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Smart Tractor Reinvented for Safe Crops and Pesticides Control

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Abstract: *This study addresses the challenges faced by rural Indian agriculture due to labor shortages and the migration of rural populations to urban areas. To mitigate these issues and enhance agricultural productivity, a novel solution is proposed: a GPS-guided autonomous robotic tractor equipped with advanced agricultural functionalities. The system incorporates features such as intruder detection, security measures, irrigation facilities, pesticide spraying, and environmental monitoring capabilities.*
With agriculture being the primary occupation in many Indian states, the significance of this innovation cannot be overstated. By harnessing autonomous technology, the project aims to optimize crop yields while minimizing labor requirements. The robotic tractor's design integrates basic components including DC motors, intruder sensors, a WIFI camera, and a solar panel for sustainable charging. The mechanical design prioritizes simplicity and functionality to ensure efficient operation in farm fields.
Overall, this research contributes to the advancement of smart agriculture in rural India, offering a promising solution to the evolving challenges faced by the agricultural sector

Keywords: Smart agriculture, GPS guidance, Robotic tractor, Security measures, Pesticide spraying, Sustainable charging

I. INTRODUCTION

Agriculture is the primary occupation in our country for ages. Due to migration of people from rural to urban there is hindrance in agriculture. Crops are very sensitive in nature, they require proper watering or harvesting on time , usually large farm owners face problems of unreliable tractor drivers who miss dates and time which may damage crops. Also, Farmers are exposed to reptiles like Snakes and deadly Scorpions in the farm. To overcome this problem, we go for smart agriculture techniques using autonomous vehicle technology . This project aims at creating a autonomous GPS guided robotic tractor which includes various features like intruders scaring, security and proper irrigation facilities, pesticide sprinkler ,temperature -humidity measurement ,live streaming camera , autonomous GPS guided navigation system. Bluetooth acts as the communication device between android application and robot. It makes use of wireless sensor networks for monitoring intruder. Also,the robot is charged using inbuilt solar panel This concept is created as a product and given to the farmer's welfare.

Most of states in India are agrarian economies and rural populations depend on agriculture and animal husbandry for their livelihood. Aimed at increasing the crop yield and reducing the labour involved, various kinds of agricultural robots have been proposed and developed. This robot can perform basic elementary functions like spray the pesticides. The application of agricultural machinery in precision agriculture has experienced an increase in investment.

The robot starts its function by navigating itself n farm field using GPS guidance and spraying of pesticides and water . It uses basic components like DC motors, intruder sensor(ultrasonic sensor), WIFI camera , motor driver circuit, relay, sprinkler pump and atmega328p as the main controller. The mechanical design of the robot is also simple. It is programmed to carry out the above function simultaneously. Robot has a sprayer equipped with sprinkler which is controlled by a relay.

II. LITERATURE SURVEY

A Development of an autonomous Unmanned Aerial Vehicle (UAV) that can locate and map people in flooded areas using image processing and GPS technology

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Ana Antoniette C. Illahi; Christoph S. Kitane; Inicca C. Lee; Elijah R. Minguez; Juan P. Señires

Published in: 2022 IEEE 14th International Conference on Humanoid, Nanotechnology, Information Technology, Communication and Control, Environment, and Management (HNICEM)

This study aims to equip an unmanned aerial vehicle (UAV), also called drone, with an onboard microcomputer that can perform autonomous surveying with image processing for human detection and quantification, Global Positioning System (GPS) technology for location tagging of detected people, as well as LiDAR sensors for obstacle detection to be used for obstacle avoidance to achieve an enhanced autonomous flight. A user interface for the system will also be developed to display the data being gathered by the drone, namely the detected people and their location, as well as monitor what the drone sees when in flight. This will be used to aid search and rescue operations in flooded areas and aims to speed up the victim search process. The study includes the development of the drone, the human detection and quantification model, the obstacle detection and avoidance algorithm, and the data display on a ground station's Graphical User Interface (GUI).

