SURVEYING USING DRONES AND PROVIDING RESULTS BY USING PHOTOGRAMMMETRY SOFTWARE

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Abstract— *Unmanned Aerial Vehicles (UAVs) can be used for close range mapping. In engineering survey works, the conventional survey involves huge cost, labour, and time. Low-cost UAVs are very practical in providing reliable information for many applications such as road design, bridges, Land surveys etc. UAVs can provide the output that meets the accuracy of engineering surveys and policies, especially for small-scale mapping. UAVs are also a competitive technology which is stable and rapidly developing, same as other surveying technologies. This study investigates the performance of multirotor UAV for Sona College campus. This study involves four phases which consist of preliminary study, data collection, data processing, and analysis. This study focuses on the UAV as a tool to capture data of the whole college campus from a certain altitude. The analysis includes UAV flight planning, image acquisition, and accuracy assessment of College campus with recent technological advancements, the use of drones also called unmanned aerial vehicles (UAVs) is continuously increasing in various fields. Many industries are embracing the rapidly improving scientific tools and introducing smart solutions to solve real-world problems. It can be concluded that UAVs can be used to provide all required surveying data of Sona College Campus with reliable accuracy.*

Keywords—*uav, mapping, pre processing, flight, post processing, area calculations.*

1. INTRODUCTION

With recent technological advancements, the use of drones (UAVs) is continuously increasing in various fields. Many industries are embracing the rapidly improving scientific tools and introducing smart solutions to solve real-world problems[1]. The planning and monitoring of construction activities is one of the key areas where the drones and UAVs can significantly improve the performance and speed[2]. In fact, the construction industry can take the advantage of such technologies in almost the whole range of practical aspects[3]. For example, the drones can be potentially used at several stages in a construction project including pre-planning, detailed survey and mapping of job site, construction process monitoring, post-build checks, and sales and marketing[4]. Similarly, the drones can serve as a real time tool for the planners to monitor if their construction projects on the ground are conforming to their vision or not[5]. The data acquired from drones can also help developers and construction firms to keep a track of their inventory and plan out the entire construction site[6].The use of drones and has been increased in recent years for surveying, facility management and other relevant fields[7]. However, more recently, the technological progress in the design and navigation of low-weight and autonomous drones and UAVs have resulted in their more practical and cost-effective operation in the fields of architectural engineering and construction management and monitoring[8].This study presents a framework for the development of a fully automated smart construction monitoring and reporting system based on real-time data obtained from drones and UAVs[9]. The data in terms of drone images from multiple locations and point clouds (from 3D scanning of construction site) can be used to construct a 3D model using the photogrammetry techniques[10]. This so-called "drone model" can be compared to BIM model at various construction stages to monitor the construction progress. Beside construction scheduling and costing, this comparison can be expanded to include real-time recording, reporting, billing, verification and planning[11]. Using the example of a case study construction project, the effective use of drone data is demonstrated in terms of smart construction monitoring and comparisons between drone model and BIM model[12]. It is shown that this fully automated system can significantly reduce the effort required in traditional construction monitoring and reporting procedures. The system not only provides convenient and smart ways of site supervision and management but also results in better operations, planning and effective on-site adjustments[13].Unmanned aerial vehicles (UAVs), including drones, provide invaluable help and cost savings with wide views of inaccessible and otherwise difficult and tough to navigate locations. It sends back a full image of the territory to teams planning logistics for next steps[14].

