UNMANNED GROUND VEHICLE(UGV)

Prepared by: Muhamad Zulfadhli Bin Mohd Zulkiflee

History of the UGV

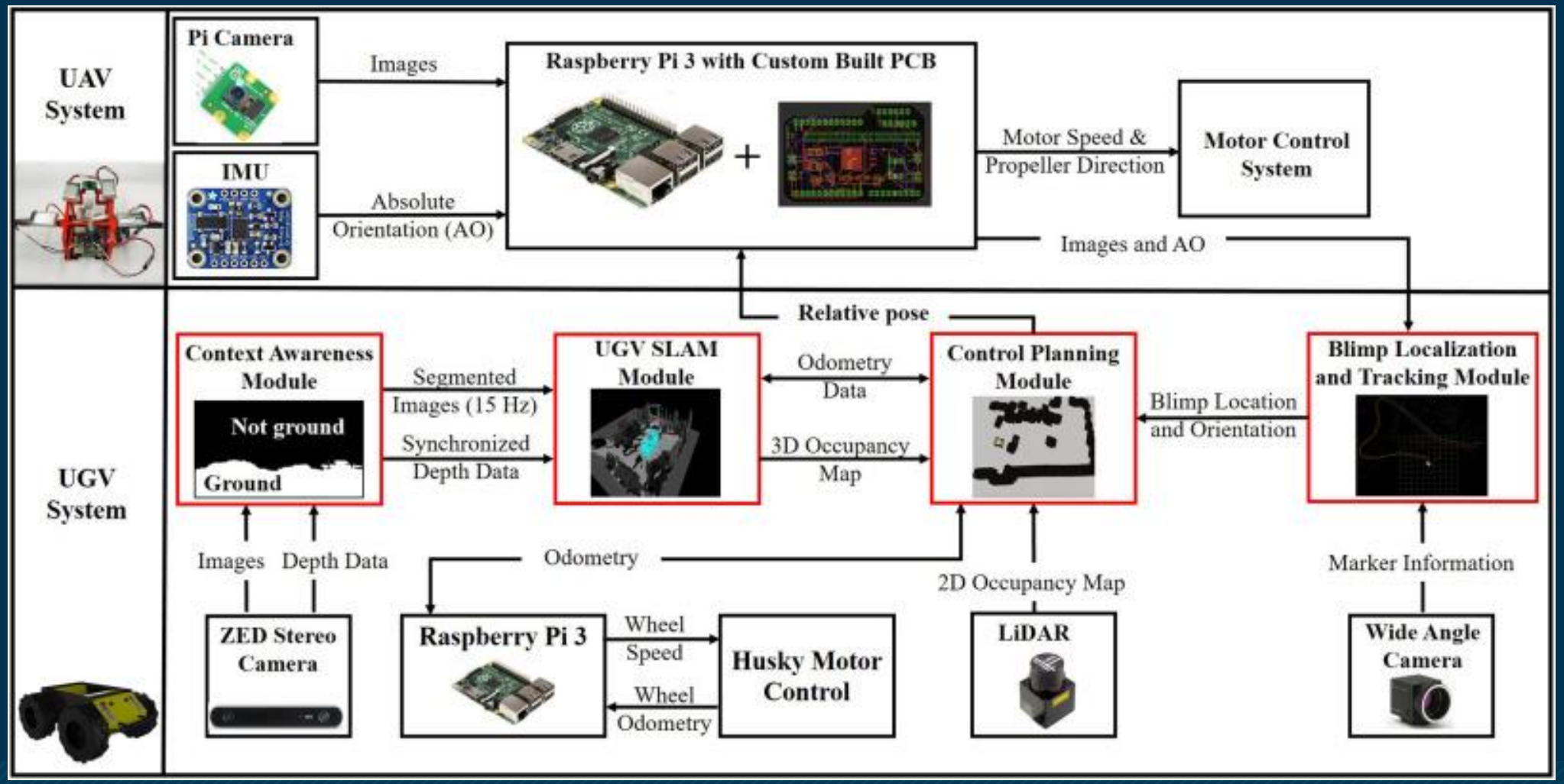
- A working remote controlled car was reported in the October 1921 at Dayton, Ohio.
- The car was unmanned and controlled wirelessly via radio; it was thought the technology could someday be adapted to tanks.
- The first major mobile robot development effort named Shakey was created during the 1960s.