Sensor Fusion Module Using IMU and GPS Sensors For Autonomous Car

Publisher: IEEE

Ch.S. Raveena; R.Sai Sravya; R.Vinay Kumar; Ameet Chavan

Autonomous vehicle employ multiple sensors and algorithms to analyze data streams from the sensors to accurately interpret the surroundings. The aim of the research presented in this paper is to design a sensor fusion algorithm that predicts the next state of the position and orientation of Autonomous vehicle based on data fusion of IMU and GPS. This is essential to achieve the highest safety and security standards through enhanced performance that enable consistency, accuracy and reliability. Traditionally, for vehicle navigation, GPS standalone solutions have been utilized which lack to scan the surrounding environment. Therefore, the data from an Inertial Measurement unit (IMU) is fused and correlated with GPS measurements to overcome the limitations of GPS based navigation system.

Published in: 2020 IEEE International Conference for Innovation in Technology (INOCON)

GPS-Aided Auto Navigation System for Autonomous Vehicles

Publisher: IEEE

Manchala Shivamani; K.C. Meghavardhan Reddy; Shaik Shakeera; Hrishikesh Venkataraman

Autonomous Vehicles (AV) are the future of the smart digital world. Auto Navigation is the heart of AVs. However, researchers have been working on precise auto navigation control of AVs for many years. Hence, In this paper, a GPS-aided auto navigation system is proposed with position control and heading control of AV. Further, to test the proposed algorithm an AV is designed and developed with low-cost sensors and actuators. The real-time testing of the proposed adaptive control auto navigation mechanism has been performed with three test cases such as straight line, L-shaped and Semi-circular. The results shown in this paper are the deviation between the travelled path and the defined path of the vehicle in different trajectories by assuming no obstacles in the path. The deviation of the path travelled by AV with respect to the defined path using the proposed algorithm is less than 0.5m. Finally, the telemetry of AV has been monitored by the developed Graphical User Interface (GUI). This work is very useful in auto navigation of vehicles where humans can not be sustained.

Published in: 2023 11th International Symposium on Electronic Systems Devices and Computing (ESDC)

Smart Automated Pesticide Spraying Bot

Publisher: IEEE

Kalpana Murugan; B. Jaya Shankar; A. Sumanth; C. Venkata Sudharshan; G. Vigandhar Reddy

Nowadays the farmers are playing the crucial role by working hard in the agriculture lands and planting the crops for the societies living in different regions for earning their minimum needs. In India the pesticide usage is higher which 70% is whereas the world-wide pesticide usage is 44% only. Air is getting polluted by using these pesticides. This is the major problem in agriculture. For this, a robot is developed to spray the pesticides by its own and it is less harmful to the environment. The project is under wireless sensor network. The application of wireless sensor network agricultural, Bio-medical, Environmental etc. This bot will help the farmers very effectively. This bot will spray the pesticides over

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entire the crop with the help of mobile phones. This bot can be easily controllable. The bot sprinkles the pesticides covering all plants in the farm. This will use in pest control and disease prevention application forms. By using this bot, the time and work of the farmer will be reduced.

