UNIVERSITI TEKNOLOGI MARA

DESIGN AND DEVELOPMENT OF PRECISION LOCALIZATION MEASUREMENT TECHNIQUE FOR LOW ALTITUDE UAV IN PADDY FIELD MONITORING APPLICATION

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MSc

April 2019

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Thesis submitted in fulfillment
of the requirements for the degree of
Master of Science
(Electrical Engineering)

Faculty of Electrical Engineering

April 2019

ABSTRACT

In Malaysia, rice has been adapted as the staple food for the nation. To raise the production from the paddy field, a modern technology must be adapted to the paddy plantation system. Over the years, in Europe especially, a new modern technology has been adapted in their agriculture system to help saving cost on plantation management. The jobs of fertilizing the crops, pesticide control, crops monitoring and harvesting are all done using automatic machinery system. By this way the farmers can maximize their production and expense less on farm management for a long period of time. All these positive development are done using the help of modern technology especially with the help of using the Global Positioning System (GPS). One of the greatest achievements by using the GPS is that the GPS has the ability to map the agriculture field so that a machine can move or works autonomously inside an assign boundaries of the field. One of the favourite modern technologies that have been used in an agricultural field is using the Unmanned Aerial Vehicle (UAV) or sometimes they called it as the drone. The UAV has the ability to do lot more of things from the air. The UAV has ability to fly at low altitude to spray the fertilizer and the pesticide and the most important task is that it can monitor the crops from the air. The movement of the UAV is usually manual controlled by the user and sometime there are also an autonomous UAV. Both of the control types have the help of the GPS for their positioning. Using the GPS has some setback on its own. The GPS is exposed to low signal problem, signal blockage and intentional or unintentional interference. On this work, other method of technique to replace the GPS is introduced. Two on ground beacon at a known distance using the radio frequency (RF) signal is built and tested in order to replace the GPS technique. The RF signal is used because of the ability to be reach at a long distance compare to other sensors. Also the cost for the system will be considered. The two on ground beacon will transmit the RF signal to the coordinator. The coordinator is a circuit that can be connected to the UAV controller on-board of the UAV. The coordinator will received the signal from the transmitter and at the same time it will received signal strength indictor (RSSI) that will show how much power present in the receive the signal. The RSSI signal will be read and analysed using a custom built C language algorithm on the receiver and the range will be calculated and estimated using trigonometry. All these functions are created, formulated and tested thoroughly in an integrated development environment (IDE) board system by using the ATmega328P on top of the Arduino Uno. In the end, this technique has helped the development of a measurement technique which can determine the distance and localization that can be used on the UAV in the paddy field, without the dependency of the GPS for localization. Using this technique, the range accuracy for the three type of field condition that has been tested showed the average margin of about 0.5 meters from the original measured distance using a tape measurement. The accuracy of the measurement has been improved from 95% using traditional GPS to 96.6% using the on ground beacons technique.

ACKNOWLEDGEMENT

Firstly, I wish to thank God for giving me the opportunity to embark on my Masters and for completing this long and challenging journey successfully. My gratitude and thanks go to my supervisor Dr. Nor Hashim Bin Mohd Arshad and co-supervisor Dr. Norashikin Bt. M. Thamrin.

My appreciation goes to Jabatan Pendidikan Politeknik and Politeknik Ungku Omar for giving me the opportunities of furthering my studies. Not to forget the students of JKE, PUO who assisted me during sampling. Special thanks to my colleagues and friends for giving me some moral support with this project.

Finally, this thesis is dedicated to my loving wife and children who always understand and supports me along this journey. Not forgotten to my loving mother and the loving memory of my very dear late father for the vision and determination to educate me. This piece of victory is dedicated to all of you. Alhamdulillah.

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