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Design a Framework of Swarm Drones for Monitoring In Agriculture Field

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ABSTRACT: The aim of the present paper is to propose a framework, for swarm drones or in other words unmanned aerial vehicles (UAVs), with IoT applications for monitoring a wide agriculture fields in economy perspective, we propose to send the collected data to centre station which can analysing the current data, after process that can pass information to Robots or other involved machine .We are interested in building algorithms in collecting data from cultivated areas accurately and in a relatively short time and also help farmers to eliminate harmful pests and spread fertilizer in a timely manner. According to the design scenarios, UAVs they carry out specific actions such as transporting signals from the field to the main station and also spraying pesticides and fertilizers based on a GPS map. In other hand,the central station also sends some orders to the robots to carry out certain tasks such as regulating irrigation, cleaning irrigation canals and cutting grass. So all operations controlled from one place the central station.
KEYWORDS-IoT, Algorithms, GPS, Robot, and swarm drones

I. INTRODUCTION

Agriculture is the foundation of life for most of humanity, playing a vital role in the growth of the economies of countries, especially the Arab countries. It also provides great abundant job opportunities for people. Growth in the agricultural sector is essential for the development of the country's economic situation. Unfortunately, many farmers in our country still use traditional farming methods that lead to lower crop and fruit yields [1..3] Thehighlighting features of this paper that The researcher introduces the idea of using the Internet of Things in conjunction with the Swarm drones to solve the problems of agriculture, such as crop control and distribution of fertilizers and irrigation, Through our search in the Internet to make a comparison and evaluation of similar papers to the research that we are doing now we discover that many of the papers presented on the sustainability of the wireless sensor network. Which collects data from different sensors with aim to send data to the master server using a specific protocol. The collected data provides the information about different environmental factors, whichcan helps to monitor the system. But the monitoring environmental factors is not enough and complete solution to improve the yield of the crops[9] We know that careful monitoring is an important factor , but there are other factors to consider when designing a system that is interested in developing agriculture There are number of other factors that affect the productivity to great extent, such as the attack of harmful insects,[7,8] which must be confronted with the use of swarm drone technology to spray pesticides in efficient way to exterminate all insects because of the drones have smart technologies as including smart cameras which can trap insects in tight places.

II. UAV CLASSIFICATION

Most UAVs operate in line sweep patterns. Specifically, given a sequence of waypoints defined by their GPS coordinates, they move from one waypoint to the next, in order. However, in the context of agriculture, our objective is to optimize for the area covered in a single flight. Thus, we aim to minimize the time taken to cover a given area. To that end, we observe that increasing the number of waypoints to cover the same area increases the time taken to cover it, even though the total path length may be the same. This is because the quad rotor has to decelerate at each waypoint and come to a halt before it can turn around and accelerate again. We present a novel flight-planning algorithm that minimizes the number of waypoints required to cover a given part of the farm. Each of the three control methods consists of some subset of the following behaviour modules like (Launch) means Take off from a stationary position, (Avoid) means Avoid collisions with buildings and obstacles. See (Fig1).

In general specifications like Altitude, aircraft speed, flight time, load ability of materials such as pesticides, accuracy of imaging, extent of coverage of a large area and electrical energy used , and federal regulations. Actually, to exactly use UAVs for any particular wireless networking application, various factors such as the UAVs' abilities and their flying altitudes must be taken into account. In general, UAVs can be categorized, based on their altitudes, into high altitude platforms (HAPs) and low altitude platform (LAPs). HAPs have altitudes above 17km and are complex [7], [8]. LAPs, on the other hand, can fly at altitudes of tens of meters up to a few kilometres, can quickly move, and they are flexible [12]. We note that, according to US Federal aviation regulations, the maximum allowable altitude of LAP-drones that can freely fly without any permit is 400 feet1 [12]. Compared to HAPs, the deployment of LAPs can be done more rapidly thus making them more appropriate for time-sensitive applications (e.g., emergencies). It is not like HAPs, LAPs can be used for data gathering from ground sensors. Moreover, LAPs can be readily rechargeable, HAPs have longer endurance and they are designed for long term HAP systems are often prioritized for giving and wide-scale wireless coverage for wide geographic areas [14]. However, HAPs are costly and their deployment time is significantly longer than LAPs. UAVs can also be categorized, based on type, into Fixed- wing and Rotary-wing UAVs. Compared to rotary-wing UAVs, fixed-wing UAVs such as small aircrafts have more weights, higher speed, and they need to move forward in order to remain aloft. In disparity, rotary-wing UAVs or quad rotor drones, that can flutter and remain constant over a given area.

