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Cleaning of Vernacular Railway Tracks Using Drone

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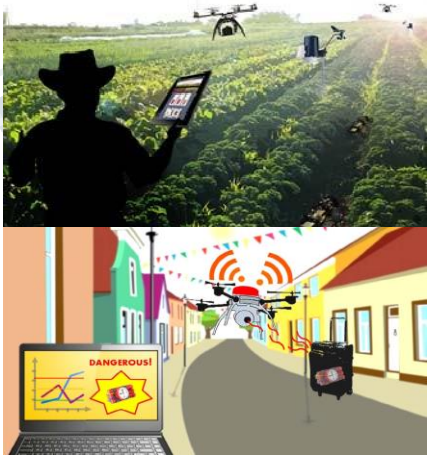
Abstract: -- **A Quadcopter can achieve vertical flight in a stable manner and be used to monitor or collect data in a specific region such as mapping terrains. Technological advances have reduced the cost and increase the performance of the low power microcontrollers that allowed the general public to develop their own quadcopter. The goal of this project is to build, modify, and improve an existing quadcopter kit to clean outdoors, gather and store GPS data, and perform auto commands, such as collecting waste from rough terrain, auto-charge, auto-flight, auto-landing, using image processing technique.**

This project uses a quadcopter kit that includes a frame, motors, electronic speed controllers, Raspberry-Pi development board, and sensor boards. Batteries, a transmitter, a receiver, a GPS module, solar panels, Raspberry-Pi camera, a micro SD card adaptor and a cleaning unit (to collect-store-dispose wastes in correct place; from rough terrains) were to be interfaced with the kit. The Raspberry-Pi will be modified to properly interface the components with the quadcopter kit, Calibration and tuning of the PID controller will be done to obtain proper stabilization on each axis using custom PID test benches. Currently, the quadcopters can properly determine its GPS location; send the data captured by camera and store and log data. This solution also describes the auto-commands, to detect and collect the waste that is led on the rough terrain automatically by using image processing technique in Raspberry-Pi board which will be having the entire control over the drone automatically or manually. The Raspberry-Pi has the facility of IOT Using which we can provide and receive information of train status, cautions to various stations which make them inter-connected between them and the passengers.

1. INTRODUCTION

Autonomous aerial vehicle are becoming trending technology in many fields due to the lack of labor and risk reduction of many hazardous cases in working procedures. Unmanned Aerial Vehicle (UAV), an aircraft which has no pilot, and can be controlled remotely and it is in use in several fields such as military, aerial surveillance, aerial photography, cargo delivery, forest fire detection, oil/gas and mineral exploration and manufacturing, etc. Recently, using UAV as a remote sensing apparatus draws interest from researchers in numerous fields; various sensors to be equipped on drone have been demonstrated. Drone is one type of drone that is lifted and propelled by four rotors. It use two set of identical propeller which rotates in clockwise (CW) and counter-clockwise (CCW), to control the movement of drone by alter the rotation rate of one rotor disc or more. The advantages of quadcopter compare to others drone are low cost, steady flying, accurate position to handle the work and most importantly the ability to carry various instruments to operate in the air. Some previous works have shown installation of various types of gas sensors on quadcopter or hexacopter to detect odor diffusion pattern and find the odor source in many situations but there are quite few works that employ sufficient number of gas sensor in an array to work as a so-called E-nose system.



(a)

(b)

Fig.1. (a) Drones are flying above the farm land and working like swarm and (b) Sensor drone is detecting the hidden explosive material.

On the other hand, many types of drone or UAV commonly used in military or security services are very expansive, hard to maintenance and required to be operated by professional user. Survey drone is one type of military drones used for detecting the dangerous targets by installed sensors such as infrared camera, motion

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detector, etc. It means that the targets must be seen by the drone. In case of hidden or invisible targets, it will be quite difficult for a visual survey drone to detect them. Installation of an E-nose system on the fix-wings drone to detect and classify the chemical volatiles or odors is very useful method for seeking the hidden hazardous target such as bombs and chemical weapons because explosive part of the weapon usually leaks some chemical volatiles which are detectable. This technology will increase the performance of survey robot and very helpful for security service to reduce the damage from the explosion as shown in "Fig.1 (b)".

