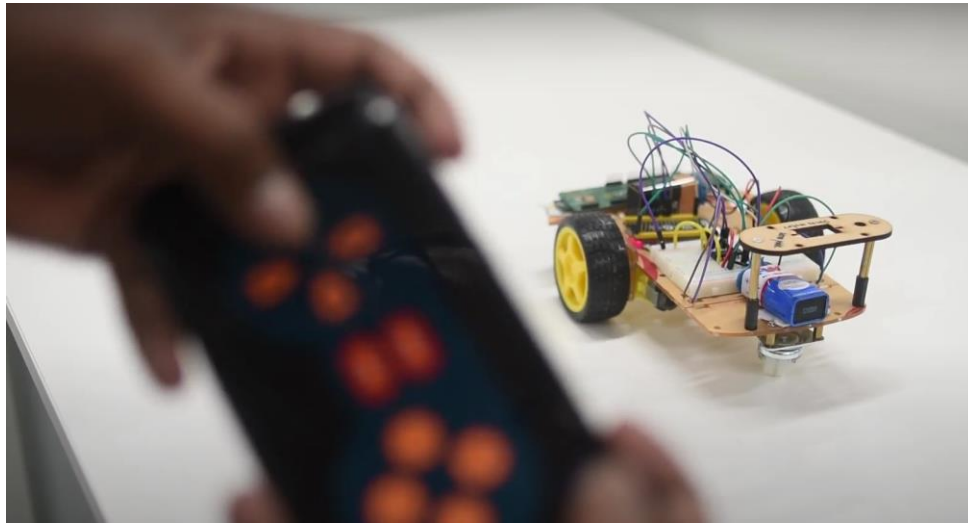


UGV KIT IN LEARNING AI

TABLE OF CONTENTS

INTRODUCTION	3
COMPONENTS INCLUDED IN UGV KIT	4
RELATION WITH AI	5
BASIC APPLICATIONS	5
Voice-activated operations	5
Inter-Vehicle Communication	5
Automatic parking using UV sensor.....	5
ADVANCE APPLICATIONS.....	6
Edge and Lane detection in autonomous car.....	6
Object (poles, pedestrians etc.) recognition in autonomous car	6
Traffic sign recognition	7
CONCLUSION.....	7

INTRODUCTION



Unmanned Ground Vehicle (UGV) kit is a good prototype for a real-world ground vehicle. Once can implement various algorithms and test programs on UGV before implementing them on an actual ground vehicle. The components included with the UGV kit mimic various parts of an electric ground vehicle.

UGV kit can also be used to simulate real-world automobile scenarios. For example, the remote manual override condition in an autonomous electrical car. When in autonomous mode the user can take over the control of UGV kit by accessing it through an Android phone or a pair of transmitter and receiver. The same principle can be extended to real world electrical cars.

In this document we will understand how one can learn AI concepts by experimenting with the UGV kit. We will start with the components included in this kit followed by this kit's relationship with AI and potential AI applications.

COMPONENTS INCLUDED IN UGV KIT

The components which are included in this kit are summarized in the below table:

Sr No	Components	Make	Model	Quantity
1.	UGV kit frame, caster wheel, two wheels, nuts, and screws.	Robo India	frame	1
2.	Vaman development board, USB type B cable for programming the board	Optimus Logic	वामन (Pygmy BB4)	1
3.	ESP-WROOM -32 Module	Espessif Systems	ESP-WROOM -32	1
4.	Raspberry Pi 3B with memory card and power adapter	Raspberry Pi	3B	1
5.	Arduino Uno fitted with Micro USB Type B connector.	Arduino	Uno	1
6.	Micro USB Type B cable	-	-	1
7.	Power Adapter for micro-USB type B cable.	-	-	1
8.	Dual Motor Driver Module	Robo India/other	L298 2A	1
9.	Ultrasonic Sensor	Robo India/other	HC-SR04	1
10.	DC Brushed Motor (9V DC)	Robo India	ZX-STSS1TO120	2
11.	Toy car Frame with two wheels and AA battery compartment	Robo India	RK2WD-DL	1
12.	Li-Po Battery with connector/cable	Shang Yi	B3	1
13.	Li-Po Battery charger	Imax RC	B3 charger	1
14.	Jumper Wires (M-M,M-F,F-F)	-	-	1 Set of 50
15.	Screw Drivers set for assembling the frame	-	-	1
16.	Double side tape	-	-	1
17.	Small Breadboard	-	-	1

RELATION WITH AI

Many Artificial Intelligence (AI) application related to electric vehicle can be tested on the UGV kit. The VAMAN and the Raspberry Pi included with the UGV kit are powerful enough to handle small to medium size neural network models. Further the VAMAN controller has on board IMU unit which can be utilised in many AI applications related to autonomous car.