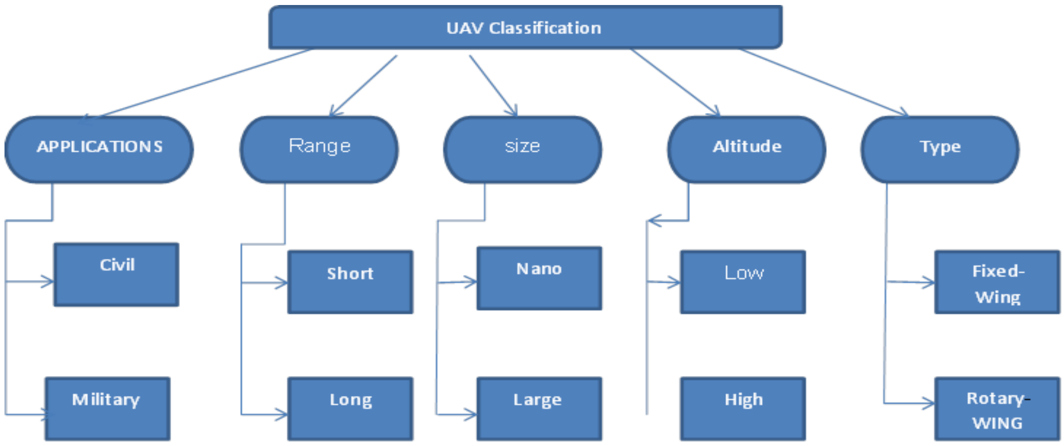

Figure 1 UAVs Classification

III. ETERATRE REVIEW

Several algorithms targeting low-complexity solutions have been proposed in [15,16,17]. The problem of low complexity placement and coordination of an unknown number of mobile cameras to cover arbitrary set of targets are considered therein. This problem it addressed as an unsupervised clustering task. A set of proximal targets are clustered together, whereas the camera location/direction for each cluster are estimated individually.

Researchers of [18] mentioned that the flight control system mainly involves three parts, that is, the kernel control, command generator, and flight scheduling. First, the purpose of kernel control law is to ensure the asymptotic stability of the UAV motion through air. Second, the purpose of the command generator is to generate a set of rules or references for the kernel control. Third, flight-scheduling function is to create a set of flight arrangements for the mission.

The authors [4] present comprehensive survey of UAV as civil applications and their related challenges. They are review several civil applications in terms of the current state of the art and research trends, overall challenges, and potential future directions. The discussion mainly provides a review from a high-insight perspective; they then presented several challenges of UAVs across different application themes. Within the paradigm of WSNs,

[15] a study on the coverage problem when the sensors are equipped with cameras for video surveillance applications but up to 2010 only. Although the study is not about UAV in particular, it provides a good review of coverage algorithms, node deployment, and coverage metrics. Similarly, [15, 16] provide a review of the coverage problem in WSNs but up to 2008 only. In particular, it focuses on finding the best solutions for the placement of sensors for optimum coverage. Furthermore, it presents different methods for data fusion for applications such as threat assessment

IV. THE SWARM ARCHITECTURE

Here we proposed framework that consider a flexible architecture design of swarm, in general, there are three main, overall command and control architectures used in swarm systems: orchestrated, hierarchical and distributed control In orchestrated control, one agent is selected as a temporary leader based on specified transient factor, state, mission. The leader receives sensor data from the other agents and broadcasts the attached, common, integrated picture. Centralized control architecture resembles a Framework for Integrating the Development of Swarm Unmanned Aerial System .A distributed architecture is characterized by the absence of a leader; rather swarm decisions are made via collective consensus among agents. We proposed canter station that consist of LAN infrastructure, by side the hardware we implemented a software layer that allows each computation module to support multiple applications by providing services to the network. Each application could create and subscribe to the available services. The services could be discovered and consumed in a dynamic way like web services.

