IoT based Smart Automation using Drones for Agricultures

[1]M. Zahir Ahmed, Lecturer in Physics, Osmania College(A), Kurnool
[2]Shaik Abdul Muneer, Lecturer in Physics, Osmania College(A), Kurnool
[3]H.Azhar Salam, Lecturer in Electronics, Osmania College(A), Kurnool
[4]D. Vijaya Pushpa Mani, Asst. Prof. of Physics, Rayalaseema University, Kurnool

***ABSTRACT*: Drones are defined as Unmanned Aerial Vehicles (UAVs). In other words drones are flying devices that are autonomously programmed or remotely controlled, either by a remote control or a ground station, and are categorized as networked robotic technologies. Unfortunately, drones haven't had a significant impact on agricultural practices, at least until recently. A lot is happening lately on the subject of drone applications in agriculture and precision farming There are significant technologies have been developed to automate agriculture in order to decrease the production cost and to increase profits of the farmers. The Internet of Things (IoTs) in agriculture can support the production process and can scale from small to big farmers. In this paper we have studied various areas of agriculture and the implementation of IoT in those areas. However, recent developments repurpose these UAVs for domestic applications in various fields. Smart drones is a more modern term, inferring that sensors within these UAVs feed into a network infrastructure where drones are connected to other devices via Internet technologies, which enables communication and thus, makes them smart. The farmers cannot stand in front of the huge markets. The cost of yield is increased while the ROI is less for the farmers. For years now, drone advocates have cited precision agriculture - crop management that uses GPS and big data - as a way to increase crop yield while resolving water and food crises.**

***Keywords:* IoT, UAV, Agriculture, Green House, Future Agriculture, Smart Drone.**

I. INTRODUCTION

The application of hardware and software with regard to smart drones depends on the setup of the device and the purpose. It is differentiated between autonomous and single person/shared control, also-called swarm UAVs. Six of Earth's seven continents are permanently inhabited on a large scale[1]. The overall solution is determined necessary was a set of "dashboard-driven connected services utilizing an IoT backend" that would accomplish several key things:

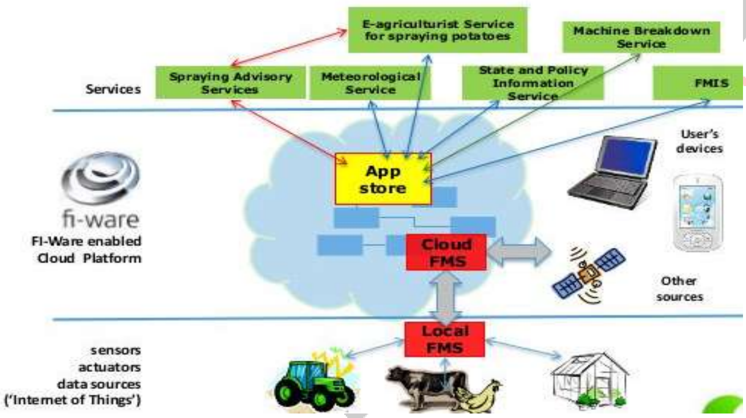

Fig1. Architecture of IoT based Agriculture system

(a) As shown in Fig1. framework of connected smart agriculture business that can fit to small farmers to large scale food production industry;
(b) Collect data from incompatible sensors via wireless networks;
(c) Integrate, analyze, and correlate different data sets of information into easily-understood and easy-to-customize reports leading to specific actionable outcomes;
(d) The end user can control remote greenhouses using their mobile or desktop;
(e) Manage end-user permissions, distribute reports and business intelligence through a customizable Web interface that would include dashboards, allowing custom organization of
data applicable to the business employing the suite of services.

Agriculture can be broadly grouped into farming, crop and food plants[2]. The growth of the plants and the quality of the products from plants include various components such as Temperature of the grow room, Relative Humidity, Light Intensity received etc.. Light intensity plays a major role in yields of a plant, causing the stem length, leaf color and flowering. An agriculture control system can maintain an adequate and appropriate lighting intensity and temperature. The IoT has been playing a vital role in many sectors. The implementation of IoT is increased every year.

II. Autonomous control

Autonomously controlled drones are characterized by pre-programmed flight plans or more complex dynamic automation systems, where humans are not involved in the actual operation. These plans are developed in advance, but are individually realized afterwards[3]. The technology needs to be involved to improve agriculture. Smart, Connected Internet Applications Maximize Agricultural Business Performance by using Drones as shown in Fig2. In developing countries the agriculture business is driven by multiple intermediate hands that make the commodity to higher price and the farmer is getting lesser price for his work. Nowadays farming lands are sold as real estate plots because of no proper yields from farming / agriculture.

