

Design and Development of a Smart Camera Tool for the Quantification of Agro-Chemical Droplet Count in Plant Canopies

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Abstract

Detection of agro-chemical applied efficiency i.e. delivering of the correct dose of agro chemicals to the target canopies, is done by droplet count and has become a vitally important aspect in smart farming systems to achieve cost effectiveness and the environmental benefits. There existing techniques are expensive, sophisticated and come as integrated systems coupled into large machineries which are not viable solution for the Sri Lankan context. Therefore, the present research attempted to design and develop smart handheld tool for the said purpose. A device was invented to perform data acquisition, storing, image processing and interpretation of droplet count data to yield the application efficiency results. A Raspberry-pi microprocessor and camera (8MP) were assembled to Arduino-nano microcontroller through serial communication. Neo 6M GPS module was used to record GPS coordinates relevant to the respective image data. The system also with the user-friendly data uploading facility to local database including high capacity of sampling rates. Field test was performed by a banana plantation *Kamburupitiya* (6.066° N, 80.561° E) and potato plantation in *Rathkarawuwa* (6.798° N, 80.896° E). Daconil and Mancozeb chemicals were sprayed into banana and potato plant canopies by Knapsack sprayers. Chemical droplets count on plant leaves were measured from 50 random sampling locations for the test by using both manual and developed smart camera device. K-Nearest-neighbor interpolation method was used to generate the chemical droplet distribution map for the selected area. Paired T test was performed to assess the statistical significance. Results revealed that there was no significant difference ($p>0.05$) of droplet count between manual and the developed smart device method. Highly significant positive linear relationship was observed for both Banana ($R^2=0.988$) potato ($R^2=0.926$) according to the correlation analysis. Therefore, this study conclude that the potential possibility of using the developed smart camera tool for successful quantification of agro chemical droplet count from plant canopies.

Keywords: Image processing, K-Nearest-Neighbor Interpolation, Raspberry pi, Smart farming

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