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IOT MULTIPURPOSE UAV

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ABSTRACT

The concept proposed here describes about the design, construction and validation of a mobile sensory platform for crop monitoring, disaster management. In the field of agriculture, the focus is on the applications of fertilizers and pesticides which is the prime importance for crop yields. The use of drones or unmanned aerial vehicle (UAV) makes it easy because of the speed and effectiveness in spraying operations. They are durable than conventional helicopters and easy to construct thus reducing the potential damage and are mainly used for surveillance of various applications in many fields such as crop monitoring and management in the agricultural fields which are helpful in farm production thus reducing the work of farmers and in disaster management where in case fire emergencies can be detected and monitored without getting close to the affected area.

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INTRODUCTION

A quadrotor helicopter, also known as unmanned aerial vehicle (UAV) is an aerial vehicle propelled with the help of the four rotors with two propellers rotating in clockwise and the other pair rotating in the anticlockwise direction, balance is maintained by the speed of rotation of the two pairs of rotors (6).The farmers have to carry bags of pesticides and evenly distribute all across the farm which is time consuming and lot of man work is need, thus spraying through drone reduces the workload (7). Another crisis faced by the farmers is occurrence of fire in the electric lines which are running across the farm fields which causes a major disaster since no one can get near electric fires. Thus through the wireless sensors which is being attached to the drone for detecting the rising temperature at a certain spot, the drone can be placed within the range away from the fire and the fire retardants can be sprayed from the drone (8) .Thereby reducing the loss and damage occurring in the farm and also help in reducing farm fires.

Related works: Many related approaches have been proposed for the usage of drone in various applications and fields for efficiency. Here we discuss the approaches that are made suitable for our proposed system.

Agriculture Field Monitoring: Deepak Murugan, Akanksha Garg, and Dharmendra Singh have proposed a drone that moniters the crops (Murugan *et al*., 2017). Earlier the large scale monitoring of crops was done with the help of satellites, the use of drones improves the efficiency to a great extent. The drawback with this drone is that the only purpose of this drone is to monitor the crops and does not involve the concept of spraying pesticides on the damaged crops.

Life Sensor: Robert Nakata, Brian Haruna, Takashi Yamaguchi, Victor Lubecke, Shigeru Takayama and Kiyotsugu Takaba have proposed a drone for remote life sensing applications including military, humanitarian and post-disaster search and rescue operations (Nakata *et al*., 2018)**.** The sensors can remotely detect human respiration vital signs. The only drawback with this is that this model is designed for post disaster remote life sensing and not for sensing disasters

Fire Sensor: Hailong Qin, Jin Q. Cui, Jiaxin Li, Yingcai Bi, Menglu Lans, Mo Shan, Wenqi Liu, Kangli Wang, F. Lin, Y. F. Zhang, and Ben M. Chen have proposed a system consists of a self-designed quadcopter that navigates to the field area and sprays water on the crops are on fire (Hailong Qin *et al*., 2016). This model helps in identifying and reducing the damage caused by the fire. The only drawback here is that it does not perform the task of monitoring the health and moisturecontent available in the crops.

Moisture Control: This proposal was covered by Leila Hassan-Esfahani, Alfonso Torres-Rua, Andres M. Ticlavilca, Austin Jensen have proposed a drone that senses the top soil

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moisture estimations for a large field served by a centre pivot sprinkler irrigation system (Leila Hassan-Esfahani *et al*., 2014), (Rao *et al*., 2007). The drawback with this model is that the drone does the job of monitoring the moisture content but not spraying of water.

Spraying: Spoorthi. S, Dr.B. Shadaksharappa, Suraj.S, V.K. Manasa have proposed a drone that carries and sprays pesticides all over the farm and reduces the work of the farmers (Spoorthi *et al*., 2017). The drawback with this drone is that it does the job of spraying the pesticides but does not monitor the health of the crops.

Proposed method: The concept proposed in multipurpose UAVis the construction of a system used for crop monitoring for detecting the moisture content in the soil and providing solutions such as spraying water and pesticides, detection of fire in the farm fields and electric lines, spraying fire retardants for controlling the spreading of fire. The proposed system helps in efficient farming and reduces the man power needed. In case of any fire emergencies, a precautionary step can be taken to control the fire spreading across the farm fields.

Crop Monitoring: In our proposed system, all the noted reading and values are received from the sensors are sent to the remote system through a wireless module attached with the Arduino. The main aim of crop monitoring in our proposed concept is the detection of moisture content which is present in the soil .The threshold values are noted and are sent to the system for further processing .This reduces the work which is being done by the farmers. The conditions to be met are embedded in the Arduino system, a spraying tank is attached to the drone and if the moisture content is detected low by the sensors. The spraying tank which is powered through the DC pump motor is automatically switched on and the crops are watered through the drone, the unmanned aerial vehicle is controlled manually, and the areas that needs to monitored and sprayed are done by the person controlling the vehicle. Thus through this process, less men is needed to perform the task and the job gets done in a short period of time. The tank can also be replaced with pesticides instead of water and can be sprayed over the fields accurately and evenly.