Figure 1. Drone

2. TYPES OF DRONES

•Multi-Rotor

•Fixed-Wing

•Single Rotor

•Hybrid VTOL

Figure 2. Multi Rotor

Figure 3. Fixed Wing

Figure 4. Single Rotor

Figure 5. Hybrid VTOL

During the past 50 years, surveying and engineering measurement technology has made five quantum leaps: the electronic distance meter, total station, GPS, robotic total station and laser scanner. Unmanned aircraft systems or drones will be the **"sixth quantum leap in technology".**

3. MOBILE APPLICATIONS USED

1. Drone Deploy
2. Google Earth Pro
3. GPS Essentials
4. DJI Go 4

DRONE DEPLOY:

- Easily make flight plans on any device.
- Automate takeoff, flight, image capture and landing.
- Live stream First Person View (FPV).
- Disable auto-flight and resume control with a single tap.
- Easily continue non-interrupted flights to map large areas.
- Explore Orthomosaic, NDVI, Digital Elevation interactive maps and 3D models.
- Measure area and volume instantly.
- Collaborate with a team through shared maps and comments.
- Get help when you need it with in app support.

GOOGLE EARTH PRO:

- Google Earth is a computer program that renders a 3D representation of Earth based primarily on satellite imagery.
- The program maps the Earth by superimposing satellite images, aerial photography, and GIS data onto a 3D globe, allowing users to see cities and landscapes from various angles.

GPS ESSENTIALS:

- Shows navigation values such as: Accuracy, Altitude, Speed, Battery, Bearing, Climb, Course, Date, Declination, Distance, ETA, Latitude, Longitude, Max Speed, Min Speed, Actual Speed, True Speed, Sunrise, Sunset, Moonset, Moonrise, Moon Phase, Target, Time, TTG, Turn.

- Show the orientation of the earth's magnetic field, shows an arbitrary tracking angle and the current target. Also a marine orienteering compass.
- Record tracks and view them on map. Export KML files and import into Google Maps, Google Earth and others.

DJI GO 4:

- All-new Homepage and UI
- Near Real-time HD Image Transmission
- Camera Settings Adjustment
- Updated Editor with improved UI
- Convenient video downloading, editing and sharing
- Integrated live streaming

4. CAMERA VIEW

Figure 5. Camera View of DJI GO 4

DJI GO 4 Displays 20 icons .The icons are listed below.

- System Status
- Obstacle Detection Status
- Battery Level Indicator
- Flight Mode
- GPS Signal Strength
- 3D Sensing System Status
- Battery Level
- General Settings
- Gimbal Slide:
- Photo/Video Toggle
- Shoot/Record Button
- Camera Settings
- Playback
- Flight Telemetry
- Virtal Joystick
- Intelligent Flight Mode
- Smart RTH
- Auto Take Off/ Landing
- Back

5. STEPS FOR FLYING DRONES

1) Selecting drone

Figure 6. Type of Drone

2) Planning Drone Movement Path

Figure 7. Plan New Mission

3) Adjusting Drone Flight Plan and Parameters

Figure 8. Flight plan and parameters

4) Start and Fly

Figure 9. Drone Movement

5) Checking Results

6) Uploding Photos

6. POST PROCESSING SOFTWARE

- Bentley Context Capture
- Agisoft Metashape
- Pix4D
- Global Mapper

7. WORK DONE

Learnt how to do preprocessing work in the month of January. Then worked on Post processing software to take out the required result in Febrauary. In the month of March surveyed the Sona College Campus.

