Paper Title*

Title: Times New Roman, 14 point bold font, center, capitalize only the first letter of the first word)

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(Times New Roman, 12 point bold font, center, author's first name, initials and surname)

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(Times New Roman**,** 11 point, italics font, center, organization and address of author(s), the corresponding author should be identified with superscript *)

Keywords: image processing, machine learning, plant phenotyping, cyber agricultural system

(Times New Roman, 11 point, between 3 and 5 keywords or key phrases, separated by commas)

Abstract: Today, efficient and cost-effective sensors as well as high performance computing technologies are looking to transform traditional plant-based agriculture into an efficient cyber-physical system. The easy availability of cheap, deployable, connected sensor technology has created an enormous opportunity to collect vast amounts of data at varying spatial and temporal scales at both experimental and production agriculture levels. Therefore, both offline and real-time agricultural analytics that assimilate such heterogeneous data and provide automated, actionable information is a critical need for sustainable and profitable agriculture.

(Times New Roman, 11 point, no more than 2 pages long, with references)

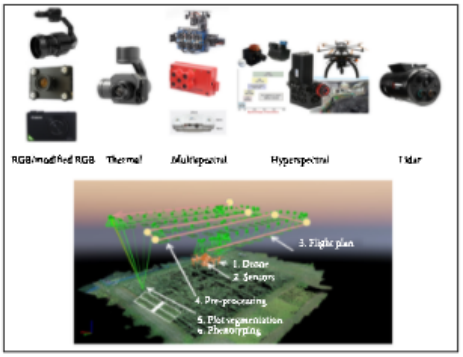
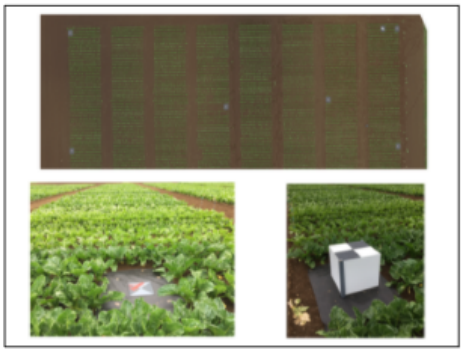
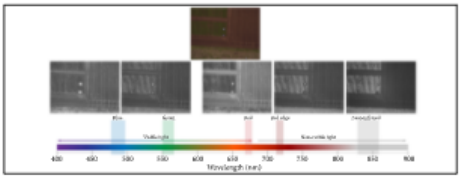
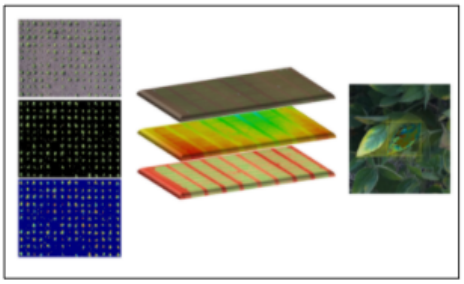
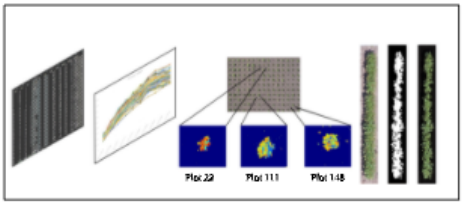
References (format according "Chicago Manual of Style 17th edition (author-date)",

Cite the paper in Chicago style. Like here (Guo et al. 2021; Ghosal et al. 2019).

Ghosal, Sambuddha, Bangyou Zheng, Scott C. Chapman, Andries B. Potgieter, David R. Jordan, Xuemin Wang, Asheesh K. Singh, et al. 2019. "A Weakly Supervised Deep Learning Framework for Sorghum Head Detection and Counting." *Plant Phenomics* 2019: 1–14. https://doi.org/10.34133/2019/1525874.

Guo, Wei, Matthew E Carroll, Arti Singh, Tyson L Swetnam, Nirav Merchant, Soumik Sarkar, Asheesh K Singh, and Baskar Ganapathysubramanian. 2021. "UAS-Based Plant Phenotyping for Research and Breeding Applications." *Plant Phenomics* 2021 (Article ID 9840192): 21. https://doi.org/https://doi.org/10.34133/2021/9840192.

(You can add more detail to the abstract or simply paste your poster here as the second page. All presenters, including oral and poster presentations, are encouraged to submit a poster (or even a "Pipeline flow chart") together with this extended abstract.)

Planning phase	Plan for the following: ➢ Plant material ➢ Field size ➢ Experimental designs, ➢ Traits under study, ➢ Location (federal laws) ➢ UAS (types, batteries) ➢ Time of flight, Duration of flight ➢ Payload (sensors) ➢ Ground Control Points ➢ Path Planning (flight parameters) ➢ Overlap ➢ Spatial Resolution	
Testing phase	Test for the following: Step 1 • Ground truth • Quality control (geo-referencing, mosaicking) • Radiometric calibration (needed before each flight) • Re-calibrate, if poor sensor output information Step 2 • Preliminary analyses for validation of UAS pipeline (Experiment planning phase to analysis to information extraction) re-plan, if needed following the planning and testing phases	
Image acquisition	List of must-have (check list): ➢ UAS, sensors, pre-downloaded flight plan, spare battery, GCP, controller, tablet ➢ Radiometric calibration ➢ Ground truth data collection ➢ Meta-data	
Image pre-processing and processing	➢ Image un-distortion, if needed ➢ Geo-referencing ➢ Ortho-rectification, if time series ➢ Mosaicking ➢ Digital surface map ➢ Point cloud ➢ Camera calibration ➢ Segmentation ➢ Labeling ➢ Thresholding	
Data analytics	Trait extraction ➢ Computer vision methods ➢ ML and DL methods ➢ ICQP of trait ➢ Linear, non-linear ➢ Validation against ground truth ➢ Model performance metrics	
Cyber-infrastructure	➢ Local vs Cloud ➢ Down-sampling without loss of information ➢ Downloading and uploading	