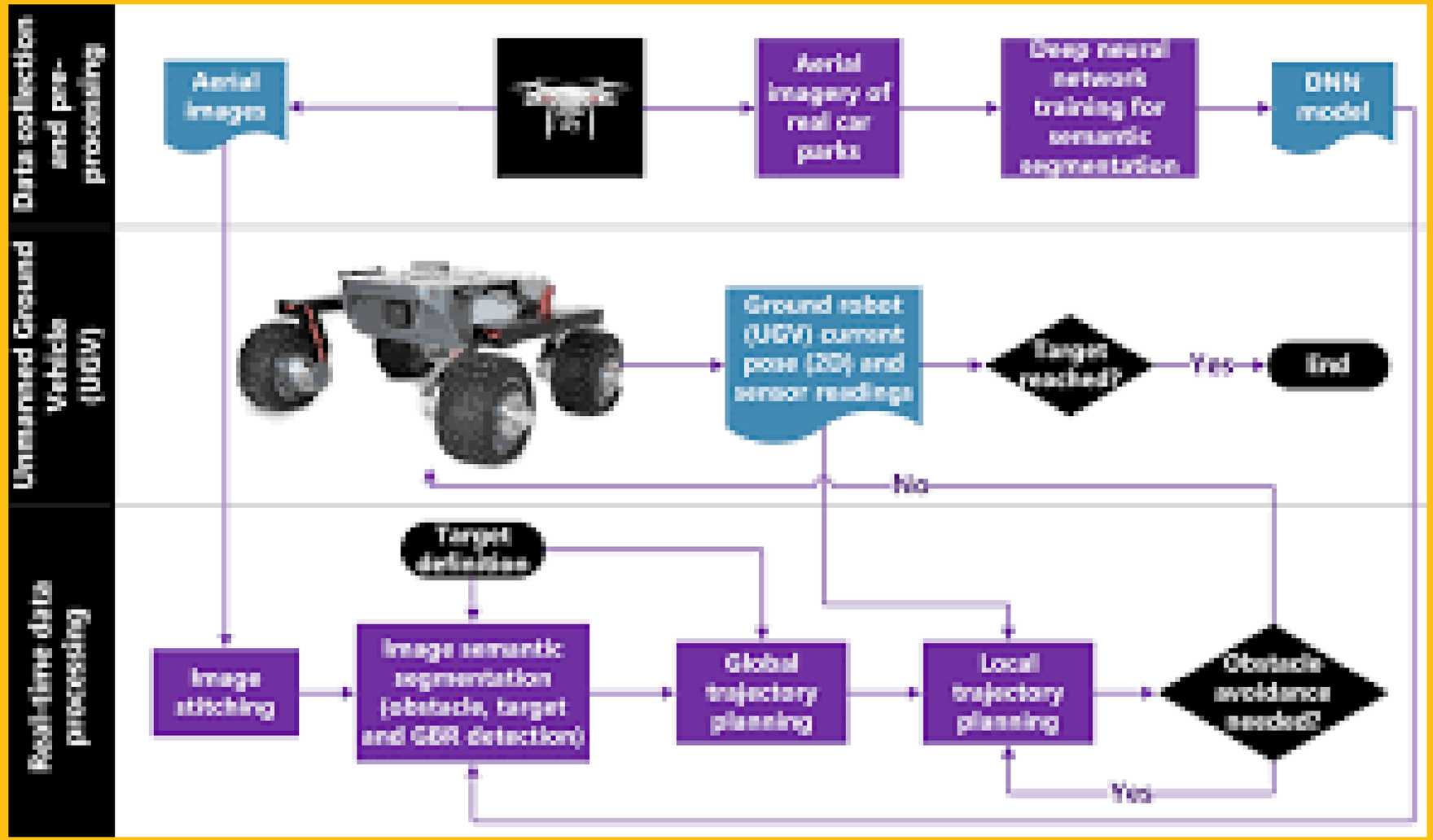

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