Fig 2. Drones Will Be Used to Improve farming using IoT Technology

An unique opportunity is to create and deliver a transformational suite of Internet of Things-based agricultural management services. These services would be delivered as easy-to-use, smart, connected product applications that would provide customers with the ability to have a real-time big picture of the large and varying data points necessary for them to create optimal agricultural working and growing conditions[4]. To do so in agriculture requires optimizing three key variables: production yield, cost, and risk avoidance, and having a real-time and holistic big
picture for optimizing each variable for maximum profitability.

III. Single person or shared remote-control

Drones can be remotely controlled either by one individual or by a group of people (shared control). In a shared control setup, when drones are controlled by so-called swarms, the UAV is
based on a modified commercial flight platform that is controlled by a ground control station. The flight platform is a software that can be either selected or developed and can involve a range of sensors, an advanced control system and autonomous flight features. In Fig 3 shows (flying autonomously) the system has to be highly reliable and process sophisticated safety features in case of malfunction or unexpected events[5]. Using sensors, agriculture gains advantage of real-time traceability and diagnosis of crop, livestock and farm machine states. Genetic tailoring of food and producing meat directly in a lab.

Fig 3: Single or shared remote-control

3.1. Nightingale Intelligent Systems: is releasing a fully autonomous drone using an extensive background in robotics and flight navigation. The Nightingale BrdsEye Aerial Security System will help support your security operations by bridging the gap in the use of physical security assets and video surveillance technology by combining commercial drone technology and advanced robotics software. BrdsEye can be thought of as a mobile security camera, able to stream live video directly to mobile devices or a

Security Operation Center (SOC) to help security teams quickly asses real threats from false. The Nightingale Flight Coordinator is designed to integrate with leading perimeter detection and video management systems. This will help security professionals design complete solutions aimed at addressing difficult to view areas. A BrdsEye autonomous drone can launch either automatically based on a perimeter alarm event,
scheduled routine guard tours or manually by an operator to obtain video at a designated waypoint[6]. Wirelessly transmitting a 1080p video feed back to security operators provides a level of response that will greatly improve perimeter protection and situational awareness. Nightingale BrdsEye will provide an effective surveillance system for remote sites (power substations, pumping stations, reservoirs, etc) The Nightingale solution truly brings a new paradigm in security technology to market and aims to help security professionals everywhere. Wave Representatives is the sole North American manufacturer rep firm providing sales and marketing support. Using large-scale robotic and micro robots to check and maintain crops at the plant level will help to automate agriculture. Engineering involves technologies that extend the reach of agriculture to new places and new areas of the economy.

3.2. Field Preparation: The ground control station is a system for managing sensor data acquisition with stationary sensors, mobile ad hoc networks and mobile sensor platforms. Ground control stations function as ergonomic user interfaces and data integration hubs between multiple sensors and a super-ordinated control center, representing are the core purposes of it[7]. Functions range amongst task management, mission planning, control of mobile platform, sensor control, dynamic situation display/awareness, fusion of sensor data, sensor data exploitation, reporting, generation or alarms and archiving. The ground control station can be realized in a modular framework that enables the adaption of the system to different operational needs and can result in a variety of setups. Figure 1 illustrates one type of setup. Crops can be monitored, measured and responded back using Precision Agriculture (PA) or satellite farming which is a farming management concept[8]. GPS is a space-based global navigation satellite system that provides location and time information in all weather and at all times and anywhere in the earth.

IV. Mobile control (lateral)

Possible for both types of control (autonomous and shared), drones can be controlled via mobile devices. Due to the widespread adoption of smart mobile devices, such as smart phones and tablets, mobile controlling of UAVs can evolve to a widely accepted way of steering drones. Mobile devices already contain native sensing, communication, computation, storage and actuation capabilities, providing the basis of mobile control. However, drawbacks result from strongly coupling with mobile Operating Systems (OS).WebGIS is a very important milestone of GIS that marks the GIS to shown in the web and which is used to store, process, analyze, display and apply spatial data[9]. This will be done using GPS and Machineries like drone or movable vehicles along with the sensors and central server and databases. The concept of Precision Agriculture has been designed and the system model has been tested

4.1. Soil Testing

Environmental monitoring is a significant driver for wireless sensor network research, promising dynamic, real time data about monitored variables of a landscape and so enabling scientists to measure properties that have not previously been observable. Soils are composed mix of solids, liquids and gases variable proportions. For larger area of soil testing we can use radiometers and
microcomputer system for data preprocessing and recording on board an aircraft. There are software available for estimating and mapping the water content in the top one meter layer using both radiometer data and a priori information on hydro physical properties of soils. Reasons for this high application rate are first of all the need for close monitoring of crops to improve management and yields on a regular basis and with cheap measures. Furthermore, the environment of private land is geographically limited and hence, restricts drones being a threat to others. One example of sensors in use is near-infrared sensors that can be tuned to detect crop health, providing farmers with the ability to react and improve conditions locally with inputs of fertilizer or insecticides quickly.

