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INTELLIGENT AGRICULTURAL PEST MANAGER DRONE IN PAKISTAN

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ABSTRACT

This paper's primary goal is to develop an agriculture drone for spraying pesticides. We discuss an architecture based on unmanned aerial vehicles (UAVs) in this study. Pesticides must be used in agriculture if the quality of large-scale output is to be maintained. It is crucial to increase agriculture's production and efficiency by employing cutting-edge technology to replace employees with intelligent equipment like robots. The research suggests a novel method to replace people in a number of agricultural tasks, including the identification of insect presence, the application of pesticides and fertilizers, etc. The created method entails building a prototype that makes use of basic, affordable equipment including a microprocessor, different motors, and terminal equipment to assist farmers in a variety of operations related to crop fields. Design and build an autonomous drone-based surveillance system capable of identifying injured crops and spraying pesticides in specified regions as needed. To combine an image processing and Artificial Intelligence based real time algorithm to determine crop health and evaluate the need for pesticides, as well as a weather monitoring system that can assist anticipate weather conditions.

KEY WORDS: Pesticide spray, drones, agricultural monitoring, weather monitoring, image processing.

INTRODUCTION

Moreover 60% of Pakistan's workforce is employed in agriculture. It acts as Pakistan's economy's skeleton (Jatoi *et al*., 2020). It is crucial to provide farmers with safe farming practices in order to increase agricultural output and efficiency. The application of fertilizer and insecticides is a highly laborious process (Waqas *et al*., 2016). Even though pesticide spraying is now required, farmers still suffer negative effects from the practice. Farmers take excessive care, particularly while applying pesticides, including donning protective clothing, masks, and gloves, among other things, to ensure that they are not adversely affected (Sadhana *et al*., 2017). Since the desired result must be achieved, totally avoiding pesticides is also not practicable (Mazhar *et al*., 2018). Pakistan's economy, which heavily depends on agriculture's high yields, is regarded as its foundation. Arable land and water are Pakistan's most valuable natural resources. Agribusiness employs roughly 42.3% of the labor force and accounts for about 18.9% of Pakistan's GDP. Punjab in Pakistan is the region with the highest agricultural production of wheat and cotton (Aqeel ur rehman *et al*., 2010). Similar to industrialized nations, Pakistan's agricultural business has adopted a number of cutting-edge techniques to boost crop yield, but there are still a number of cutting-edge technologies that need to be implemented, one of which is the use of drones for pest management (Waqas *et al*., 2021). There are two drawbacks to the traditional approach, which involves using backpack sprayers to administer insecticides. First of all, it took more time and labor. Second, because of the size of the field, it is challenging to determine which specific sections need pesticides, which results in pesticide waste (Mogili *et al*., 2018). However, the suggested system can correctly spray the pesticide based on evidence of need while also

monitoring the health of entire fields of crops, noting any changes that signal a pest infestation (Chang *et al*., 2018). An image processing-based smart drone with an HD camera, a spraying mechanism, a battery backup system, and a GPS for location tracking will be the system (Devi *et al*., 2020). It could transport a load of around 3 kilograms at an average speed of about 10 km/h. In order to improve the impact of pesticides on the field, the system would also be coupled with a weather monitoring system (Nadia, 2013). Our system, in particular, may aid in the identification of pest threats more efficiently utilizing an image processing algorithm than a farmer depending on human monitoring and surveillance, giving farmers an advantage in mounting a defense and preserving more of their crops (Aqeel ur rehman *et al*., 2010). Additionally, the suggested system is not restricted to a certain crop production; instead, it would be able to analyze any data presented, and in the event of a pest danger, a drone would fly from its base station and administer pesticide where necessary (Zhang *et al*., 2017).. The major goal of this initiative is to reduce the negative effects that pesticides have on people. There are just too many technologies used in modern agriculture. Drone-assisted pesticide application is one of the cutting-edge technologies (Bacco *et al*., 2018). Manual pesticide spraying offers a number of disadvantages for those participating in the procedure. Mild skin irritation, birth deformities, malignancies, genetic alterations, blood and nerve disorders, endocrine disturbance, coma, or death might result from exposure symptoms. (Rana.M *et al*., 2018). However, field tracking, pesticide application, and fertilizer application may all be automated using drone technology (Veroustraete *et al*., 2015). A brief overview of the usage of drones for field inspection and pesticide application is given in this study. Illustrates several agricultural drone approaches and controllers and describes key hardware, software, and application components. to create a system that is not unique to any one crop. After training the model at the base station, the drone could handle any type of yield (Avtar *et al*., 2020). In other words, our technology will be able to give the appropriate medication at the appropriate time and location to protect crops, perhaps leading to increased yields. The major goal of this initiative is to reduce the negative effects that pesticides have on people (Huuskonan *et al*., 2018). There are just too many technologies used in modern agriculture. Drone-assisted pesticide application is one of the cutting-edge technologies (Mogli *et al*., 2018). Manual pesticide spraying offers a number of disadvantages for those participating in the procedure. Mild skin irritation, birth deformities, malignancies, genetic alterations, blood and nerve disorders, endocrine disturbance, coma, or death might result from exposure symptoms. (Khamuruddeen *et al*., 2019). However, field tracking, pesticide application, and fertilizer application may all be automated using drone technology. A brief overview of the usage of drones for field inspection and pesticide application is given in this study (Qin W. *et al*., 2018), Illustrates several agricultural drone approaches and controllers and describes key hardware, software, and application components. Create a method that is adaptable and not limited to a single crop. After training the model at the base station, the drone could manage any type of yield (Jatoi *et al*., 2020).