3.1 Hardware

Control Computer is built as a set of embedded microprocessors connected by a local area network (LAN), i.e., it is a purely distributed and therefore scalable architecture, Different processors can be used according to functional requirements, and they can be scaled according to the computational needs of the application. System modules can be awakened on-line when required at specific points of the mission development. Modules can be added (even hot plugged) if new requirements appear. We proposed centre station which consist of LAN infrastructure, by side the hardware we mplement a software layer that allows each computation module to support multiple applications by providing services to the network. Each application could create and subscribe to the available services. The services could be discovered and consumed in a dynamic way like web services.

This type of architecture is robust and scalable, but requires a communication network that will support potentially increased data traffic. The last one is our choice for building our proposed swarm architecture model. The components as illustrated in figure 2

Figure 2 Hardware Components

3.2 Methodology

Hyperactive algorithm were developed. Which carry two options one of them is designed to handle the data acquisition thus allowing the Server to obtain the data from the sensors. The algorithm starts by executing a thread for each sensor with a user entered reading interval, it then keeps reading the data with the necessary conditioning from the ADC module every X seconds the second option come from UAV library which contact with GPS to get coordinates for autonomous flight. Most UAVs operate in line sweep patterns. Specifically, given a sequence of waypoints defined by their GPS coordinates, they move from one waypoint to the next, in order. However, in the context of agriculture field that we try to optimize for the area covered in a single flight. Thus, we aim to minimize the time taken to cover a given area. To that end, we make the observation that minimizes the number of waypoints required to cover a given part of the farm.

The probability from a smart drone to IoT devices on the ground will be used to estimate the coverage area and capacity, which allow IoT devices in smart environments to go around and collect data in the drone coverage area. The essential application of the channel analyser is the capability to achieve the performance of the smart drone rapidly. The altitude of a drone do a vital role in finding the coverage area and received signal strength on the ground. To enhancing the coverage area, it should increase drone height. Therefore, it will deliver services to a larger area and many users will get a nice service.

3.3 UAV Operation

Most UAVs operate in line sweep patterns. Specifically, given a sequence of waypoints defined by their GPS coordinates, they move from one waypoint to the next, in order. However, in the context of agriculture, our objective is to optimize for the area covered in a single flight. Thus, we aim to minimize the time taken to cover a given area. To that end, we observe that increasing the number of waypoints to cover the same area increases the time taken to cover it, even though the total path length may be the same. This is because the quadrotor has to decelerate at each waypoint and come to a halt before it can turn around and accelerate again. We present a novel flight-planning algorithm that minimizes the number of waypoints required to cover a given part of the farm. See figure (3)

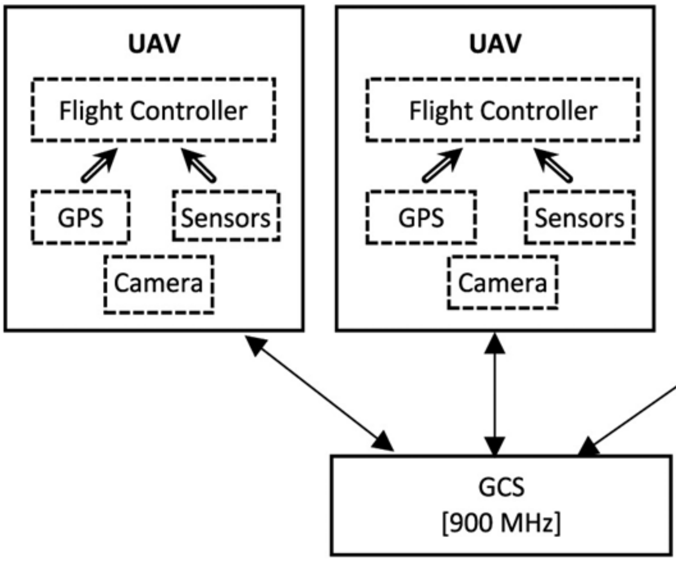

Figure 3 UAV Operation

V. RESULTS AND RESULTS DISCUSSION

We introduce the novel concept of collaboration between drones and IoT, we discuss drones in agriculture applications. we discuss also the capability of drones and IoT to collect data in real time, track insects and guide farmer in finding harm locations, as well as guiding Search and Rescue (SAR) group expeditiously, guiding to make better orientation. Here, we will try to analyse the evolution of autonomous mobility in agriculture, showing the incremental evolution of autonomous tractors from level three, four, and ultimately five. We then illustrate that how the lifting of unmanned mobility is providing rise to a new breed of agricultural vehicles: fleets of small unmanned, slow, and lightweight robots.