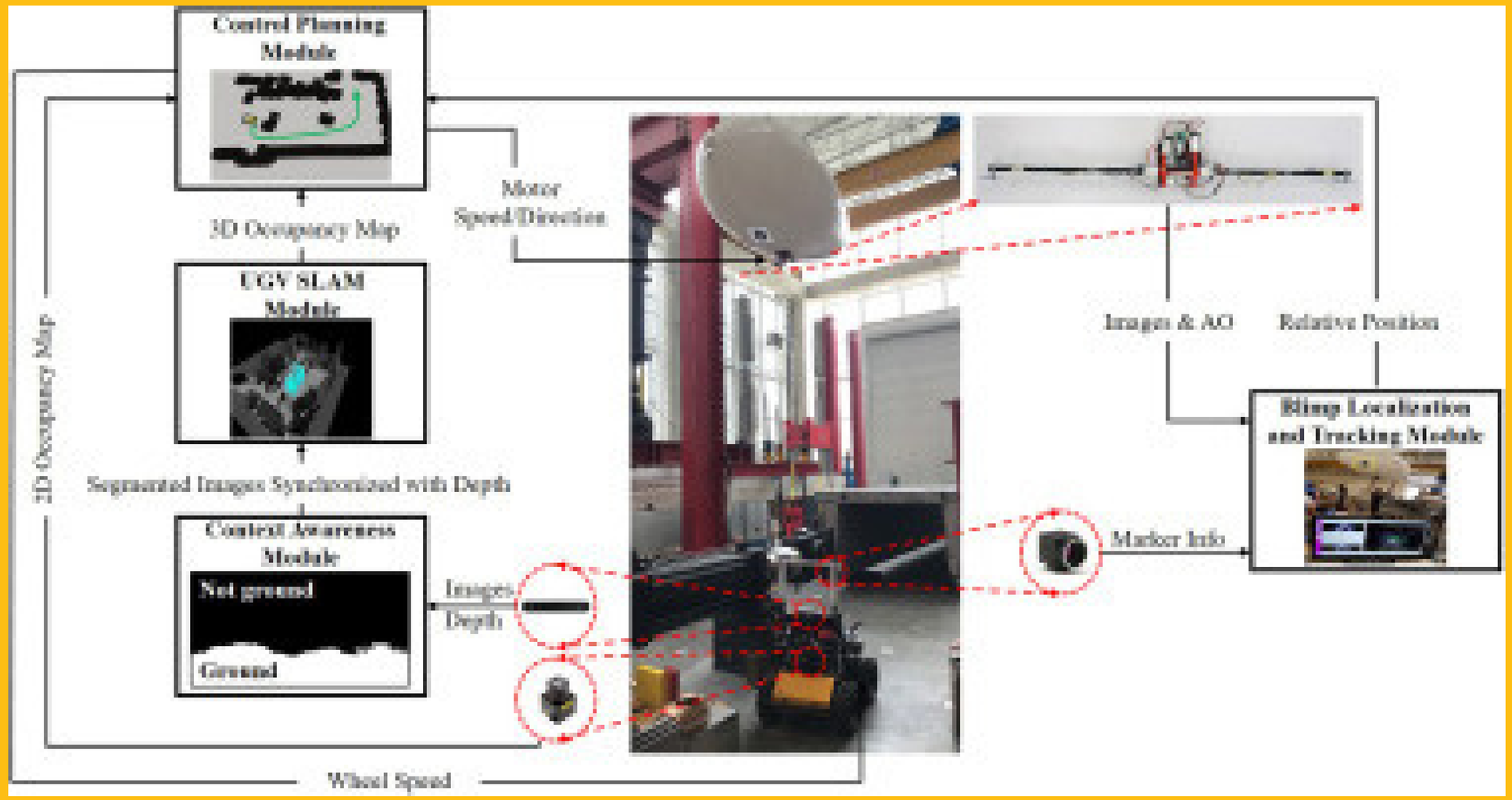
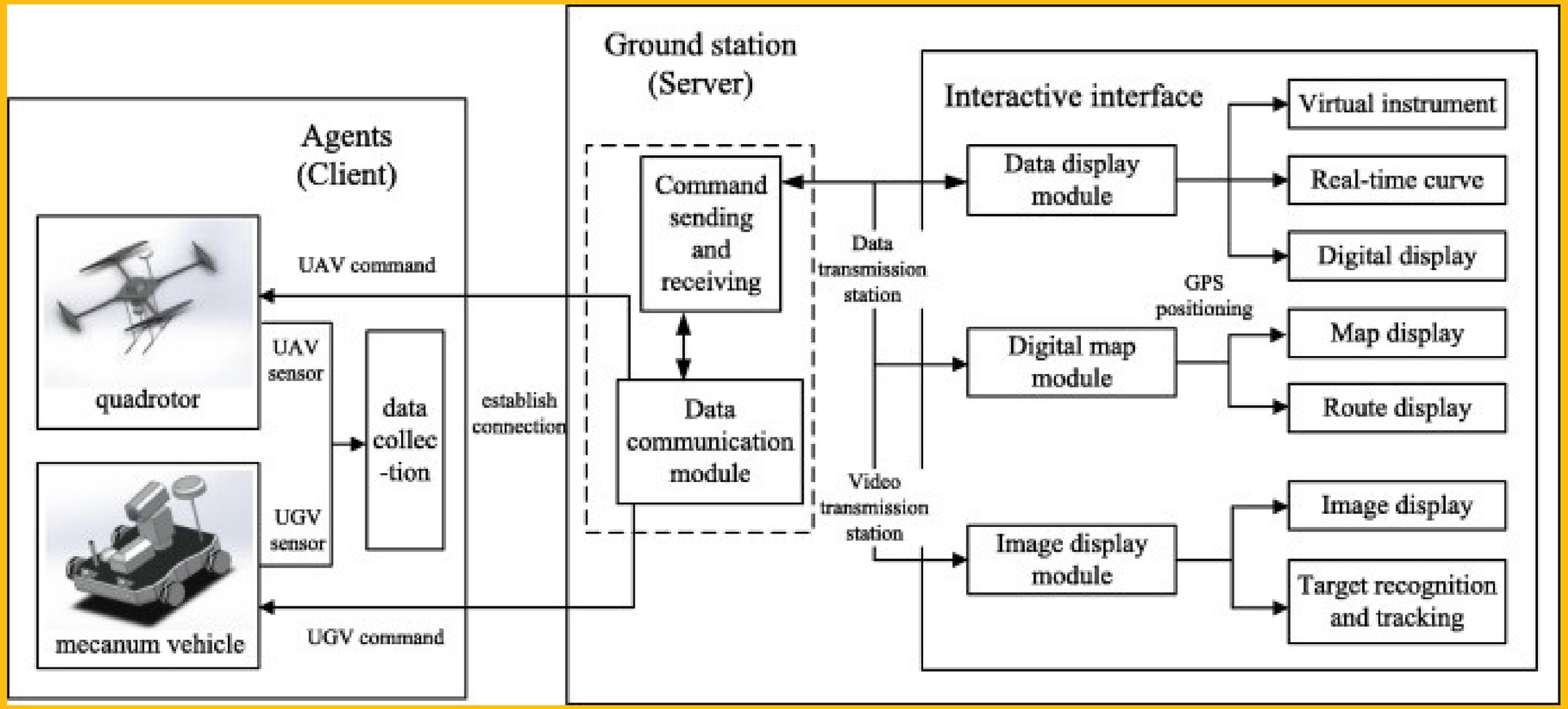
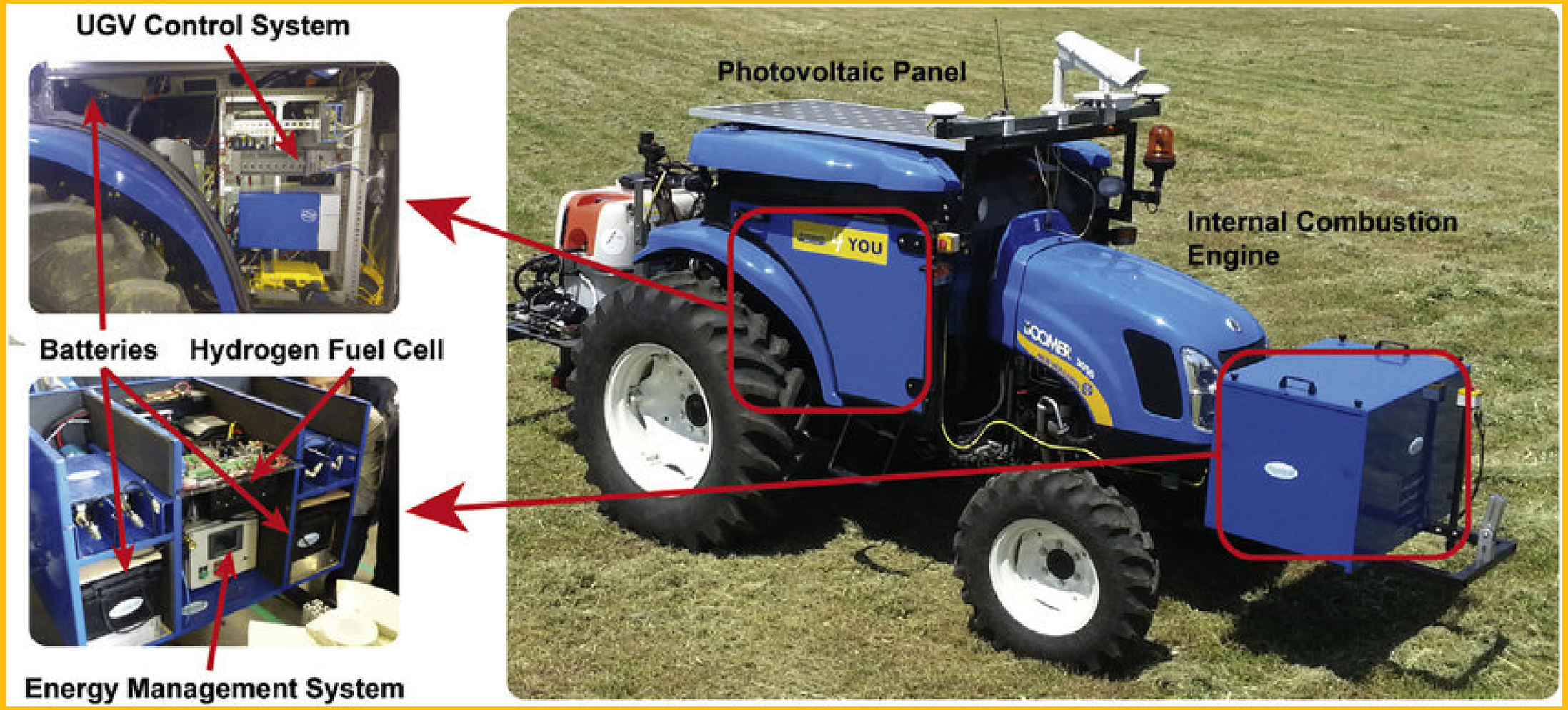


5)Data Transmissions



6) Power system management



List of UGV Company (Service / Manufacture/ Components) Locally:

- Dronology Sdn Bhd
- Vortex Edge Sdn Bhd
- Malaysia Automotive Robotics and IoT Institute