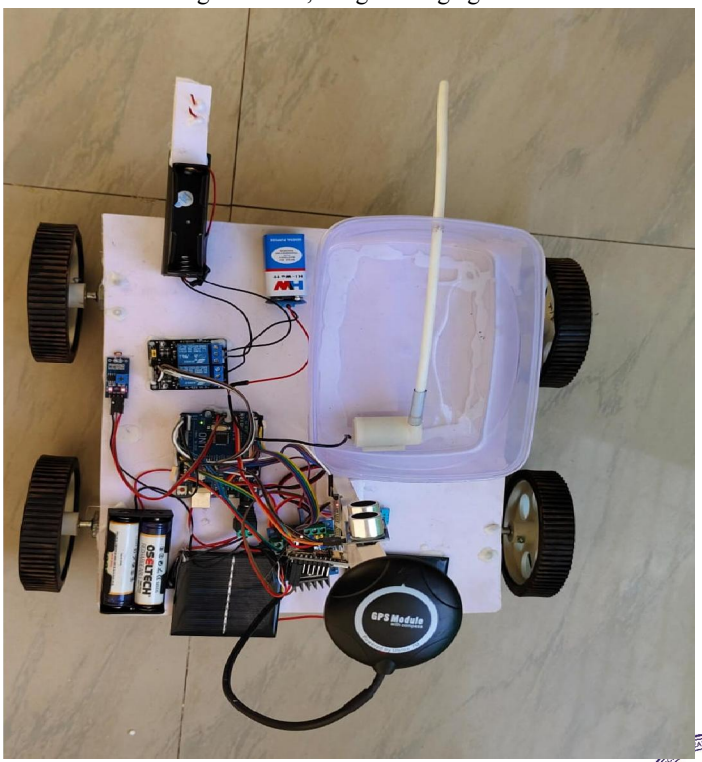
Published in: 2020 3rd International Conference on Intelligent Sustainable Systems (ICISS)

Proposed System

- An autonomous robotic tractor which is self driving using gps guidance.
- Farmer can see live video of his land when he needed or when intruder has found.
- Farmer can control pesticide sprinkling device through IOT application.
- Farmer can know worst day for his farm and take proper hydration steps for plants by seeing temperature ,humidity ,sunlight readings from the robot
- Farmer can electrically stun wild animals or intruder using on board high voltage generator.
- Farmer can use on board liquid spray system to spray pesticide or water to plants.
- The robot is self charged using solar pannel

III. METHODOLOGY

The robotic tractor is placed in the farm and its direction controlled by gps guidance system which using on board gps module and algorithm to navigate by itself .The robotic tractor is built using atmega328p microcontroller,a wireless live streaming camera is constructed using esp32 ai cam board. lithium ion batteries are used for powering the robot which is charged using 9v solar panel.Four dc geared motor is connected to esp32 via motor driver which controlled the movement of the robot.A dc pump is used to spray liquid. The spraying of pesticides can be done with the help of pesticide sprinkling pump and is periodically sprayed whenever the relay switch is on. The system focused on the design, development and the fabrication of the self driven agricultural robotic tractor with pesticide spraying system in addition to security system using IOT. can also measure temperature ,humidity,sunlight and moisture and send data to app.in case of wild animal or intruder entering the farm , a high voltage generator is used to stun the offender.



