Novel Smart Trap with Edge AI for Pest Insect Monitoring

Halyomorpha halys (HH), is an invasive shield native to East Asia. Due to climate change and global trade, it has arrived in Europe where it is causing significant losses in food production. As part of the HALY.ID project, we propose to develop a novel smart trap for automated insect monitoring.

Automated Insect Pest Monitoring System

Integrated Pest Management (IPM) strategies, such as physical barriers, crop rotation, or monitoring traps play an important role in helping growers manage insect pest populations in their crops. Effective implementation of IPM strategies is critical to minimise crop loss and pesticide use, thus ensuring the sustainability and economic viability of crop production. Monitoring for insects and insect damage is an integral part of the IPM. However, it is a time consuming process that requires frequent crop inspections and reliable monitoring tools. Continuing international trade and climate change ensure the continual threat of new insect pests entering into Europe. The proliferation of HH in Europe is a good example of that. It was first reported in southern Europe in the early 2000's, with recent losses in Italian fruit orchards being reported in the hundreds of millions of euro each year. Moreover, HH continues to spread towards northern Europe including the United Kingdom where multiple interceptions have been recorded since 2020. The example of HH invasion highlights the urgent need for better tools for insect pest monitoring.

The HALY.ID project is aimed at tackling this challenge with a range of innovative ICT tools for monitoring of HH and other pest insects. HALY.ID is a European project that comprises of partners from multiple European institutions, each offering extensive expertise in state-of-the-art technologies that can help tackle this problem. Overall, the project takes a holistic approach to develop solutions to this problem with each project partner focusing on different technologies such as: drones, ground based vehicles, and stationary sensors. Researchers are utilising the advances in sensor technology, machine vision, and artificial intelligence algorithms to develop novel systems for identifying and monitoring the pest insects of interest.

The Tyndall National Institute, an ICT research institute based in Cork in Ireland, is one of the partners in the project. It focuses on the development of a novel stationary smart trap system for detecting and monitoring the presence of insect pests. The proposed device is a low-cost automated device that incorporates a camera with a mechanical servo motor for rotating the sticky trap. It is shown in Figure 1. The camera can capture an image from both sides of the trap. The images are processed on the sensor device with a microcontroller that executes the state-of-the-art algorithms. The algorithms include novel image processing and artificial intelligence techniques to detect and identify the target insect pest, such as the HH or other insects. The result is subsequently sent to the grower who can use it to make more informed decisions are part of their IPM strategies.

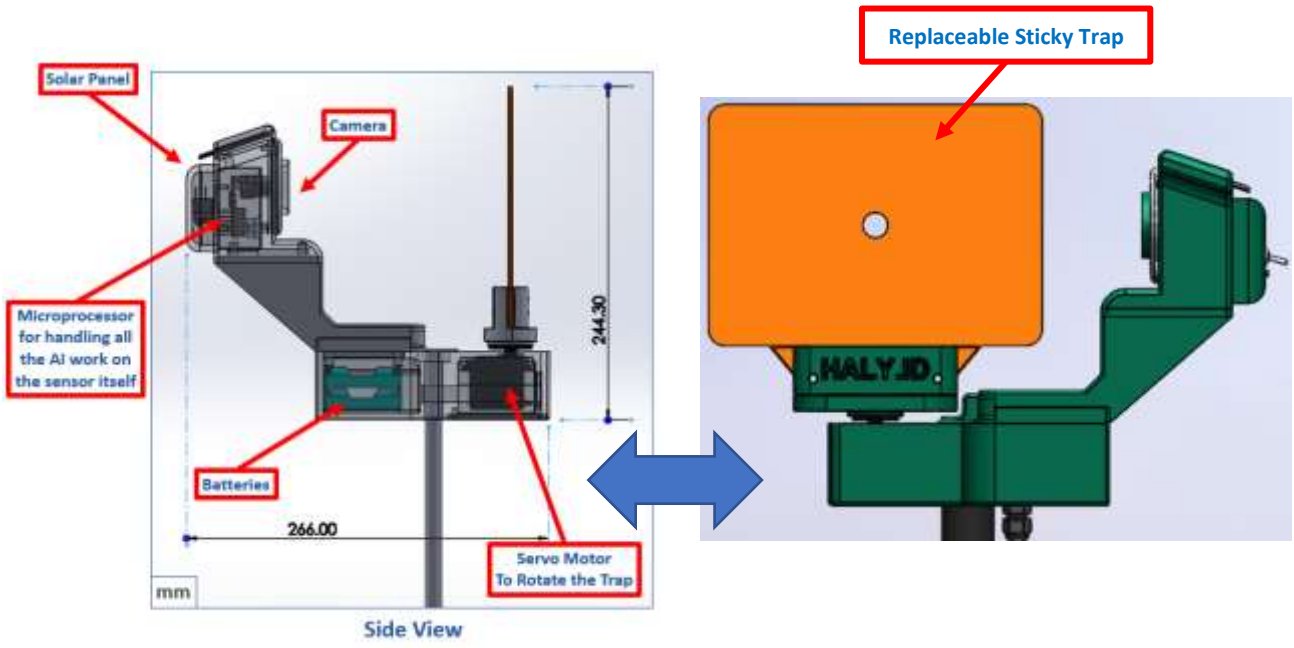

Figure 1: Smart Trap System: Low Power, Artificial Intelligence, and Machine Vision on the IoT Device

This system can function automatically for months, throughout the growing season, once installed and deployed. Growers would only be expected to visit the deployment site to replace the sticky trap; as they normally would with the commercial traps. Therefore, Tyndall National Institute's novel stationary trap system can play a major role in tackling the growing challenge of insect pest infestation in Europe and beyond. It complements the other technologies being investigated by other partners as part of the HALY.ID research project.

More information about this project can be accessed at the project website.

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