Wireless Transfer: The drone is an aerial vehicle and the data that is being monitored must be viewed in a remote system and checked to make further actions if needed such as spraying water or pesticides. Since the drone is in surveillance during monitoring .The data so far monitored is send via Esp-8266 which is a Wi-Fi module capable of transferring data from the drone to the remote system. The Wi-Fi module is attached with the Arduino which in turn connected to the internet and the Wi-Fi system is embedded through the programming section, thus when the code is uploaded, the readings so far is seen in the serial monitor of the Arduino software. While the Wi-Fi module acts as a transmitter of the readings monitored, the remote system acts as a receiver where the readings are viewed either in the serial monitor or through an open source application available in the internet which is used for storing and retrieving data from the Arduino. The API key is copied from the application and embedded into the Arduino software along with the libraries and a connection is established with which we can view our readings.

Disaster Management: Occurrences of fire mainly in the farm areas can cause damages to both the farmers and the crops, here the multipurpose drone has an advantage of being an aerial vehicle with fire sensors and retardants attached to it which can help reduce the fire spreading throughout the fields, when the threshold values of the fire sensors changes from 0 to 1, it indicates that the fire has been detected. The spraying tank which is attached to the drone can be filled with fire retardants and used for spraying and helps in bringing the fire under control in the affected areas. Another advantage is when the fire is detected over the electric lines running across the fields, the temperature sensor attached to the drone is used for detecting the rising temperature at that certain point in the wires, thus we can detect the electric fires with the help of temperature and fire sensor, the flame retardants can be sprayed from a certain distance away from the electric lines. This may help in keeping the fire under control until help arrives.

Algorithm: In our concept we used fuzzy logic which is viewed as a multi-valued logic, it shows the degree between truth and false .In simple the logic involves in the classification of objects and functions into fuzzy sets. In our project we set threshold values for each sensors and if the values go beyond the threshold conditions, the values will be uploaded to the remote system and the values are also used for taking further actions.

Algorithm: Fuzzy Logic detection
Get the monitored values from the sensors
Set a threshold value based on per time
If sensor values > threshold then
Upload data in the remote system.
end

RESULTS

The Experiment we have presented in this section tests the moisture content present in the soil, temperature of the atmosphere, detection of fire and motion. The noted values are viewed through Thing Speak, an open source application which is available on the internet. To view the values, first we setup the API key and the ip address of the application in the Arduino software and then connect it to the internet. The output values are represented in a graphical view where the readings will be updated for every one minute. The temperature sensor monitors the surrounding temperature in Celsius scale, during the occurrence of electric fire where the temperature is high at a certain point. The peak of temperature is noted and the retardants can be sprayed at that point from a certain distance. If a movement is detected in the fire affected areas, the sensor value changes to 1, if no motion is detected the value remains at 0.