BASIC APPLICATIONS

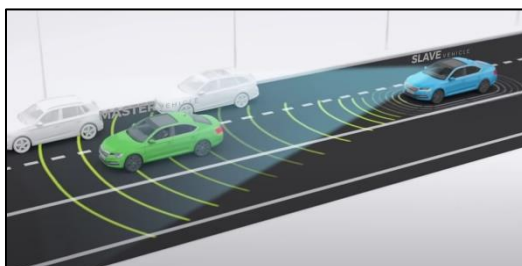
Some of the basic applications of AI which can be implemented using the UGV kit are listed below:

Voice-activated operations

One can train speech recognition model and implement it for navigating the UGV kit. For example, a simple model can recognise navigation commands (forward, backward, left, right, and stop) and instruct the UGV to navigate accordingly.

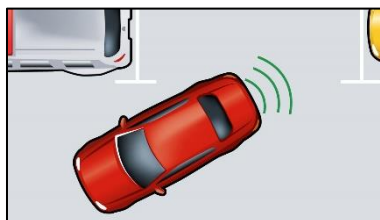


Inter-Vehicle Communication



Inter vehicle communication can be tested using multiple UGV kits before deploying the technology in the field. For example, one can take a pair of UGV kit and create an application where the slave UGV follows the master UGV.

Automatic parking using UV sensor



UGV kit can be used to simulate and test the automatic parking algorithm before actual deployment. One can train a deep learning model to use the UV sensor available on the UGV kit to automatically park it in a simulated environment.

ADVANCE APPLICATIONS

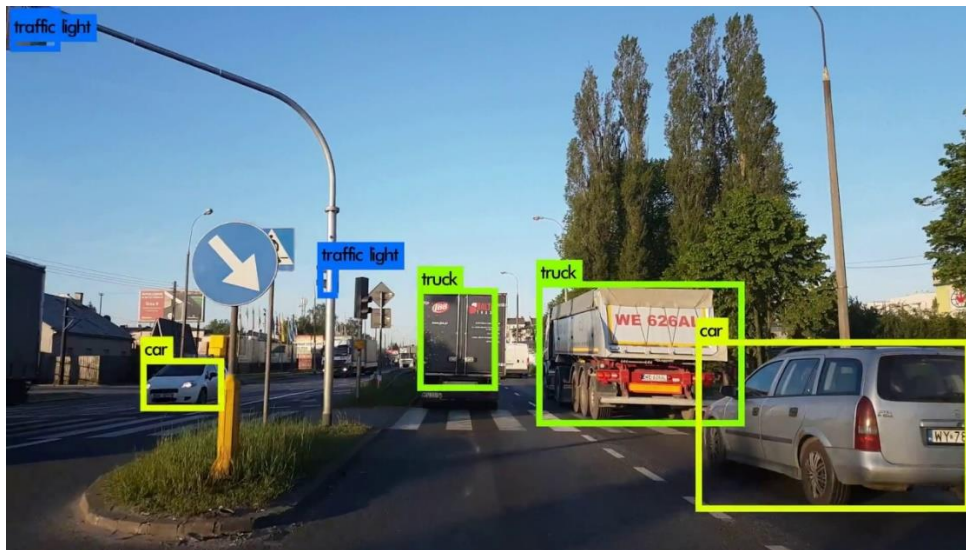
The UGV kit can be clubbed with few additional components such as jetson board, camera, and other sensors to cater sophisticated applications like:

Edge and Lane detection in autonomous car

The detection of lanes is essential for ensuring safe driving practices. Using a vision system on the vehicle is one of the main approaches to detecting road boundaries and lanes. To achieve this, the UGV kit can be used along with a camera module. Deep neural network models, or basic image processing can be applied at the subsequent stages.



Object (poles, pedestrians etc.) recognition in autonomous car



NN and Non-NN models can be implemented using the UGV kit for the purpose of object detection during navigation. This allows to test the safety features such as automatic braking and obstacle avoidance before actual field deployment.

Traffic sign recognition



Providing drivers with the necessary information about traffic signs is an important part of controlling daily traffic. Traffic signage detection and recognition is one of the most critical concerns when it comes to unmanned driving systems. UGV kit can be utilized to efficiently test the sign recognition NN models.

CONCLUSION

UGV kit is a great tool for students who want to get started within a limited budget. It allows testing of wide range of AI applications in the field of Automobile/Electric cars. Beginners in the field of AI can understand basic AI concepts by implementing the discussed applications. Students who have knowledge of AI theory can implement their original ideas using this kit.

Before actual field deployment, one can test their algorithms and programs and identify the problems and short comings in their system. As discussed, the UGV kit is a good AI education tool thanks to its many applications and prototyping capability.