	Pimpri Chinchwad Education Trust's **Pimpri Chinchwad College of Engineering & Research, Ravet, Pune** **Department of Electronics & Telecommunication**	
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PROJECT SYNOPSIS

Area of Project-Multi-functional UAVs with pseudo satellite technology

Project Group No- 24

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Project Title: Unmanned Ground Vehicle

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ABSTRACT

This project aims to evaluate the viability of using drones equipped with pseudo-satellite technology as a visual assist and guide to augment the capabilities of unmanned ground vehicles (UGVs) and act as additional peripherals. This endeavor is part of a larger initiative to reduce human interference in a variety of disciplines, including industrial, hazardous, defense, and agricultural .In addition, the technology shows promise for military applications, enabling long-distance communication in isolated locations under observation and offering a flexible and reasonably priced foundation for a wide range of missions. The idea is still in its early stages of development and exploration .The agricultural sector can benefit greatly from the vast range of applications of Unmanned Ground Vehicles (UGVs). One such application is the targeted and selective removal of weeds and pests, which is carried out by a specially trained Al model .The autonomous ground vehicle has multiple object detection options that may be changed while it is in motion .The processing is done on a remote PC, and the options accommodate a wide variety of conditions and scenarios.

Introduction

The proposed system will be designed and manufactured in such a way that it will be able to cross rough terrain,it will be using high torque motors (250W 140 KG CM TORQUE 2 units, skid steer drive). The capabilities of the LoRa network will be researched and then design and prototype several circuit boards to harbor and ensure proper communication levels between LoRa and microcontroller. The codes will be developed in python and work on AI models for weed detection along with automated tracking of targets .We'll be also using AI for data analysis, predictions and autonomous vehicle control. Communication channel between mobile stations, a serial communication between base microcontroller and mobile microcontroller using loRa will be established.

Problem Statement

" Unmanned Ground Vehicle" to reduce human presence on field and provide multiple functionalities.

Literature survey

Table 1: summary of Literature Survey

Authors and Year [Citation]	Paper Title	Methodology	Advantages	Disadvantages
S.Basu,S. Chakraborty, K.Mukherjee, S.K.Pandit, "Online Tracking of Skin Colour Regions against a Complex Background"	"Online Tracking of Skin Colour Regions against a Complex Background"	Online tracking of human activity and complex background	Efficiency in online localization and tracking	Reliance on RGB intensity values for segmentation may limit accuracy
WEI FANG 1,2, (Member, IEEE), LIN WANG 1 , AND PEIMING REN 1 1School	YOLO: A Real-Time Object Detection Method for Constrained Environments	Model Optimization,Feature Enhancement	Reduced Model Size,Improved Detection Accuracy	Complexity and Training Resources

S. Maheswaran;G. Murugesan; Prakash Duraisamy; B. Vivek; S. Selvapriya; S. Vinith; V. Vasantharaja	"Unmanned Ground Vehicle for Surveillance" International Conference on Computing and Networking technology (ICCNT) IEEE	Choosing the appropriate hardware components, such as a robotic chassis, camera module, and Wi-Fi module.	Remote Surveillance Capability	Power Consumption
S.Basu, S. Chakraborty, K.Mukherjee, S.K.Pandit,	"Online Tracking of Skin Colour Regions against a Complex Background"	Online tracking of human activity and complex background	Efficiency in online localization and tracking	Reliance on RGB intensity values for segmentation may limit accuracy

Objectives

1. To design a system which will demonstrate mechanical, electronics and AI/ML capabilities integrated together in the UGVs.
2. To understand various aspects of AI/ML integrated into complex hardware to perform specified task.
3. To finalize an achievable plan of action which will be inclined towards each aspect of the UGV taken into consideration.
4. To achieve the target of implementing a sophisticated system in the fields of agriculture and military over a greater audience.
5. To test out the capabilities of the UGV for future scope of development and encouraging innovative ideas, setting a foundation of a new field in technology.

6. To deploy the technology in such a way that it will be brought to the attention of customers and engineers alike.

Working and Block Diagram

This block diagram gives the basic idea and all the models and systems used in our UGV.

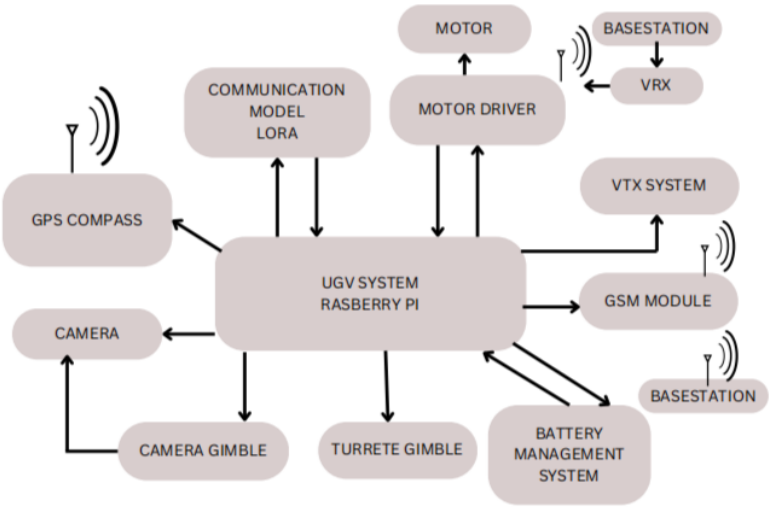

Figure: Block Diagram

1. Raspberry pi 5 as the main processing unit which runs various AI/ML models and controls the entirety of the UGV. It forms the master slave configuration with it being the master in UGV
2. Raspberry pi pico forms the microcontroller unit of the UGV. It works in master slave configuration with raspberry pi to execute motor commands and sensor data.
3. LoRa communication is used to establish wireless communication protocol between base station and Rasp pi on the UGV, along with its 433 kHz bandwidth and 8 km LOS .It is preferred for long range communication.This communication system setup is best for mission planning.
4. Networks of cameras are used for visual feed from UGV to base stations. It uses * megapixel for live streaming transmitted through VTX module over a Local network between base station and UGV.An run cam is used for object detection and tracking as per the ML models implemented. This data is then use to control the servo motor in the camera gimbal and turret.

5. Planetary Gear motors are controlled using cytron motor driver and raspberry pi pico to control the speed and direction on the individual motor with calculated speed and precision.
6. Power management system is designed around an 18v battery used to power the entire ugv. Voltage levels are divided as per the requirements of each component.
7. GPS and compass sensors are used to determine the position and orientation of the ugv which is crucial for mission planning and waypoint navigation of the ugv.

Advantages

1. The developed UGV has a modular design and is versatile in most of the terrain.
2. The developed ugv has a replacement like turret spray gun,etc.
3. It is customizable for specific applications through software changes like change of ML models.
4. Multi model object movement tracking using sort algorithms and assigning unique ids so it can systematically target the targets.
5. Designed robot will carry 250 kgs of weight through rough terrain and perform rescue and payload carrying tasks and perform surveillance operations.

Disadvantages

1. Limited autonomy and decision-Making abilities: UGVs may lack the advanced cognitive abilities of humans, limiting their ability to adapt to dynamic and unpredictable environments.
2. Cost of Development and Maintenance: Designing and maintaining advanced UGVs can be expensive.
3. Sensor Limitations: UGVs heavily rely on sensors for navigation and obstacle avoidance.
4. Environmental factors such as poor weather conditions (heavy rain, snow, fog) or low-light situations can affect sensor performance and compromise the vehicle's ability to operate effectively.

References

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