

Methodology paper On Construction Project Management Using Drone And Photogrammetry For Residential Building

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Abstract- *Unmanned Aerial Vehicles (UAVs) or better known as 'drones' are aerial modules that are operated by a manned remote or by a predetermined flight path. Since the invention of the drone it had been utilized and developed mainly by militaries. But nowadays drones in the form of multi-copters are more accessible to general people and therefore can be used by companies in a very wide array of tasks. This monitoring work becomes faster and more productive with the use of drones Although the developed UAVs are capable of performing tasks like installation, retrieval, tool operations, pick up and drop, peg in the hole, and valve turning, etc. There is a lack of studies in understanding applications of UAVs and their capabilities in construction and in advancing construction activities. Therefore, this research focuses on identifying the potential applications of UAV in construction indicating their potential capabilities in the construction process. In this paper work is carried out on research methodology i.e. the process of conducting the proposed research. At the end of this paper one will understand how the final work for this project will be done. The prepared questionnaire, its measure and method of analysis is also discussed in the paper.*

Keywords- UAS, UAV, drone technology, construction projects, etc.

I. RESEARCH OVERVIEW

Methodology also is a well planning for a research that starts from the beginning until the end of research. The problem of conventional method of visual inspection which is efficient way throughout current time but still it can be questionable on time affect, cost impact and efficiency in documentation process or suitable methods that can meet the objectives can be carried out when the methodology is well planned and followed. There will be five pillars of research area that will generate to four phase of data control and process for each pillars and to tele back with aims and objectives of this research. The appropriate research design and research methodology will assist to achieve research

objectives by clearly shown method of data gaining, data analysis and to generate the information and results. The flow chart covers the stepwise procedure of thesis work.

To study how the drone technology concept is applied in various construction industries. Details obtained from the above study are formulated and then comparative study of this data is done with the conventional inspection plan. Analyze whether the drone technology procedure is useful or not for the construction project.

Project work started with collection of data for study and analysis from the various research paper published by various authors. Thereafter a theoretical concept of project (work to be carried out) is decided. After studying the research paper it is concluded that preparation of questionnaire survey will be the best study about the use of drone technology in construction sector. And then the standard sample of questionnaire is being taken from one of the research paper. Along with the questionnaire some questions are also added in the survey to find out the perception to use drone technology in construction sector for better project management by using the questions obtained from studied research papers.

II. EMPERICAL DATA PERCEPTIONS DRONE USAGE

Due to the nature of drones in the construction industry being very new and innovative, a research towards change is best to be done. Such research is aimed at implementing improvements. This includes monitoring possible problems that can withhold the implementation of the innovation. The best strategy to get good insight in the situation as it would be by using the research strategy of an interview. But interviews take a lot of time to process, so in order to save the researcher some time it was chosen develop a survey and combine the survey with a small number of interviews.

a. Developing A Survey:

The survey will be in English because this is the technically sound native language of proposed areas. The list of questions is based on what is found in literature. The questions to be asked will be in the form of closed questions which have pre-formulated answers, this makes the results easier to process and analyze. Often the option of 'Other, namely' will be given, this gives the respondent the opportunity to give an answer the researcher might not have thought about yet of about what the respondent would want from imagery. The goals of the survey will be to get insight in how often imagery is made, with what devices it is made, what the subject being photographed/filmed is, to see which devices are most preferable, when the imagery is made and eventually whether people are familiar with drones and if they are willing to adopt drones in their business. This will eventually give insight in how far the industry is ready for drones and will help to answer the research questions and/or test the answers found in literature. After some iteration about the questions that needed to be in the survey in consultation with the supervisor the final survey was put together on paper and translated to a digital format with the help of Google form. This format is easy in use and makes good quality surveys that can be spread through an internet link. The printable version of the survey can be found in Appendix. The chosen method of spreading was preferably by spreading it under the members of associations that represent companies in the construction industry. Only one of those associations was willing to post the link to the survey in their newsletter to the members. Another association was not willing to spread the survey under their members but had the contacts of these companies on their website. The researcher called these companies in the name of the institute in order to spread the survey. Unfortunately the companies were unwilling to cooperate. They get requests too often to do this. An answer that it gives as well is to send an e-mail with the description and the link of the survey so the secretary could forward it to their HR section. As time goes by the researcher asked for the status of the spreading of the survey. No update could be given or the request to spread the survey was denied. Another method of spreading the survey was by the education professionals, consultancy employees, and LinkedIn contacts of some of the local supervisor. This fortunately led to a better response rate. In consultation with the supervisor a combination of the survey with interviews at companies would be the method of getting the data wanted. The researcher later visited consultancies through meeting from the online platform about energy saving housing in order to spread the survey there. This is why the printable version of Appendix is made. Unfortunately the meeting could not aid in spreading the survey.

