Drone Application in Precision Agriculture

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INTRODUCTION

Over the years, a lot of burning questions come up, which deducts how well and for how long the human race can survive for on the land, that we've got. There are many, still unsolved and exponentially growing issues, which we still have no solution to, but one of the biggest topics, which will most likely always be an important topic upon which we, as a humankind can improve - agriculture.

It is self explanatory, more people on earth, requires more food, more food - use more land. But land is not an endless resource, so what else can we do, to keep growing the quantity and quality of the food production, keeping in mind, that land is a precious resource, which we can not use for granted. Well this specific topic is expanded and still remains to be a very important subject 'till this day, called Precision Agriculture (PA).

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DEFINITION OF PRECISION AGRICULTURE

This specific topic analyses and develops the most efficient methods on how to monitor and reassure the quality, sustainability and protection of crops, soil and the environment surrounding the specific area of agriculture.

From simple humidity sensors, to whole autonomous drones collecting information and spraying various supportive chemicals aiding crops in the growth process, to even laser land leveling, to reassure as precisely flat as possible land - there are endless implementations in this field and since it is relatively new and still in constant development, various of new adaptations are arising each day.

2.1 TECHNOLOGY

Generally PA mostly uses technology, which are common in automation and robotics, such as geographic information systems, global positioning systems, remote sensing and various wireless network communication implementations.

Focusing on the less common technologies, which are purely created for PA, there are also many various methods of implementation, from different purposed software solutions to specific hardware systems. Just naming a few:

- SmartNode - low cost software and hardware platform, which is used to monitor agriculture specific climate variables for optimal crop development (Reference [1]);

- Floratest - a digital tool, which estimates a plants state in several seconds without needing to inflict damage to the plant itself. The data used in this implementation is chlorophyll fluorescent induction, which is a property of plants light re-emission after being exposed to a bright light, the result - a graph of this specific signal. Surprisingly there are many areas of application for this device: quick estimate of plants vital activity after environmental hazards (like drought, frost, pesticide infection), quick detection of optimal doses of chemical fertilizers, quick detection of water pollution used by the plants and so on (Reference [2]).

2.2 VARIABLES

Climatic properties, which are important in agriculture are as follows: temperature, solar radiation, humidity, soil moisture, wind and so on. These variables are important in a couple of aspects - they help to understand the possible performance of plant growth and its grain formation and also grants a possible estimate of pesticide infestation and crop disease.

Expanded upon in [3]

2.3 IMPLEMENTATION

Common implementation and practices used to get the best outcome.

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DRONE SPECIFICATION

A drone is an unmanned aerial vehicle, which is generally a flying vehicle, which does not need to have a human on board to pilot it. Originally they were created and were most commonly used in military to perform various of tasks. Only about a decade ago drones became publicly available, where from that point on fields of drone application suddenly opened up to many various and interesting paths.

One of the fields, which just recently started to become more and more researched for drone application, is exactly in PA. In order to understand this specific field, it is useful to go through general understanding of common applications and characteristics of drones.

3.1 COMMON FIELDS OF ADAPTATION

These days drones are really used in many fields: areal videography and photography, mapping and surveillance, delivery of goods and medical supplies, pipe inspections and even rescuing, but most importantly to this subject, it is already also used in agriculture (Reference [4]).

Generally this specific piece of technology in theory has endless amounts of use cases. Taking a look at one of the

most popular brands of drone manufacturing - DJI [1], their catalogue mostly focuses on video/photography, but they also have their line-ups for enterprise, with information about various fields of application, they have agriculture line-up, which focuses on spraying liquid on crops, mission planing line-up, which focuses on mapping out areas and packs other interesting features, they even have a developer line-up, where they provide an open-source drone, which a customer can program. Hence on the public market, there are many various of adaptations in drone industry, which any customer can easily buy right now.

3.2 CONSIDERED CHARACTERISTICS

real-time, security, latency, energy managing, etc

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1 www.dji.com

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DRONE APPLICATION TO PRECISION AGRICULTURE

Quick idea and overview of how it is being implemented into this field.

Quite a lot of introductory information and grouping of specific type of drones in PA [5], Figure (1).

4.1 CURRENT MARKET AND FEATURES

Mention and describe a couple of currently existing drones for precision agriculture, what features they provide and what is the price difference (if applicable).

5

COMMUNICATIONS

6

SOFTWARE

6.1 OPERATING SYSTEM

6.2 PROGRAMMING LANGUAGES

mapping (pathing)

Using DroneScript to control and assist in pathing for a group of drones and DicoScript to provide a detail task to a single drone. [4]

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SUMMARY AND CONCLUSION

7.1 ADVANTAGES OF DRONE APPLICATION TO PRECISION AGRICULTURE

Mention and pick out a couple of main points why drones should be used in Precision Agriculture

7.2 DISADVANTAGES OF DRONE APPLICATION TO PRECISION AGRICULTURE

Which fields other methods might give better or quicker results.

7.3 CONCLUSION

Summary of paper and conclusion to the whole topic in one.

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APPENDIX CHAPTER

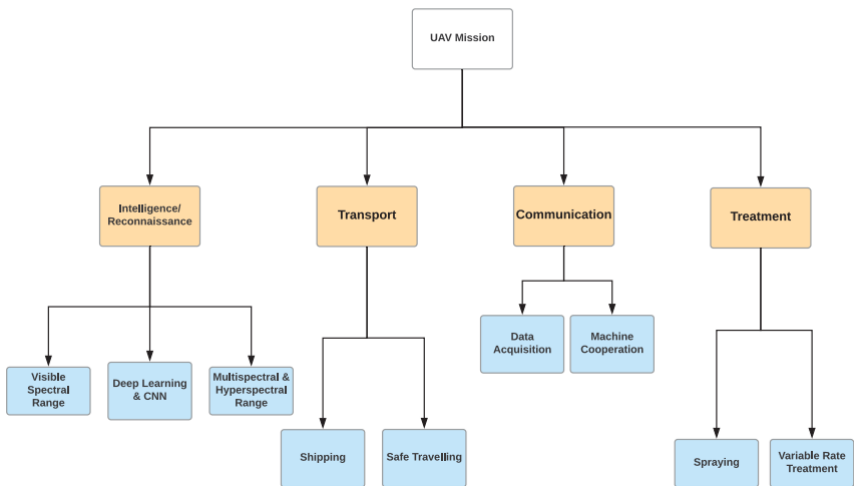Figure 1: Classification of Drones in PA [5]

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AFFIDAVIT

I, Vytaras Juraska, herewith declare that I have composed the present paper and work by myself and without use of any other than the cited sources and aids. Sentences or parts of sentences quoted literally are marked as such; other references with regard to the statement and scope are indicated by full details of the publications concerned. The paper and work in the same or similar form has not been submitted to any examination body and has not been published. This paper was not yet, even in part, used in another examination or as a course performance.