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A Novel Plug-in Board for Remote Insect Monitoring*

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Abstract

In all fields of agriculture, a general goal is to achieve high crop rate year by year. In Hungary the most widely produced fruit is the apple. Its most harmful pest is the codling moth (Cydia pomonella) [1]. The crop loss due to the high harmfulness of the insect can be extremely expensive therefore farmers use insecticides periodically. However, a much more optimized approach would be to use insecticides only if the insect population exceeded a threshold level [2]. The question is: when will this happen?

The most common information source of insect pest density prediction is the outsourced traps. The traditional trap-based insect monitoring requires an expert who manually recognizes and counts pests. This approach is a very slow, labor-intensive, and expensive process because it requires a skilled person capable of distinguishing insect species. Moreover, this type of pest counting does not give immediate feedback. On the other hand, an automatized insect pest trap with pest counting software provides continuous sampling, thus the pest population monitoring has a higher temporal resolution. Consequently, automatized traps can be exploited for pest invasion detection and survey which will help farmers to schedule orchard spraying.

To create an automatized trap, a dedicated data acquisition device is necessary, which makes the online pest monitoring possible from a distant location. In addi-

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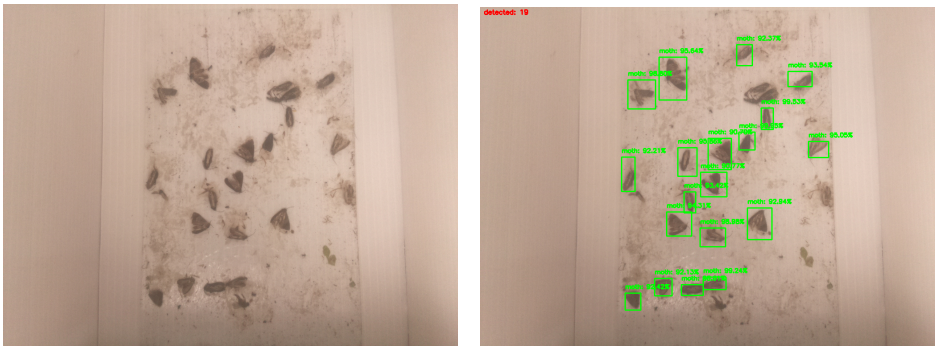
tion, it is beneficial for the device to run machine learning algorithms that count and identify insects automatically from pictures [3]. Thanks to the advantages of integrated circuits, more systems have been designed to improve integrated pest management in the context of precision agriculture. However, in our opinion, all of those systems have one or more disadvantages, such as high cost, low power autonomy, low picture quality, a WIFI coverage requirement, intensive human control, and poor software support. Therefore, the aim of this work is to present a novel plug-in board for automatic pest detection and counting. The proposed plug-in board is dedicated to Raspberry Pi devices, especially the Raspberry Pi Zero. This board, in combination with a Raspberry Pi device and a Pi camera, constitutes a complete sensing device which overcomes the limitations of other prototypes found in the literature. In this paper, a detailed description can be found about the schematic and characteristics of the board with a deep-learning-based insect-counting method. Sample images about the insect pest counting in the proposed system can be seen in Figure 1.



(a) Sticky-paper image taken in the trap. **(b)** Processed image.

Figure 1. Illustration of insect pest counting using the proposed sensing device

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