4.2. Storage Built for the Challenge

With Quantum, you no longer have to choose between performance, reliability and cost effective storage - you get it all. We help you design and implement a storage solution that puts your data in the right place at the right time. The crops growth and product quality in greenhouse are dependents on temperature and humidity. The greenhouse humiture monitoring system based on ZigBee wireless sensor networks (ZWSN) is the best solution. Adopting the technology of wireless sensor network based on Zigbee, GPRS and Web Services technology, we can get a set of low cost, low power consumption, flexible automatic networking temperature humidity monitoring system of soil.

V. Water flow

An optimized irrigation system has become a necessity due to the lack of the exhausting resources like water, oil etc.,. Automatic irrigation of wireless sensor network and Internet technology can be used to improve irrigation water and to reduce cost of irrigation water. Use of Smart phones or wireless PDA can easily monitor the soil moisture content and control the irrigation. Irrigation using sprinklers is widely adopted in agriculture. When a rotating sprinkler malfunctions due to jamming, clogging or being worn out, may cause over watering in some small areas. To overcome the issue the camera based irrigation control system can monitor the sprinklers using standard security cameras and control the sprinklers. The drip irrigation schedule system can saves the cost of water, price of yield, uniformity of the drip irrigation system, crop response to water.

5.1. Pesticide

Identification and monitoring of plant diseases, nutrient deficiency, controlled irrigation and controlled use of fertilizers and pesticides needs to be managed for crops from early stage to mature harvest stage. eAGROBOT (a prototype) is a ground based agricultural robot that overcomes the challenges existing in large and complex satellite based solutions and helpdesk form of solutions available as m-Services. Variable rate spraying control system can automatically change with the variation of duty factor at the fix frequency[10,11]. The characteristics of the flow control system provides development platform, fuzzy control, PID algorithm, PWM, temperature property, response speed for spraying. An optimal pest management strategy of the chemical control needs to be maintained the level below the economic threshold, which makes pesticide residuals and the total dose of the spraying pesticides least, and reduced pest populations. There are several ways for spraying pesticide together with their possible disadvantages such as crops may be crushed when using tractor, pesticide droplets may be perfused unevenly when it is applied by a person, or using aircrafts such as helicopter or plane for spraying may contaminate regions surrounding the target area. We can use Unmanned Aerial Vehicle (UAV) that is able to fly on and spray farmland autonomously.

5.2. Harvesting

At the harvest season, crops are harvested using various methods at different times. Mapping and monitoring of the patterns of croplands during the harvest provides information for farmers to help guide the harvest practices that are time critical and to support early warning of threats to food security. Harvesting labor is a major cost factor in the production of specialty crops. Today accruing harvest labors is still done by hands, which is error-prone and costly. By integrating cloud-based web application with purposely designed Labor Monitoring Devices (LMDs), we can attain the monitoring and accruing harvest labors. Automatic detection of harvesting using multi-source information fuzzy inference with the overall accuracy of 93% will lead to effect decides the harvesting time.

5.3. Drying, Monitoring and control

The grain moisture sensors are already in yield monitoring processes on harvesters employing precision farming. High-quality products can be yield with better grain handling and storage operation management. This can be achieved through the ability to more closely monitor the grain moisture content, which will provide important information of grain status on time. The trend is towards simplified methods of drying in which the advantage is of the drying properties of unheated air and towards techniques which gives to a favorable and economic use of electric heating of the air. An intelligent control method for the cold-storage of fruits and vegetables, humidity will make a direct impact on the quality of the food storage of high-precision monitoring environmental parameters which can effectively improve the quality of food storage, energy conservation significantly, the cost.

5.4. Environmental Monitoring

Similar to emergency response applications, drones can reduce risks of human health in the field of environmental monitoring, because they fill the gap between manned aerial inspections and traditional fieldwork. This way, areas that are difficult to reach, such as contaminated places can be monitored by UAVs, not people in person. Habitat restoration, environmental assessments, monitoring and remediation can be improved by e.g. near-infrared sensors that give insights into details.