RCA radio controlled car

Shakey the mobile robot

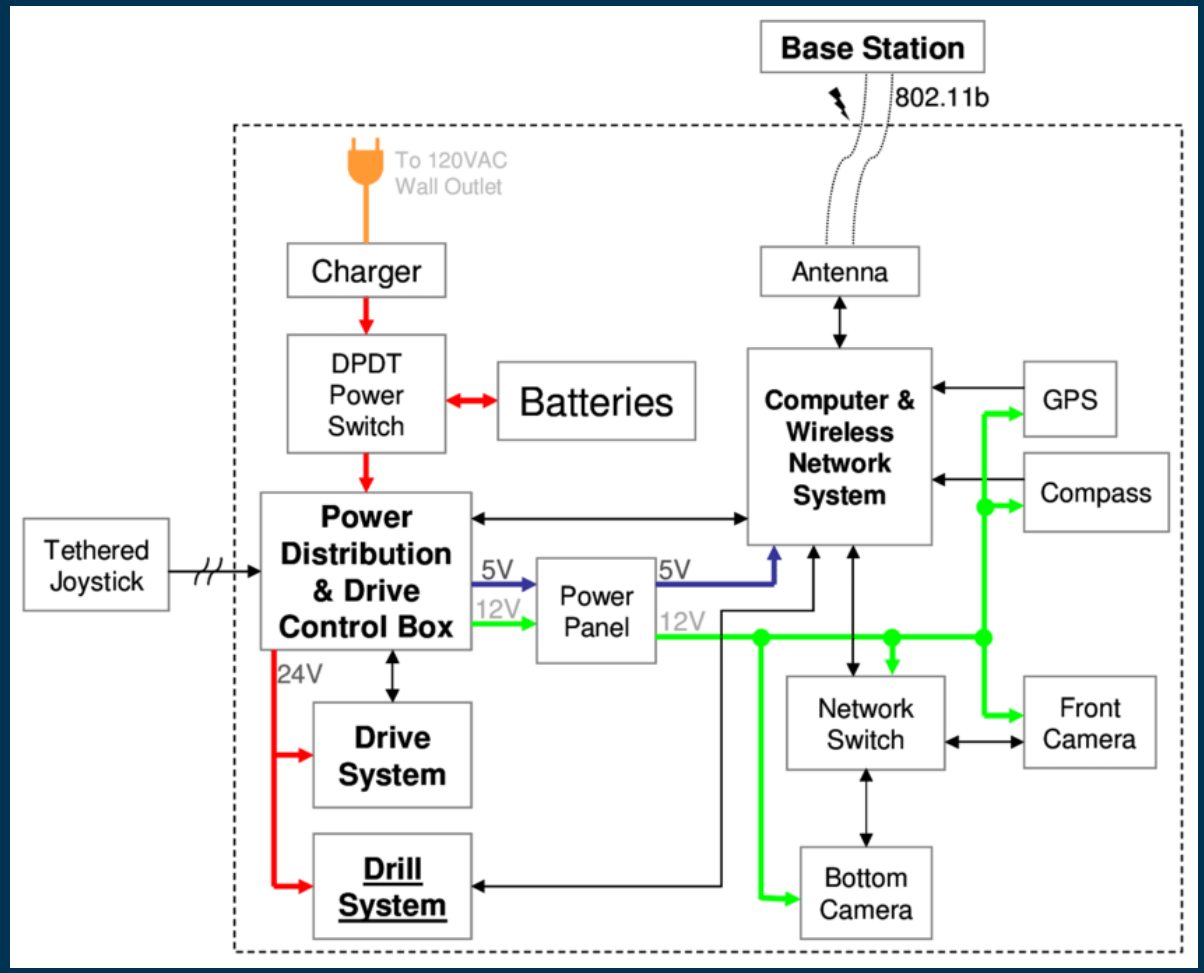
- Shakey was the first general-purpose mobile robot able to reason about its own actions as it could analyze commands and break them down into basic chunks by itself.
- Shakey was a wheeled platform that had a TV camera, sensors, and a computer to help guide its navigational tasks of picking up wooden blocks and placing them in certain areas based on commands.

Robot Architecture 1



Robot Architecture 2

- Blocks inside the dashed line represent components that are located within the UGV chassis.
- In normal operating mode, the UGV is controlled from a base station that communicates to the UGV's on-board computer via an 802.11b wireless connection.
- In fail-safe mode, a tethered joystick is plugged into the back of the UGV.