Above figure shows the implementation of smart autonomous tractor

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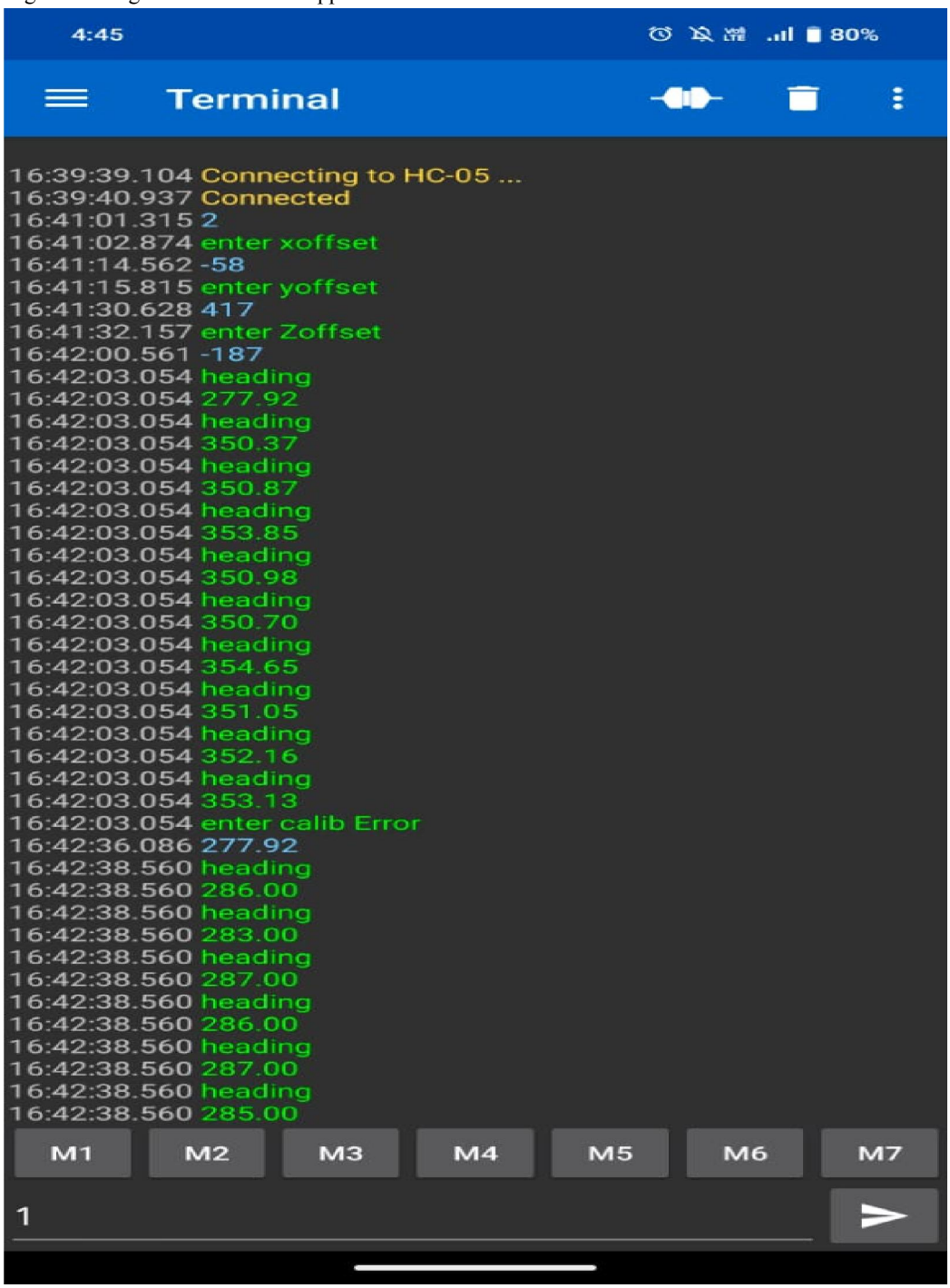
IV. RESULTS

Inputs are given through mobile terminal app via Bluetooth Connection.