Figure 10. Learnt Piloting Work

8. HOW TO SURVEY

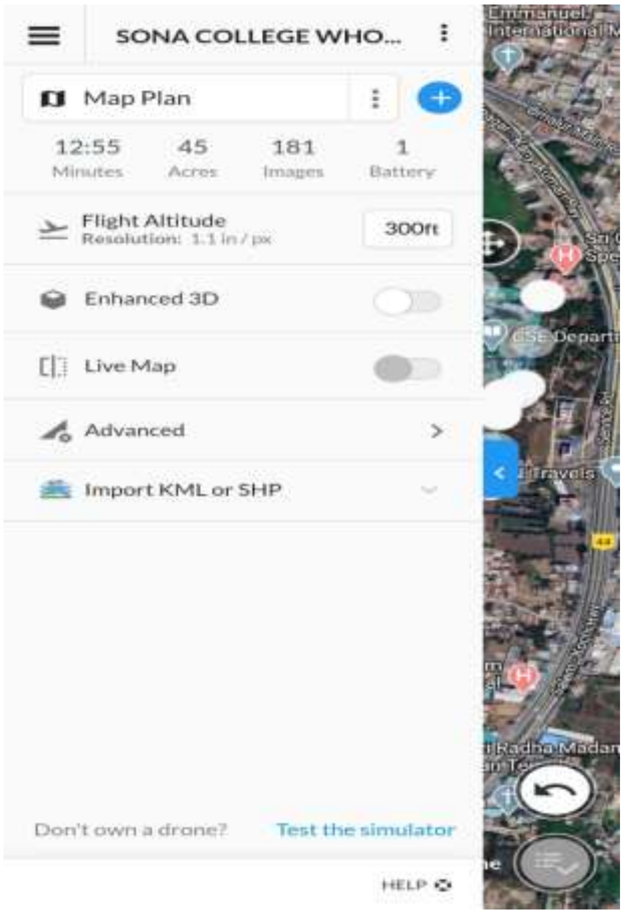

Figure 11. Fixing Way Points

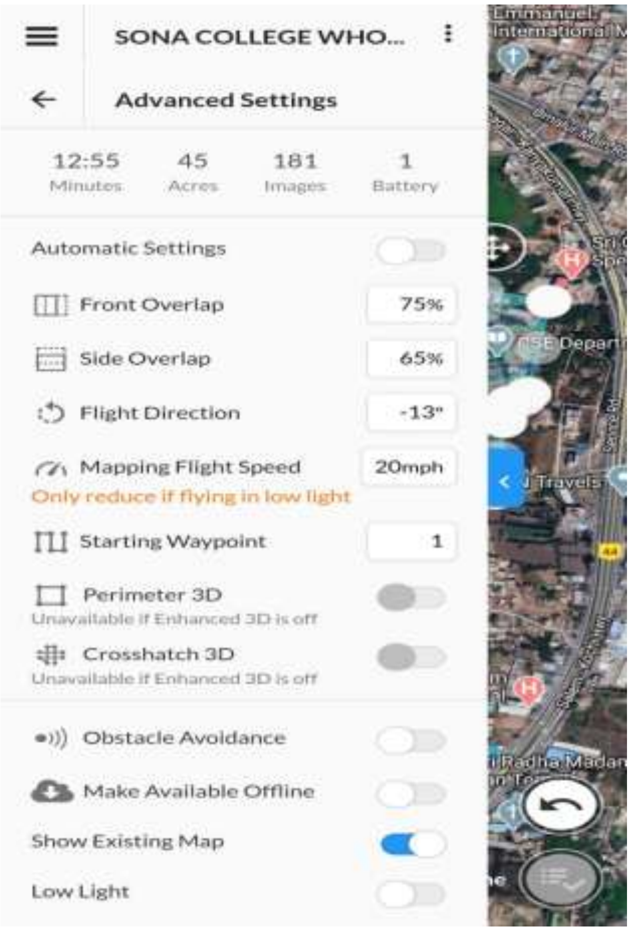

Figure 12. Advanced Settings View

Figure 13. Way points marked in Sona Campus

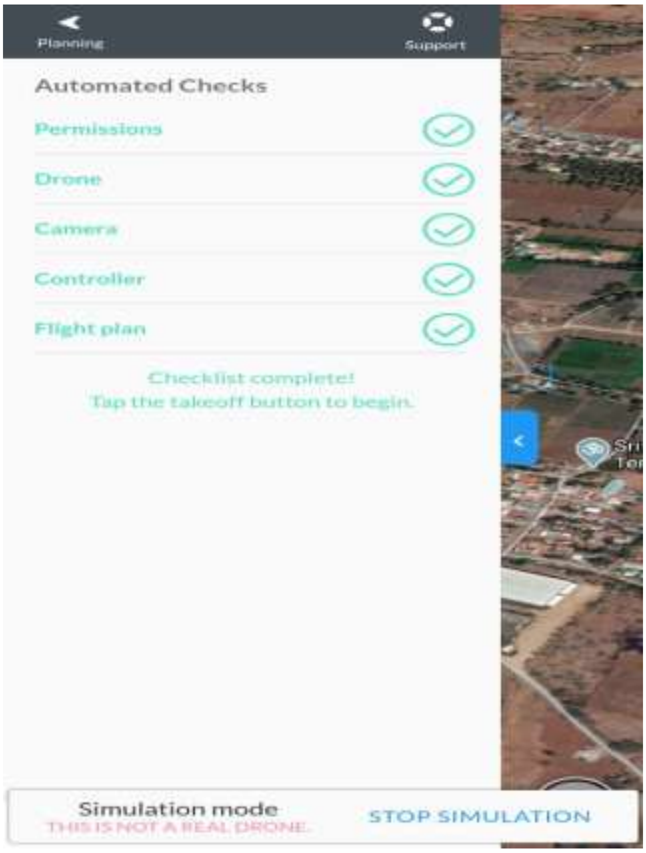

Figure 14. Checklist to Takeoff

Figure 15. Surveyed College Campus.