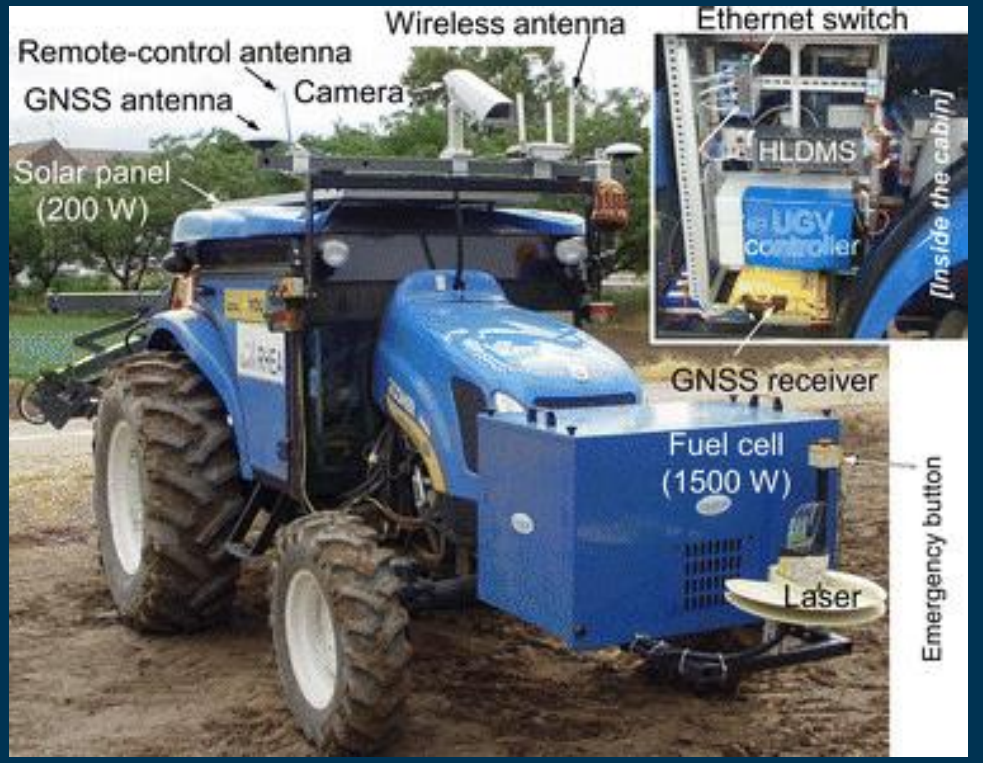


Robot Design and Task

Military UGV

Include EOD (explosive ordnance disposal), equipment carrying, forward reconnaissance, mobile weapons platforms and manned-unmanned teaming.