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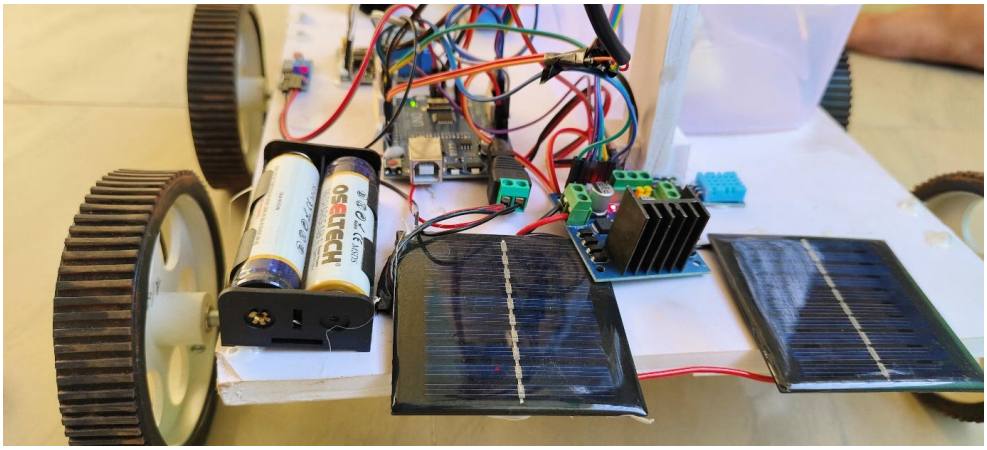
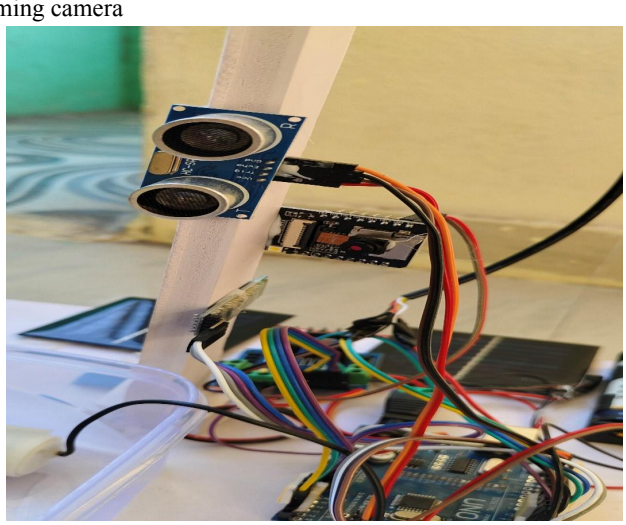
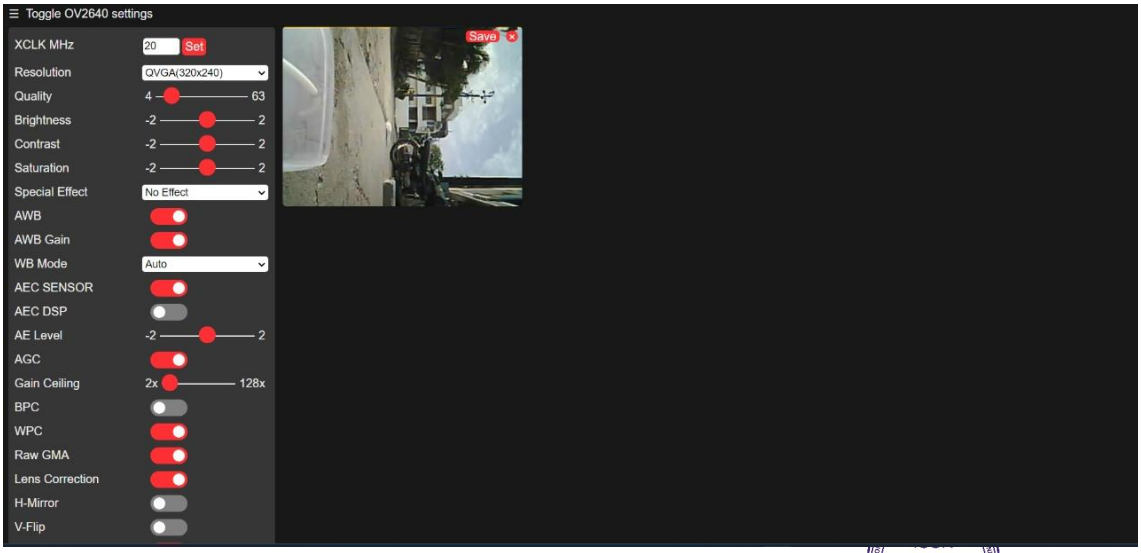
Solar Panel Implementation for Sustainable Energy