These robots is considered less prolific on a per unit basis than traditional vehicles. The gate to success however lies in remotely controlled fleet operation, which is effected by no needs for driver per each vehicle. After deploying the UAVs in the lab(Simulation) it was kept recording data and playing the audio stream, including showing the data in a live formatwith playing the audio. The data acquisition script is started and so is the stream. Also, the live data and GPS trail of markers from the positions of the UAV The GPS device showed a really good precision on providing the coordinates(X, Y,Z). As the data is being shown in this screen, the stream is also playing at the same time. After finishing with the tests, it is possible to stop the data acquisition it download the resulting as video or audio file, mainly result focuses on the network performance of drones and IoT. Furthermore, we introduced the novel concept of collaboration between drones and IoT; we had discuss drones in agriculture applications. we discussed the capability of drones with IoT to collect data in real time, track insects and guide farmer in finding harm locations, as well as guiding Search and Rescue (SAR) teams effectively and efficiently. In this case, the collaboration between drone technology and IoT represents a key technology for determining the location, the second result it deepens on camera and target position.

Here we have many result come from different scenario as shown in experiments: camera and target are both fixed, or camera is mobile and the target is fixed or camera is fixed and the target I mobile at the end both camera and target are move, also we found good result from comparison the total transmitter power per UAV see figure 4

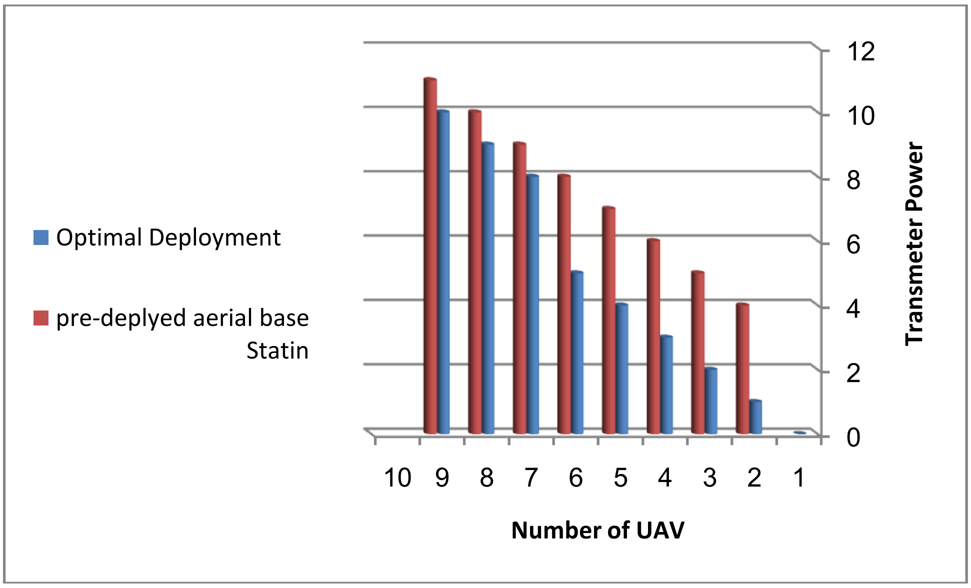

Figure 4 Results

VI. CONCLUSION

Swarm robotics has several possible applications, including exploration, surveillance, agriculture search and rescue, humanitarian demining, intrusion tracking, cleaning, inspection and transportation of large objects. Despite their potential to be robust, scalable and flexible, up to now, swarm robotics systems have never been used to tackle a real-world application and are still confined to the world of academic research.

There are many possible reasons for the absence of robot swarms in the real world, such as, for instance, the hardware limitations of the available robots. We foresee that, in the near future, swarm robotics will be used more and more frequently to tackle real-world applications.

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