Agriculture UGV



Agricultural spraying and harvesting

Robot Design and Task

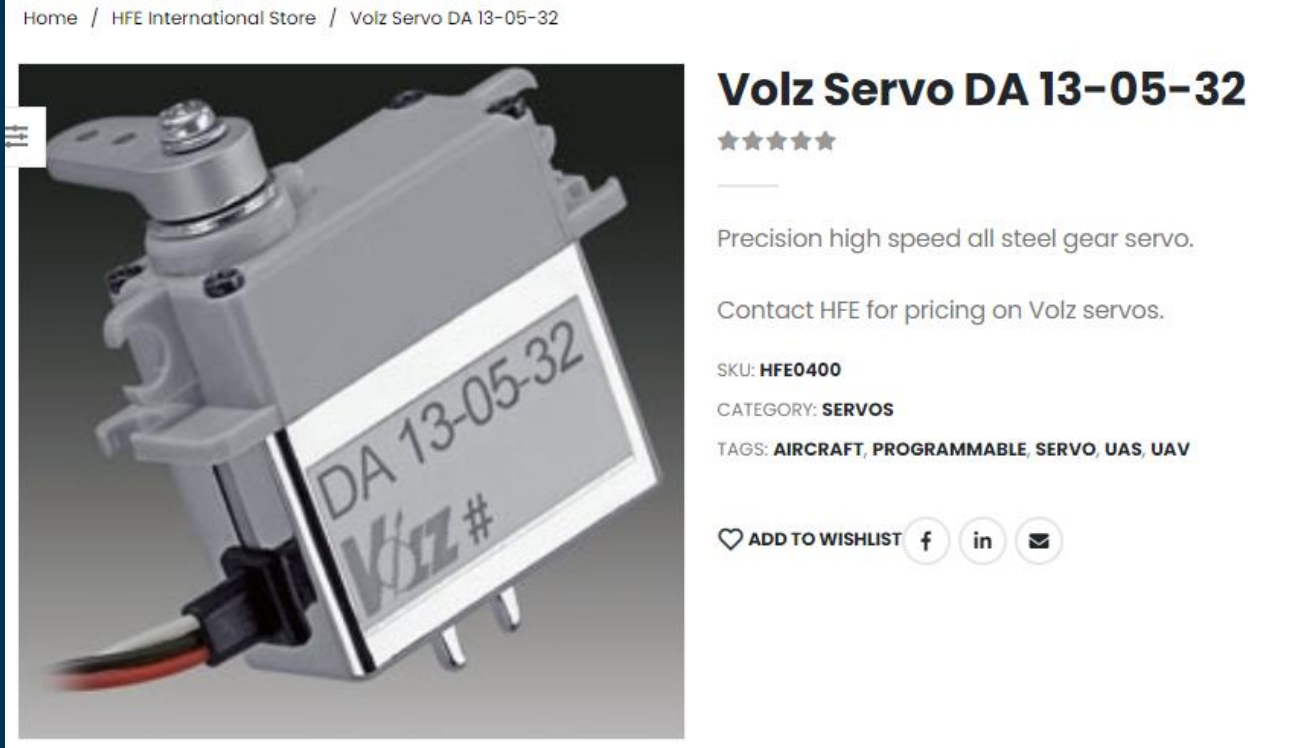
Commercial UGV

For outdoor autonomous navigation, remote inspection and long distance tele-operation, and larger scale mapping and localization

Locomotion UGV

Legged ground robots can cope with a wide variety of terrain, but are limited in speed and require complex control and stability hardware.

Actuator and Locomotion



- Servo is a precision actuator and has been used consistently in UAV applications.
- It is the best servo suited for the high vibration and temperature environments required for an engine throttle actuator.

UR5

Universal flexible robot arm enable safe automation of repetitive, risky tasks.

Lug Tread Tire

Allow robot to tackle challenging real-world terrain.