In agriculture, E-noses were applied in many applications such as detection of awful smell from swine farm, hazardous elements from food industry, quality grade identification of green tea, etc. E-nose consists of an array of various chemical gas sensors that present distinct gas-sensing behaviors. The different selectivity of each gas sensor is very useful for classification and analysis of the odor data via pattern recognition techniques such as principal component analysis (PCA). Because a typical quadcopter cannot load a heavy thing, so the weight of E-nose system and other necessary equipment must be light enough. Among the available types of sensing materials applicable for E-nose system on mobile robot, polymer/carbon nano tube nano composite gas sensors are the most popular due to their high sensitivity, high reversibility, ease of maintenance and low power consumption that helps reduce weight of the battery. However, development of E-nose on drone for agriculture and industry has been rare, and most E-nose on UAV applications are still involved with the use of only one or two gas sensors. For such reasons, it is very important to develop a drone platform that integrates both E-nose and robotic technology together for field deployment.

In this work, the applications of E-nose on drone have been demonstrated in order to explore the opportunities in the field of precision agriculture, security and environmental monitoring.

II. PROBLEM DEFINITION

The Indian Railways (IR) is the second biggest railway network in Asia. It is the biggest public sector enterprise in India and connects the entire country. One of the biggest worries is the amount of solid waste (mainly paper and plastic) generated each day by train passengers across the country. As of now, there is no comprehensive system to collect and manage this enormous amount of waste. Here we have a solution for this problem by the use of DRONE. This solution uses drone system for detecting and cleaning wastes that are laid down by passengers

III. OBJECTIVE

The main aim of this project is to develop much cleaner noise less cost effective different way to clean railway tracks An Image Processing technology can be used to solve this problem. The image processing technique will help us to detect the wastes and process it with the help of Raspberry-Pi placed in a drone system to carry the waste and dumb in specified place. The use of Raspberry-Pi will reduce the experience level of operator who can command the system as per his need. The power source for the drone system is solar panel strips, which charges the system when train has arrived and cleans the tracks until the next train arrives. With the help of IOT we can send and receive train status.

IV. TECHNOLOGY STACK

The aim of this project is to create a simple system to clean outdoor, to reduce the demand of professional flight controllers and to protect drone from unauthorized user.

We modified the controlling system of the drone. By using an Raspberry-pi board, we are controlling the system manually as well as automatically, GSM, and GPS module, which allows only system to clean in a set path. In addition, the GPS (Global positioning system) and GSM (Global System for Mobile Communication) module will send us the location of the surroundings in user mobile whenever need.

1) POWER MANAGEMENT SYSTEM:

The applications of drone as described above, generally require long flight time and reliable power supply. However, current drone designs utilizing traditional battery or fuel cells usually struggle to meet such requirement. This solution aims to provide an innovative solution to this problem by introducing the current popular photovoltaic system into the drone power system design. It focuses on the electrical system design. The

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block diagram explains the process of Power Management System briefly:

V. WORKING

The working of drone is as follows:

- The operator on starting the drone with the help of mobile, the system performs auto flight on a set path.
- The camera fixed on the drone captures images continuously; the images will be processed and manipulated.
- Once the waste is detected the drone goes near it and collects it.
- Again the camera keeps on capturing images if none of the wastes are detected then the system keeps on travelling in the set path.
- Once the system reaches the destination it alerts the operator and auto lands in a place where sunlight is sufficient enough to get charged.

A. The flowchart explains the working briefly

VI. ADVANTAGES

- Use of solar panels makes it go greener and power efficient.
- A drone does not require a large area to obtain lift, like a fixed wing aircraft does.
- The drone creates thrust with four evenly distributed motors along its frame. A helicopter suffers from torque issue due to its main rotor.
- The design of the drone does not suffer from the same torque issues as the helicopter.
- Because the drone uses four rotors instead of one main rotor, it requires less kinetic energy per rotor for the same amount of thrust when compared to the helicopter.Due to this and its symmetrical design, drone maintenance and manufacturing costs are relatively lower than other aircrafts

VII. CONCLUSION

With the help of this drone and our technology we can save manpower and energy and clean the tracks and stations in a clean and automated way.

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