Sonar Sensors and live streaming camera





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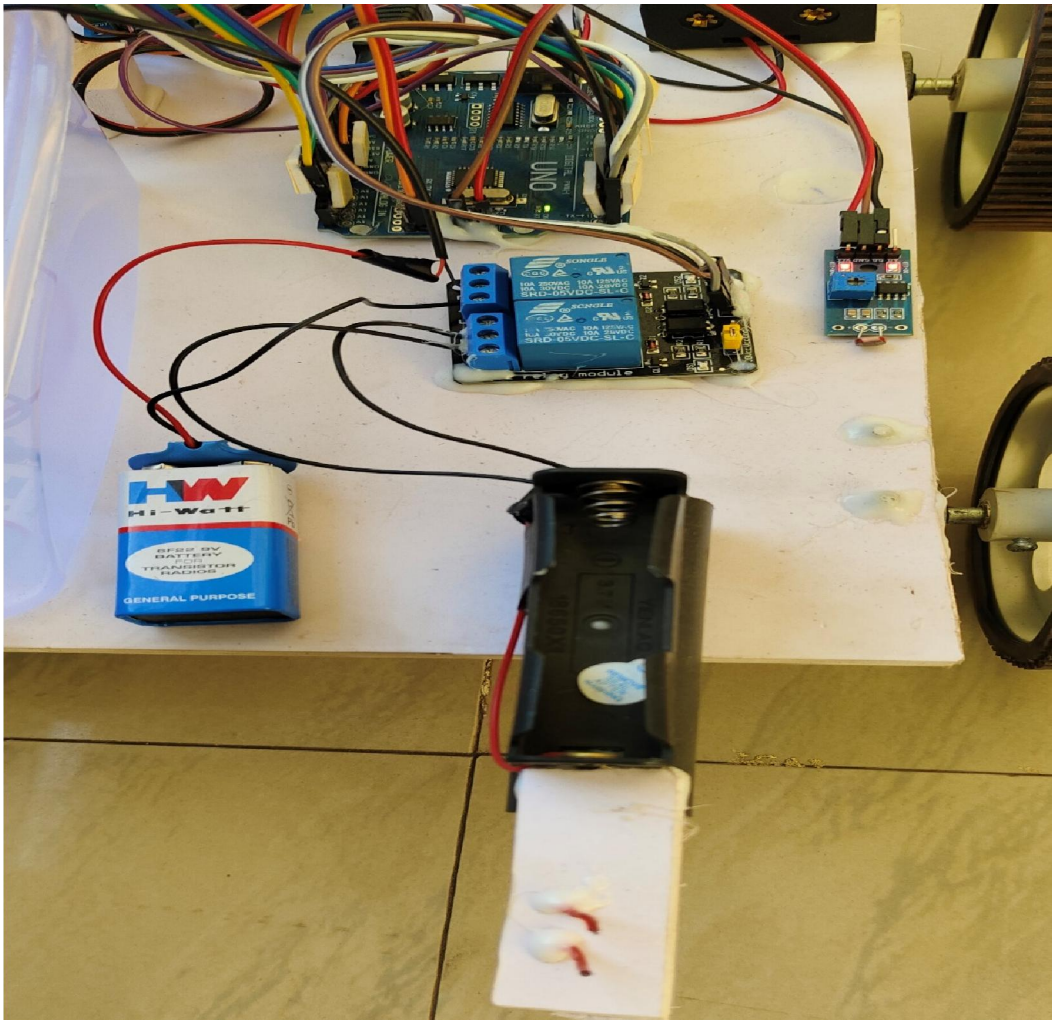
In above figure shows the live streaming



The above figure shows Electric Tazing of animals and thieves.

V. CONCLUSION

On successful implementation of our project will be able to save many lives of farmer and also reduce health hazard to farming while spraying pesticide. Farmers are avoided from being exposed to snakes and scropions.Farmer no longer has to relay on drivers to maintain his farm .Also we will be able to give farmers ability to farm with statistical planning by providing him realtime information about temperature , humidity , moisture , sunlight of his farm with easy to use mobile interface.

Farmer will also be able to protect his farm from wild animals and thief using detect and defence capabilities of robot which is very crucial for crops like Shri-Gandha.

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