Robotiq 2F-85

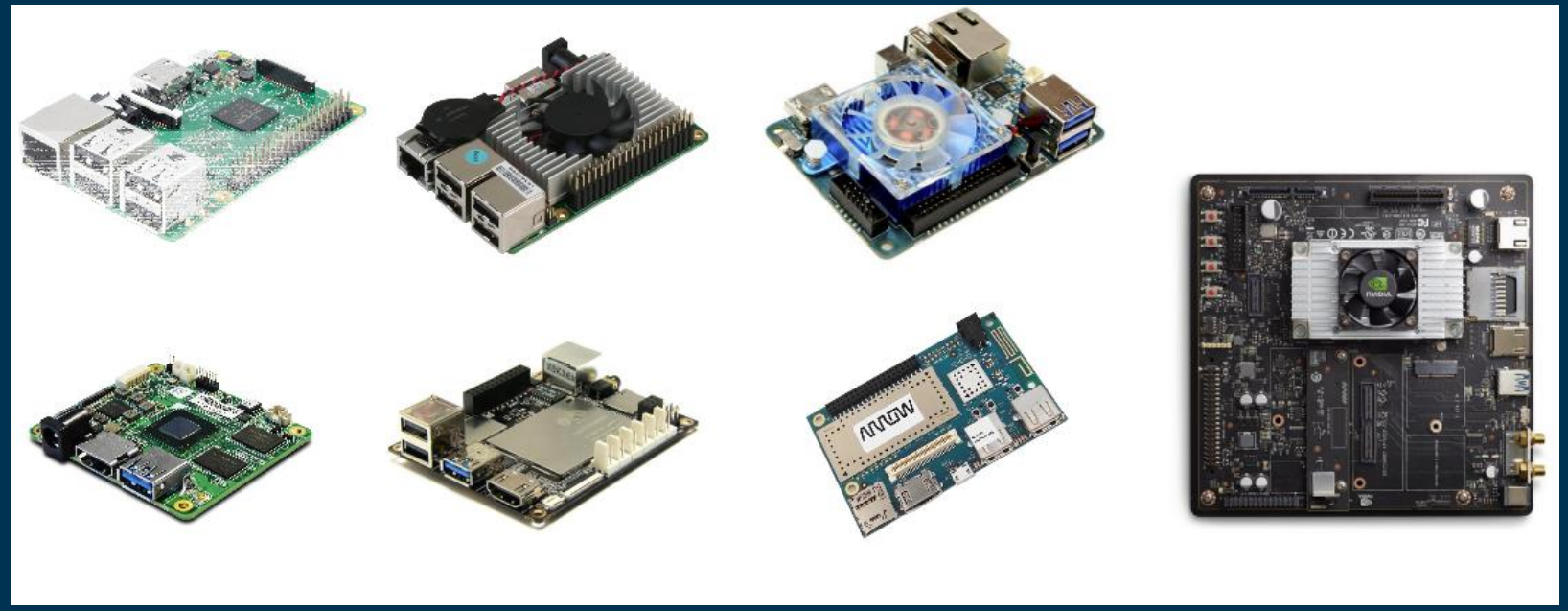
End effector for pick and place

Brushless Actuator

Brushless motor and contactless, wear-free position sensing system makes it immune to wear, vibrations and shock loads.

Navigation System and Controller

- SBCs (Single Board Computer) are enough to use the basic features like TurtleBot , but users need to increase CPU performance, use GPU, or add RAM size for other purposes.
- Can install Linux and ROS on the SBC to use it as the main computer for the ugv.



MINI ITX

- Commonly used in small-configured computer systems. Originally, they were a niche product, designed for fan-less cooling with a low power consumption architecture.

Wheel Odometry Sensor

- A motion sensor that use to determine the robot's change in position relative to some known position.

Data Collections

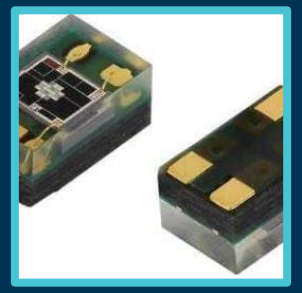
Mapping:

LIDAR sensor

GNSS navigation system

Navigation:

RTK gps



Agriculture:

Smoke sensor

Humidity sensor

Explorer:

Laser range finder

IMU

Military:

Laser scanner

Camera

Data Transmission

RS232

Standard protocol used for serial communication

Broadband communication

Wireless network station

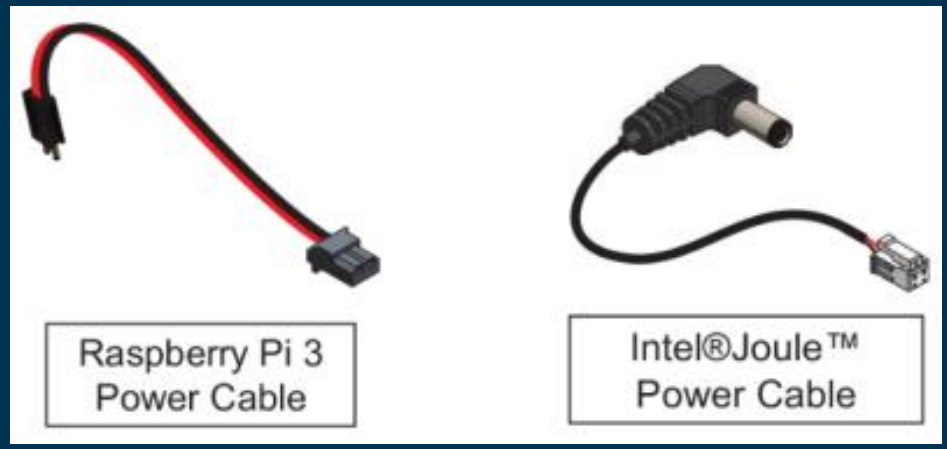
A long-range base station to enable localization accuracy to less than 1 in (2 cm) and remote communication up to 0.62 mi (1 km).

Mesh Radio

NLOS(non-line of sight) two-way data transmission system and wireless mobile emergency communication private network, which is independent of telecom operators wireless network.

Power System Management

- Power cable for the computer.
- 24-V 20-AH Sealed Lead-Acid Battery.
- Solar panel.



LIST OF UGV Company (Service / Manufacture/ Components) Locally

Ideasparq