

Pre-Application submission for USDA NIFA & NSF I-CORPS Program

Team Composition and Roles:

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Previous NIFA Awards:

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Title:

Experiential Training in Use of Unmanned Aerial Systems
Technology for Agricultural Applications

Recipient Organization:

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Commercialization Impact:

The purpose of this proposal is to increase the efficiency, productivity and profitability of the agricultural industry by utilizing Unmanned Aerial Systems (UAS) technology, along with other necessary software components and payload equipment, by monitoring and maintaining crops. The UAS technology will consist of multispectral cameras and sensors with the ability to capture RGB, near-infrared and heat signature images that will be stored onboard the platform of the UAS until retrieved. The data collected from the UAS platform will then be transferred into an open source program where the data will be transformed into a 3D orthomosaic model that can be analyzed or exported for future reference. This data, once analyzed, will provide useful feedback regarding nutrient deficiencies, flood/drought damage, pest invasion and wildlife & cattle tracking.

Sunlight is an electromagnetic radiation given off by the sun that emits infrared, visible and ultraviolet light. Healthy vegetation reflects higher signatures of near-infrared (NIR) light than stressed vegetation while non-vegetative objects absorb NIR light (NASA Goddard Space Flight Center). By equipping a camera with infrared capture capabilities, a field of crops can be measured to determine their health throughout their life cycle by calculating the amount of NIR light they reflect using the normalized difference vegetative index (NDVI). The NDVI determines the density of NIR reflected by plants. Increased density of NIR signifies healthier vegetation. This routine monitoring process can detect highly stressed areas, which can then be targeted directly without the hassle of overusing pesticides and wasting water and fertilizer due to generalization (NASA Goddard Space Flight Center). With less expended resources, the efficiency of the farming process will increase. The aerial coverage of the field will also reduce the amount of physical labor required to manually inspect the field on foot or by vehicle. This technology is also not limited to photography as video footage can also be obtained.

The data collected over a period of weeks, months or even during different seasons can be used to establish productive planting habits and harvesting procedures. Farmers will be able to choose the appropriate areas of the field to plant specific crops based on previous data collected from the earlier seasons which will include the effects of weather on the field, changes in fertilization and the possible invasion of pests. The collected data can also be used as a time lapse portraying the progress of crop growth throughout the season, providing an increase in accuracy when predicting the season's yield come harvest.

Commercialization Plan:

The use of UAS technology for agricultural applications is viable as it will reduce the amount of time needed to view aerial images of crops while increasing the resolution of those images. This reduction in delivery time will allow the farms to adjust to outside stimuli, such as pest invasion or drought, quicker to avoid loss of crops. Another benefit to using UAS technology is the availability of using multispectral cameras and sensors. Standard images are received from satellite sources and take up to 3 weeks for delivery and only come in the RGB color bands. Instead, the UAS can be the farm's personal photographer and work in tandem with the satellite for GPS location when determining the needs of the crop. Potential applications for the UAS technology includes crop monitoring, livestock tracking, land surveying & mapping, general reconnaissance and emergency disaster relief efforts. The UAS platform will be targeted towards an audience of farmers who use computers to aid in their

agricultural efforts. According to the USDA 2012 census, there are a total of 2,109,303 farms with about 900 million acres of farms (United States Department of Agriculture, 2014). Most of these farms already utilize satellites for monitoring their pastures and farms, which signifies a large market for this UAS technology.

References

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