9. RESULTS TAKEN

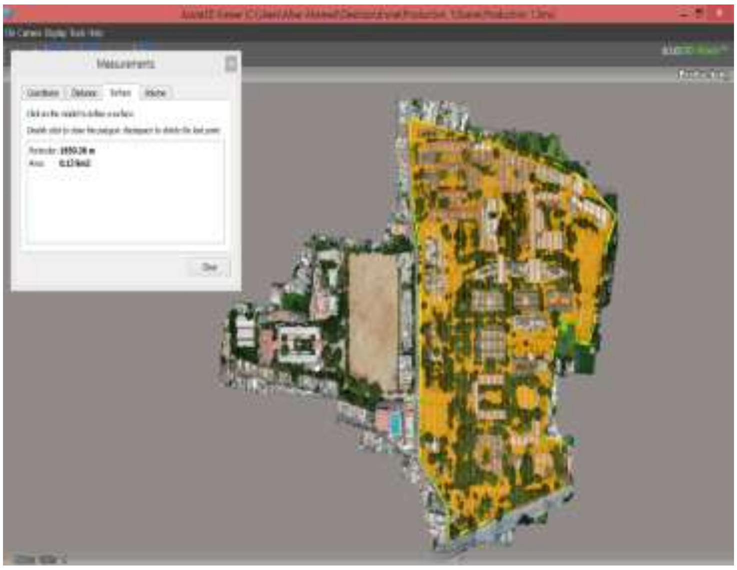

Figure 16. College Campus Area

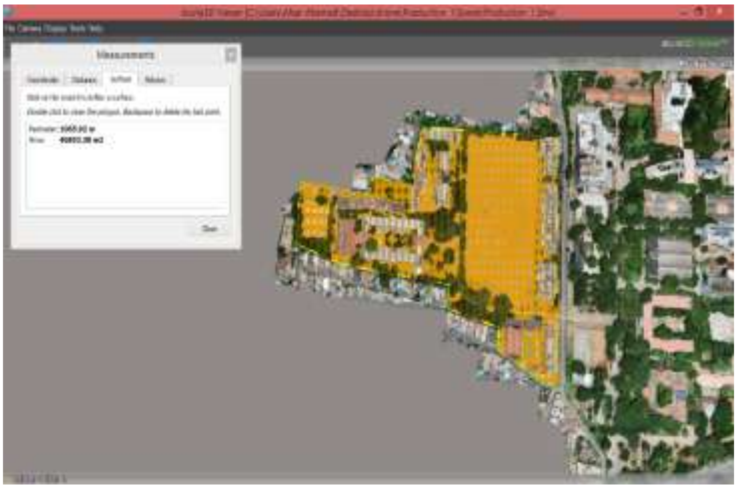

Figure 17. Hostel Area

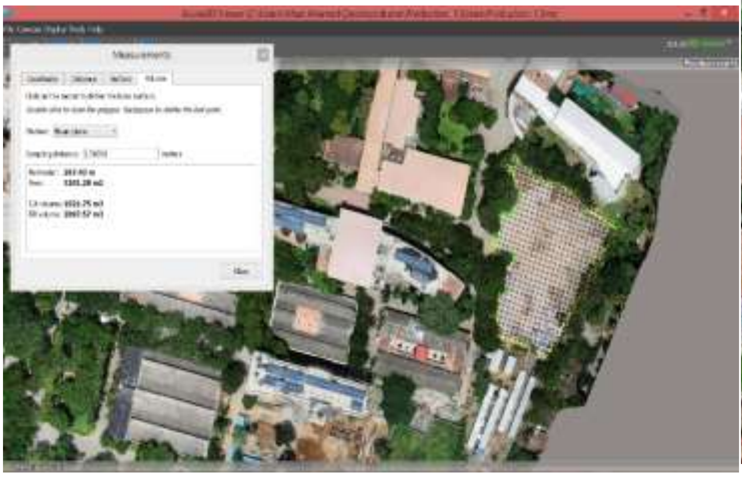

Figure 18. Cut and Fill volume of Empty land for construction

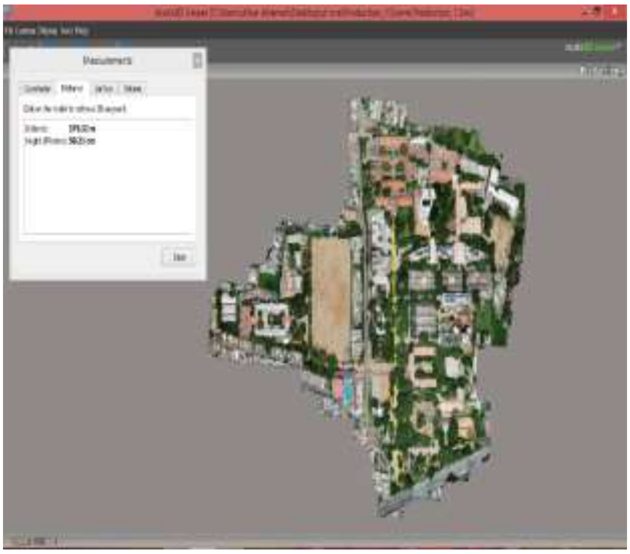

Figure 19. Distance from Main gate to Main Building

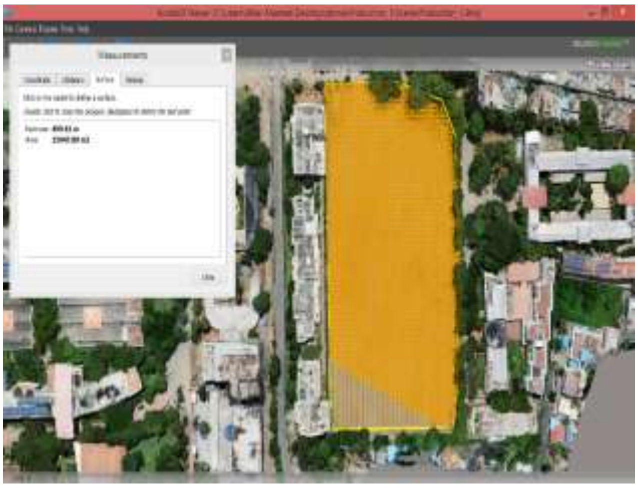

Figure 20. Area of College Ground

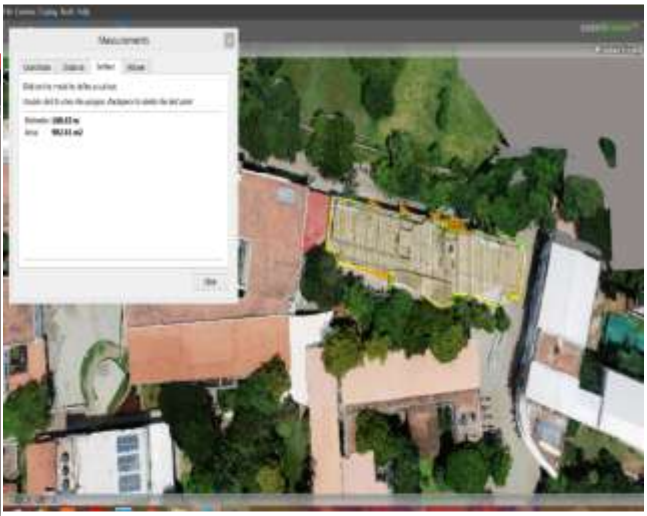

Figure 21. Area of Civil Department

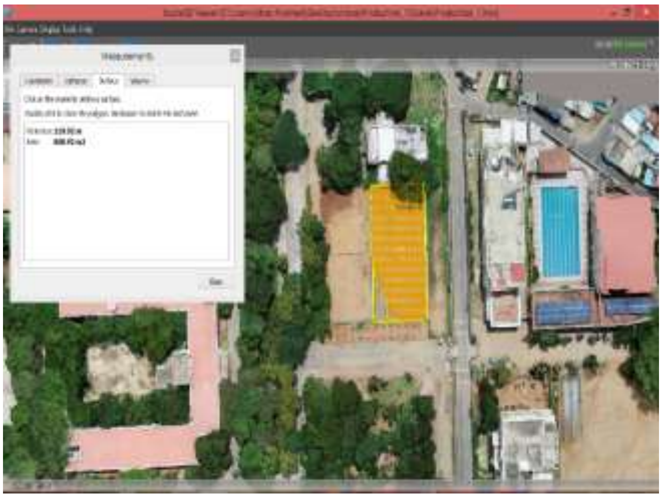

Figure 22. Area of Basket Ball Court

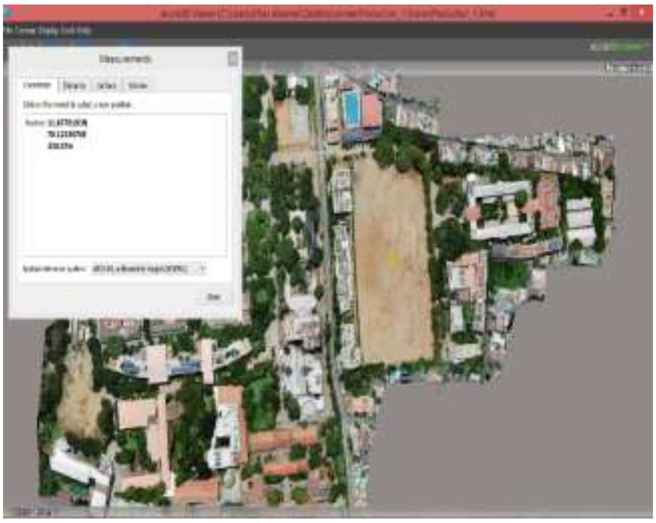

Figure 23. Coordinates of College Ground

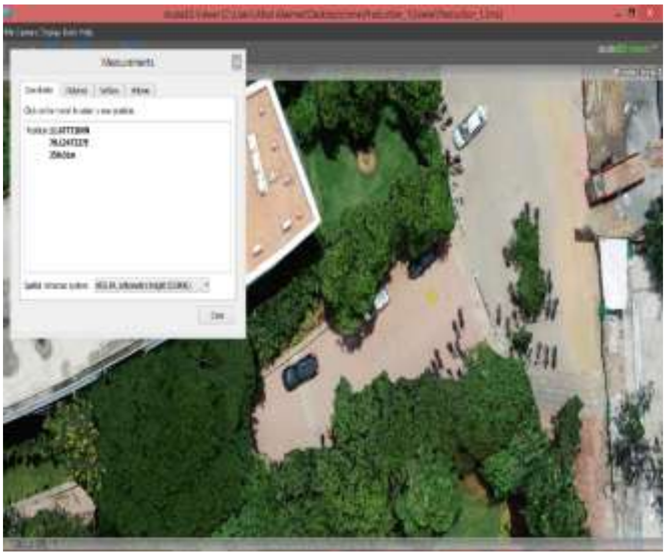

Figure 24. Coordinate points at Main Building

10. CONCLUSION

In this paper we laid out the conceptual foundation with available drones, Mobile application, software available, step by step operation of drones to survey the site with clear concepts. The