b. Developing Interview

The interviews will take place in approximately 60 minutes and will include some general questions about the person and the company interviewed in order to get a fair comparison between the interviews. A longer interview is too hard to process and analyze for the time that is available. The interview will be composed of open questions and some questions where it is asked to choose from some options and explain his/her choice. The open questions give the person that is interviewed the chance to use his or her creative mind and outgiving to answer the question. Interviews can be held in a variety of ways. Interviews can be face-to-face, via telephone, or nowadays even with the help of software like Skype, Zoom, Google meet, etc. The preferred way of conducting an interview is with the use of software like Zoom meeting & Google meet by video graphic interviewing the company employee. This gives the most pure and unfiltered results as body language can also tell a lot and the kind of personal approach of a face-to-face interview will probably be possible and it will be more attractive to the respondent. The companies that will be interviewed are mostly within short range of the nearby cities. This is done to save time for the researcher; also the number of interviews is limited to three. Interviews will be recorded so they can be transcribed to a text format, but the researcher will also take notes. This will be done by hand or if possible with specialized transcription software. The interviews will take about one hour and as mentioned will be conducted in English because both parties will probably speak same language more fluently and answers will be more accurate. The questions asked in the interview will be mostly based on the survey questions provided, but since it is an interview the respondent will be asked to give as many answers he could think of by himself and is given the opportunity to give his thoughts about the questions asked. Something which is not possible with just an online survey.

III. DESCRIPTION OF SECTIONS OF QUESTIONNAIRE

The whole questionnaire is worked out in the form of Multiple Choice Questions and some theoretical questions also. None of the question is made compulsory to answer as it may lead to leaking personal data of the respondents. Details along with section titles are mentioned below for basic understanding of questionnaire.

According to authors, a questionnaire is a properly thought-out device designed to elicit data that may be acquired through written responses from the examine subjects. In this study, the questionnaire covered quantitative questions very well organized and piloted to make sure they contemplated a high degree of 'validity'. It consisted of five to six pages divided into 4 sections specifically A, B, C and D. An extra

page with inside the form of a cover page becomes covered to provide an in-intensity clarification of the purpose of the study and the terms of the survey. In the questionnaire, the sections have been specially based in this kind of manner that the questions therein might be eliciting solutions to the research questions offered in review.

The questionnaire consists of the following four parts:

Section A: General information about the Organization:

In this section details about the organization are asked. It consists of question regarding the ownership of the organization and its establishment. Some questions about geographical information of the organization are mentioned. One may be able to analyze the financial status of the organization from the question of annual turnover and cost of project. Total number of questions in this section= 7.

Section B: Respondent’s background:

In this section respondent details are asked. A question about designation and department of respondent tells about his/her proficiency in the area. Respondent’s educational qualification and work experience is also asked to check his/her liability to fill the questionnaire survey or whether we should consider the response or not for our analysis. Total number of questions in this section= 6.

Section C: Personal Overview on Drone Technology:

In this section questions about the personal overview of respondent about drone technology are asked. For this section it is not mandatory that respondent should be drone user. A person who has knowledge about drone and its efficiency can also answer the questions of this section. Total number of questions in this section= 14, out of which 6 questions are rating scale based that are to be analyzed by using Likert’s scale. The rating is from 1 to 5, as 1 for “Most Unlikely”, 2 for “Unlikely”, 3 for “Neutral”, 4 for “Likely”, and 5 for “Most Likely”. Remaining 8 are about individual’s opinion on drone technology. Arithmetic mean, standard deviation and relative weightage is to be calculated and compared for that 6 rating scale questions.

Section D: Drone Survey:

We used these final questions to share respondent’s observations of the drone surveying sector. We are particularly interested to know what, if anything would prevent him/her from commissioning an aerial drone survey as opposed to a manual or traditional survey or aircraft survey. In this section

2 comparative questions about drone image shooting are asked in the difference of now and then i.e. what kind of images they can shoot by using conventional method and what will they get by using drone technology. The responses are then to be compared for the same 2 questions. Remaining 12 questions are theoretical type and MCQ type; discussion will be made for the same individually depending on the responses received.

IV. QUESTIONNAIRE MEASURE

The questionnaire is measured based on a Likert’s Scale of five ordinal measures from one (1) to five (5) according to the level of agreement by the respondents as stated in Figure 5.1. As discussed earlier, the data generated from the questionnaire survey is analyzed using factor descriptive analysis. The measurement tools in the survey provide quantitative indication of qualitative judgments.

1	2	3	4	5
Most Unlikely	Unlikely	Neutral	Likely	Most Likely

Fig. 1 – Likert’s scale used for this Study

The rating scale used for the questionnaire is;

- 1 = Most Unlikely
- 2 = Unlikely
- 3 = Neutral
- 4 = Likely
- 5 = Most Likely

V. CONCLUSION

In this paper, the survey design and methodology employed in meeting the research objectives set was discussed in detail. After an introduction describing the main objectives of the research and what to expect in the chapter, the research paradigm chosen for this research was then discussed. A case for the justification of the use of the questionnaire as a survey tool was immediately given afterwards. The research population and sampling technique were then discussed. An in-depth description of the sections of the questionnaires, what they contained and why the questions were asked, were then given. The process of pilot testing then immediately followed. The data-collection process and the data analysis then followed each other. Limitations of the questionnaire survey chosen also explored. Finally, statistical analysis and procedures applied to examine the objective of this study such as data screening; descriptive analysis, were discussed in detail. From the above mentioned, a conclusion can be made

that the methodology outlined was appropriate for addressing the objectives of the research. The findings, as well as the results of the methodology are discussed in this paper, will be presented in the final paper.

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