VI. Drone in Agriculture

New technological methods based on Unmanned Aerial Vehicles (UAV) leverage precision agriculture approach that includes crop monitoring which provide farmers real time data about the plant health and crop spraying chemicals over the field. The application of pesticides and fertilizers in agricultural areas is of very importance for crop yields. The aircrafts are becoming increasingly common in carrying out this task mainly because of its speed and effectiveness in the spraying operation. However, some factors may reduce the yield, or even cause damage (e.g. agriculture areas not covered in the spraying process, overlapping spraying of crop areas, applying pesticides on the outer edge of the crop). Particle Swarm Optimization (PSO) is used to reduce the amount of pesticide used and improve the quality of agricultural products as well as mitigate the risk of environmental damage. Recent technologies such as Cloud computing, wireless sensors, communication, networking technologies, embedded systems, Data Mining and Data Warehousing, NANO, Radio Frequency Identification using the standardized Internet routing protocol, IPv6 provide the farmers with new opportunities to use these technologies for holistic innovative approaches.

VII. Conclusion

In any case, executive authorities shall market the use of drones well, because the majority of people is poorly informed and relates drones to military. Thus negative connotations exist in people’s minds, representing a barrier that needs to be overcome in order to be accepted by society. Positive applications, such as search-and-rescue, border patrol, firefighting missions etc. can lead to a safer life and save lifes[12]. Communicating clearly and transparent about all related sensitive threats and risks shall create trust and understanding. In agriculture, there is a quite research and development has been done. The economy of eastern countries is still depends on the agriculture. The implementation of drone will reduce the time and efficiency of the production which leads the higher production. At the same time the cost of the IoT implementation needs to be reduced. This will enable the small farmers to utilize the smart agriculture. The farmer needs to be educated or the agriculture studies could have separate subjects about the current development of IoT and the connected smart world. The fully customizable modular approach needs to be enabled in the agriculture software for adopt the vast area of the agriculture segments. Most of the IoT products running on the electricity; but the new technologies need to be inventing like sensors running on the bio gas for implementing the IoT on the rural area. Now a days the mobile networks are focusing on urban areas compared to the rural area. So we need to find the new technology that can enable ad-hoc joining of the rural area in the existing mobile networks with the small device. The investment on the agriculture needs to be increased and the farmer to customer model needs to be motivated.

REFERENCES

[1] Xiaohui Wang and Nannan Liu, “The application of internet of things in agricultural means of production supply chain management”, Journal of Chemical and Pharmaceutical Research, 2014, 6(7):2304-2310, ISSN : 0975-7384,2014.
[2] Meonghun Le, Jeonghwan Hwang, and Hyun Yoe, “Agricultural Production System based on IoT” IEEE 16th International Conference on Computational Science and Engineering, 2013, pp 833-837.
[3] Jeetendra Shenoy & Yogesh Pingle, “ IoT in agriculture” International Conference on Computing for Sustainable Global Development”, 2016, pp 1456-1458.
[4] Y. Guo, “Plant Modeling and Its Applications to Agriculture”, Second International Symposium on Plant Growth Modeling and Applications (PMA’06), Beijing, 135-141, 2006.
[5] G. He, X. Wang and G. Sun, “Design of a Greenhouse Humiture Monitoring System Based on ZigBee Wireless Sensor Networks” , Fifth International Conference on Frontier of Computer Science and Technology (FCST), Changchun, Jilin Province, 361-365, 2010.
[6] Y. Liu, C. Zhang and P. Zhu, “The temperature humidity monitoring system of soil based on wireless sensor networks”,International Conference on Electric Information and Control Engineering (ICEICE), Wuhan, 1850-1853, 2011.
[7] Zhang Feng, “Research on water-saving irrigation automatic control system based on internet of things”, International Conference on Electric Information and Control Engineering (ICEICE), Wuhan, 2541-2544, 2011.
[8] E. Shadmot and E. Katz, “A novel camera based irrigation control system “, IEEE 27th Convention of Electrical & Electronics Engineers in Israel (IEEEI), 1-5, 2012.
[9] Y. F. Qiu and G. Meng, “The Effect of Water Saving and Production Increment by Drip Irrigation Schedules”, Third International Conference on Intelligent System Design and Engineering Applications (ISDEA), Hong Kong, 1437-1441, 2013.
[10] S. K. Pilli, B. Nallathambi, S. J. George and V. Diwanji, “eAGROBOT - A robot for early crop disease detection using image processing” , Electronics and Communication Systems (ICECS), 2014 International Conference on, Coimbatore, 1-6 , 2014.
[11] Chen Aiwu, Liu Ailin, Liu Zhizhuang, Zhang Wenzhao and Tang Xinling, “Design of flow control system on sprayer”, International Conference on Computer Application and System Modeling (ICCASM), Taiyuan, V12-577-V12-580, 2010.
[12] H. Guan, “Optimization chemical control in integrated pest management”, 26th Chinese Control and Decision Conference (2014 CCDC), Changsha, 1022-1026, 2014.