AIM OF DRONE IN PAKISTAN

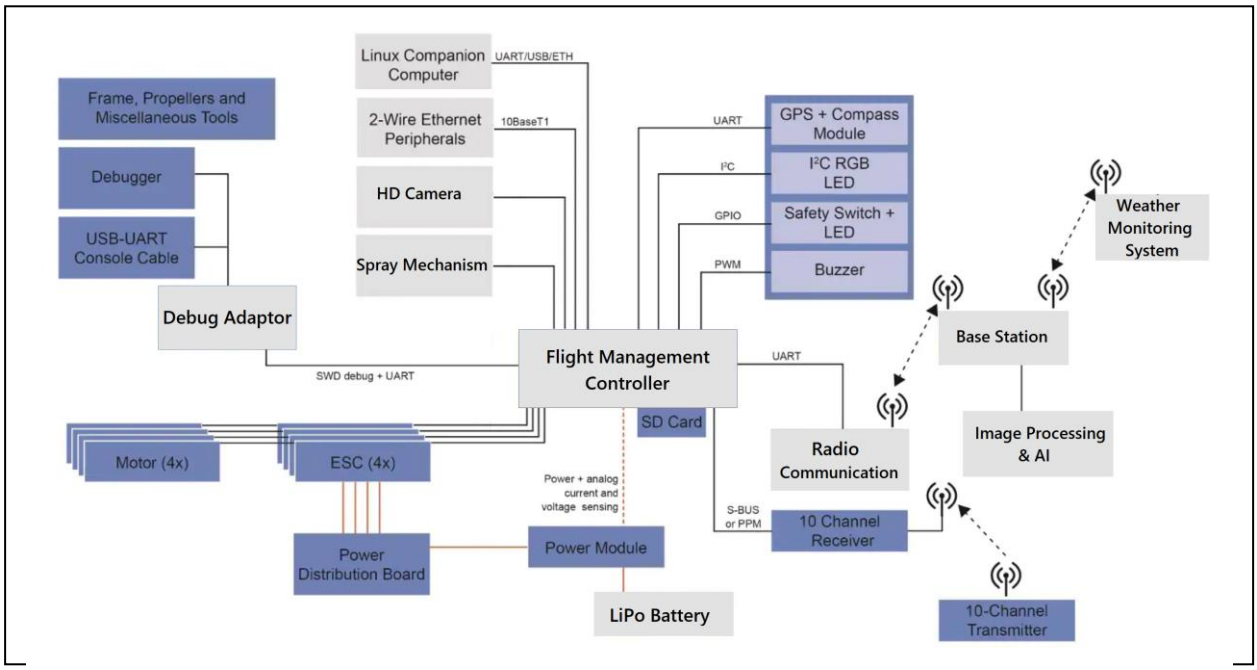
Pesticide poisoning kills up to 220,000 people per year, according to the World Health Organization, with the majority of cases occurring in developing countries. Carbonates and organophosphates have an effect on the neurological system. Others may irritate the skin or eyes. Some insecticides may cause cancer. Others may have an effect on the endocrine or hormonal system of the body. Children are particularly susceptible to the negative effects of pesticides, as are other young and developing creatures (Shivaji *et al*., 2017). Even extremely modest exposure levels throughout development may have harmful consequences on health. Pesticide exposure can have a variety of negative consequences on neurological health, including memory loss, loss of coordination, slowed reaction times to stimuli, decreased visual acuity, changed or irrational mood and behavior, and diminished motor abilities. This research aims to reduce the negative effects of pesticides on people (caused by manual pesticide sprayers) and to spray pesticides over bigger areas of fields more quickly than using a manual sprayer.