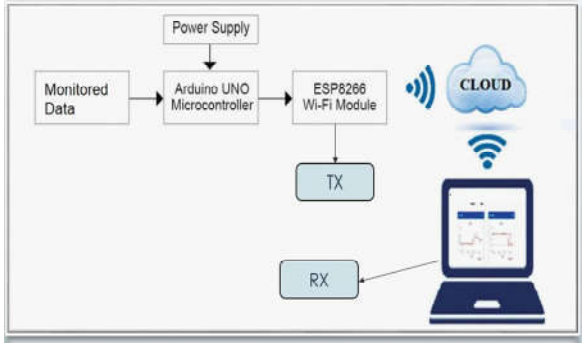

Fig. 1. Wi-Fi Module

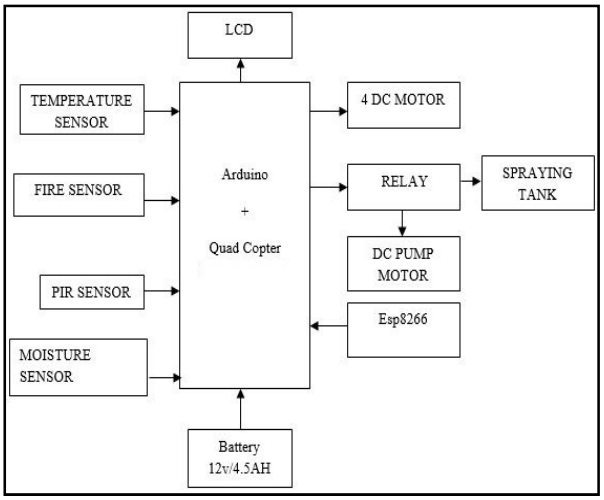

Fig. 2. Overall Architecture

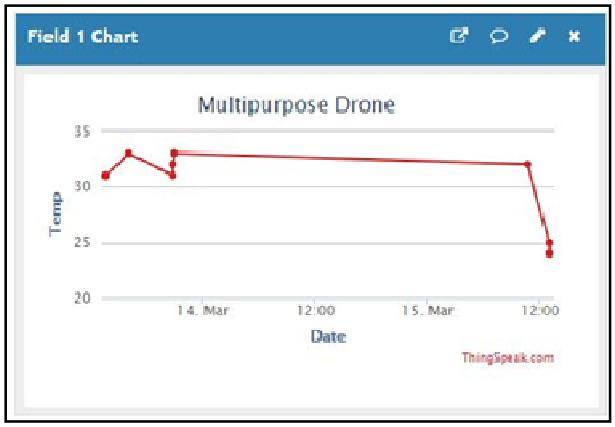

Fig. 3. Temperature readings

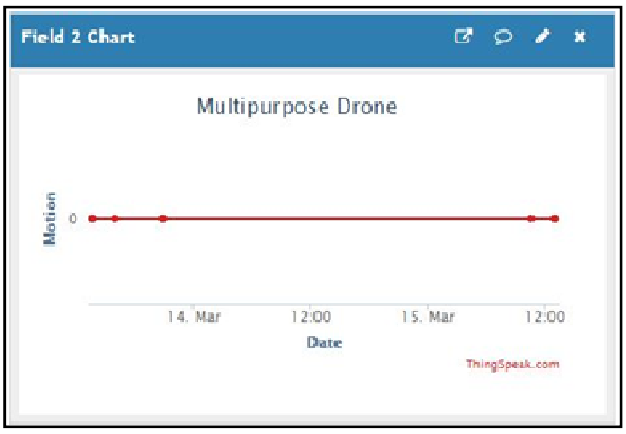

Fig. 4. Motion Detection

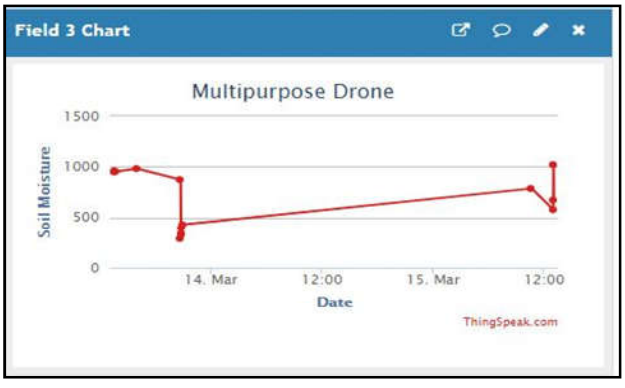

Fig. 5. Moisture readings

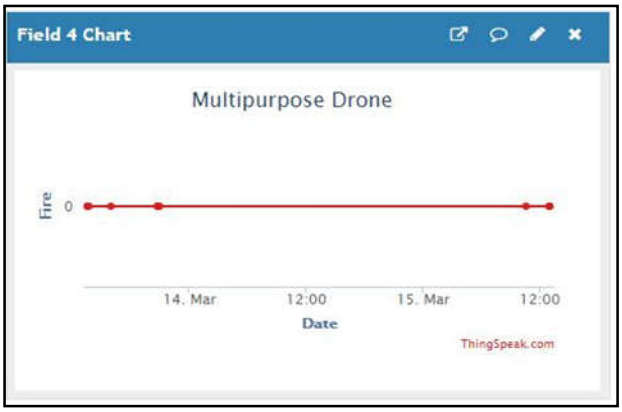

Fig. 6. Fire Detection

Here the moisture Threshold values is set to thousand and values below the threshold condition denotes that moisture is present in the soil, if the values are above the threshold condition, dryness is detected and the motor is switched on for spraying. Fire Detection works on a simple basis, if the fire is detected, the values turn from 0 to 1, if flame is not detected the value remains at 0.

Conclusion

The scope of the project is to develop a multipurpose UAV with a user friendly interface for sensing the moisture level of the soil and disaster management in the case of fire emergencies. The multipurpose UAV is a drone that sprays water for irrigation and pesticide based on the soil moisture level for agricultural purpose. It evenly sprays the pesticide all over the farm and reduces the work involved. Disasters like fire emergencies are a challenging task because of the lack of high-payload platform and portable fire fighting systems. The multipurpose UAV uses the Arduino board which is the open source electronics prototype platform which is interfaced with the Wi-Fi module. The dronewill precisely route the land no matter shape of the field and get the job done.

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