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Thesis: "PRECISION AGRICULTURE WITH VISION SYSTEMS"

Summary:

Robotic systems used to collect and process crop data in the context of precision agriculture are expensive and treated as black boxes which make it hard to achieve any progress on that field. For that reason, it is presented a low-cost, open-source, robust, and user-friendly Unmanned Aerial System (UAS) for precision agriculture tasks. The system features a flexible methodology for data collection and image processing, a new vegetation index proposal for temperature estimation on vegetation, and a control algorithm that is robust against disturbances. The system is capable to collect visible and near-infrared radiation with a compact multispectral sensor for the computation of a variety of vegetation indices. The output information is used then to estimate the vegetation's temperature without thermal imagery as usually done by other related systems. The presented system estimates the temperature of vegetation using only visible and near-infrared radiation. Such radiation is selected after a correlation analysis that provides a temperature model that fits best to real temperature. The results are compared with reference temperature maps to assess the performance of the proposed system and methodology. In regard of the control part of his work, it features a nonlinear control law for the stabilization of a fixed-wing UAV. Such controller solves the path-following problem and the longitudinal control problem in a single control, achieving globally asymptotically stability (G.A.S.) in the closed-loop system. The experiments presented in this work are enclosed to corn fields.