MATERIALS AND METHOD

Project implementation could be divided in 5 phases:

1. Procurement: It includes purchasing of the lab equipment and the components required for hardware development.
2. Hardware Development: After the procurement, the next step is to develop the hardware. As discussed above the project hardware is rely on 3 main blocks, drone, base station system and weather monitoring system. The

base station is the centric of the system which could communicate with the drone and the weather monitoring system. Furthermore, it perform the data analysis part receive from the drone and the weather monitoring sensors. Drone perform three major tasks, gather the field data using HD camera, transfer the data to main station and apply pesticides in field using spray mechanism as shown in figure 1. The 3rd major part is weather monitoring system which consists of multiple sensors including temperature, humidity, wind speed and air pressure integrated wirelessly to the base station and on the bases of these parameter base station systems will decide the suitable time to apply pesticides. The drone's main board, or flight controller, is responsible for controlling real flight and is equipped with state-of-the-art technology. The drone's flight controller is in charge of several different tasks at once. It was created and attached to the four motors without brushes using a microcontroller. BLDC motors are attached to the rotors in the drone setup model. The Electronic Speed Controllers (ESC) are in charge of managing these BLDC motors. The radio network's transmitter and receiver provide electricity to the drone. For each RC transmitter, there are several platforms available for specific drone control operations.



3. Software Development: An image processing based AI application will develop by using Matlab and Python platform which could control the hardware autonomously and command the drone to fly and apply pesticides where needed.
4. Integration: In this step the developed software would integrate with the hardware.
5. Testing: In this step the system will be test on real field.
6. Implementation: And lastly the project will be implemented in the real field

System of Drone: These advanced drone has consists of following system

- Drone
- Pesticides spraying system
- Software for algorithm design
- Charging dock station
- Lipo-Batteries
- High end Computing PC/Laptop: Corei7, 16 gb ram, 1 TB Hard Disk and GPU
- Weather Monitoring System
- Sensors Integration Controller
- GPS tracking system

RESULT AND DISCUSSION

Utilizing modern technology is critical for a country with an agricultural economy, such as Pakistan, to handle emerging risks to domestic food security and become globally competitive. Crop losses and pesticide expenses cost millions of dollars. The introduction of agriculture robots is thought to have had a significant impact on this field due to the use of various sensors, electronic, and knowledge systems that enable more accurate and cost-effective monitoring and control of various fluxes on the farm as well as easier information dissemination to farmers. (Avtar *et al*., 2020). A

powerful real-time spraying area identification system for UAV-based sprayers was created in this respect in fig 2. The system was enhanced by simulating the real-world experiment in a virtual context. and the field was chosen for field testing and field experimentation. The data were gathered over the course of a month on various days, and the data set shows that our approach produced effective outcomes. UAVs often have a short battery life and operate quickly. As a result, it demands quick operations and high computing speed with the best recognition capabilities (waqas *et al*., 2021). Given these limitations, the created real-time identification system achieves noticeably high accuracy while consuming significantly less processing time, which is crucial for carrying out the intended activity

Fig.2 powerful real-time spraying area identification system

To demonstrate its effectiveness, a deep learning system was constructed and compared to others approaches. According to test findings and real-world data, it was found that the designed system was able to produce superior outcomes. Even while VGG 16 outperformed the proposed approach in terms of accuracy, it did so at the expense of processing time, a crucial consideration when working with UAVs due to their limited computational power. Consequently, the constructed model was the perfect system for the research. The created deep learning system can quickly identify targets and be readily implemented into many precision agricultural applications, such as identifying pests and bugs, controlling weeds, estimating yields, monitoring crop health, etc. For the aforementioned precision agriculture applications, the created technology may be put to use on unmanned aerial vehicles (UAVs).

CONCLUSION AND FUTURE SCOPE

In this work, we proposed the design of a drone-mounted spraying mechanism for agricultural and disinfection spraying applications. Pesticides are administered to agricultural regions in this manner, which reduces labor, time, money, and risk to those conducting the spraying. This drone can also expand photographs of ill crops and help with weather monitoring by employing image processing. It may be utilized to spray huge hotspot regions without physically visiting there. It may be utilized to spray huge hotspot regions without physically visiting there.

- Manual control can be converted to autonomous control. Image processing employs a real-time artificial intelligence-based system to assess crop health and the need for pesticides.
- The drone can be equipped with image processing capabilities. It would be involved in surveillance to assess insect assault on plants and ripening fruit condition.
- to create a weather monitoring system capable of forecasting weather conditions.

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