major benefits of using drones are improved data, improved accuracy, saved time, improved photos and videos with improved safety. Since drone being the future of survey projects we performed our research in this area and developed the project.

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REFERENCES

[1] Chao, H., Cao, Y., & Chen, Y. (2010). "Autopilots for small unmanned aerial vehicles",Land 6(4),86

[2] Marks, P. (2011). "3D printing takes off with the world's first printed plane", New Scientist, 211(2823), 17-18.

[3] Ahmed, N. A., & Page, J. R (2013, November). "Manufacture of an unmanned aerial vehicle (UAV) for advanced project design using 3D printing technology", In Applied Mechanics and Materials (Vol. 397, pp. 970-980).

[4] Maza, I., Kondak, K., Bernard, M., & Ollero, A. (2010). "Multi-UAV cooperation and control for load transportation and deployment". Journal of Intelligent and Robotic Systems, 57(1-4), 417-449.

[5] Ping, J. T. K., Ling, A. E., Quan, T. J., & Dat, C. Y. (2012, October). Generic unmanned aerial vehicle (UAV) for civilian application-A feasibility assessment and market survey on civilian application for aerial imaging "In Sustainable Utilization and Development in Engineering and Technology" (STUDENT), 2012 IEEE Conference on (pp. 289-294). IEEE.

[6] Jacques, C. (2014, October 14). Led by Agriculture, Market for Commercial Drones .

[7] Radjawali, I., Pye, O., & Flinter, M. (2017). "Recognition through reconnaissance Using drones for counter mapping in Indonesia", Journal of Peasant Studies,44(4), 817–833.

[8] La Flamme, M. (2018). "A sky full of signal: Aviation media in the age of the drone", Media, Culture and Society,40 (5), 689–706

[9] Meyer, D. E., Lo, E., Afshari, S., Vaughan, A., Rissolo, D., & Kuester, F. (2016). "Utility of low-cost drones togenerate 3D models of archaeological sites from

multisensor data”,The SAA Archaeological Record ,16 (2),22–24

[10] Federal Aviation Administration, 2013. Integration of civil Unmanned AircraftSystems (UAS) in the National Airspace System (NAS) Roadmap. TechnicalReport. US Department of Transportation, Federal Aviation Administration.Washington, DC, USA.

[11] Imbach, B., Erk, C., 2009. Autonomer UAV Helikopter für Vermessung undindustrielle Anwendungen. In: Luhmann, T., Müller, C. (Eds.), HerbertWichmann, 8. Oldenburger 3D-Tage, pp. 384–389.

[12] Y. B. Sebbane, Smart Autonomous Aircraft: Flight Control and Planning for UAV. CRC Press, 2015.

[13] D. W. Matolak and R. Sun, “Initial results for air-ground channel measurements & modeling for unmanned aircraft systems: Over-sea,” in IEEE Aerospace Conference,, 2014, pp. 1–15.

[14] W. Immerzeel, P. Kraaijenbrink, J. Shea, A. Shrestha, F. Pellicciotti, M. Bierkens, and S. De Jong, “High-resolution monitoring of himalayan glacier dynamics using unmanned aerial vehicles,” Remote Sensing of Environment, vol. 150, pp. 93–103, 2014.