Introduction

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**Introduction**

Fly Bye’s IPPD project is the Automated Smart Traps for Invasive Tephritid Fruit Flies, which means designing and developing an automated smart trap for detecting tephritid fruit flies.

USDA’s Agricultural Research Service is the sponsor of the Automated Smart Traps project. The goals of the USDA include promoting agricultural trade & production, ensuring food safety, protecting natural resources, working to end hunger in the US, and assisting the commercial farming industry. The Agricultural Research Service aims to solve agricultural problems like animal production and protection and crop production and protection. Fly Bye’s project assists in the ARS’s mission of crop production and protection.

Oriental, Caribbean, and Mediterranean fruit flies are extremely destructive to Florida farms and are not native species. Since 1964, these pests have occasionally been detected in Florida. Most recently, Oriental fruit flies were detected in Florida in August 2015, costing millions of dollars to quarantine and eradicate [1]. All three species have been eradicated from Florida.

The USDA wants Fly Bye to develop an early warning detection system that automatically detects invasive species in subtropical agricultural regions. Crop protection is an ongoing problem, which requires quick action if an invasive species is detected in the region. The existing traps that currently exist on hundreds of groves require manual checks, which costs a lot of time and money. The USDA would like a trap that automatically alerts USDA researchers of the presence of a Tephritid fruit fly. This allows eradication to begin sooner, which will decrease the costs of quarantine and eradication. In the scope of work, the USDA requires Fly Bye to design two different prototypes that automatically detect the invasive species.

The first trap is image-based. This trap will periodically take a picture of sticky fly paper, and using machine learning, will determine if an invasive species exists on the trap. This data will be sent online to USDA researchers. The second trap uses infrared sensors to detect invasive species. This trap will record the wingbeat frequencies of an insect flying between the sensors, and will use a Wavelet transform to determine if it is an invasive species. This trap will also send its data to research scientists.

**Results**

Fly Bye created a infrared system design that uses infrared light to record the wingbeat frequenices of flies. Originally, the USDA provided a research paper using this method in the scope of work to help Fly Bye with this process. However, upon research and experimentation, it was determined that the methodologies were inaccessible for undergraduate students as many of the components were out of stock. This required further research for Fly Bye to determine alternate ways to collect and analyze wingbeat data.