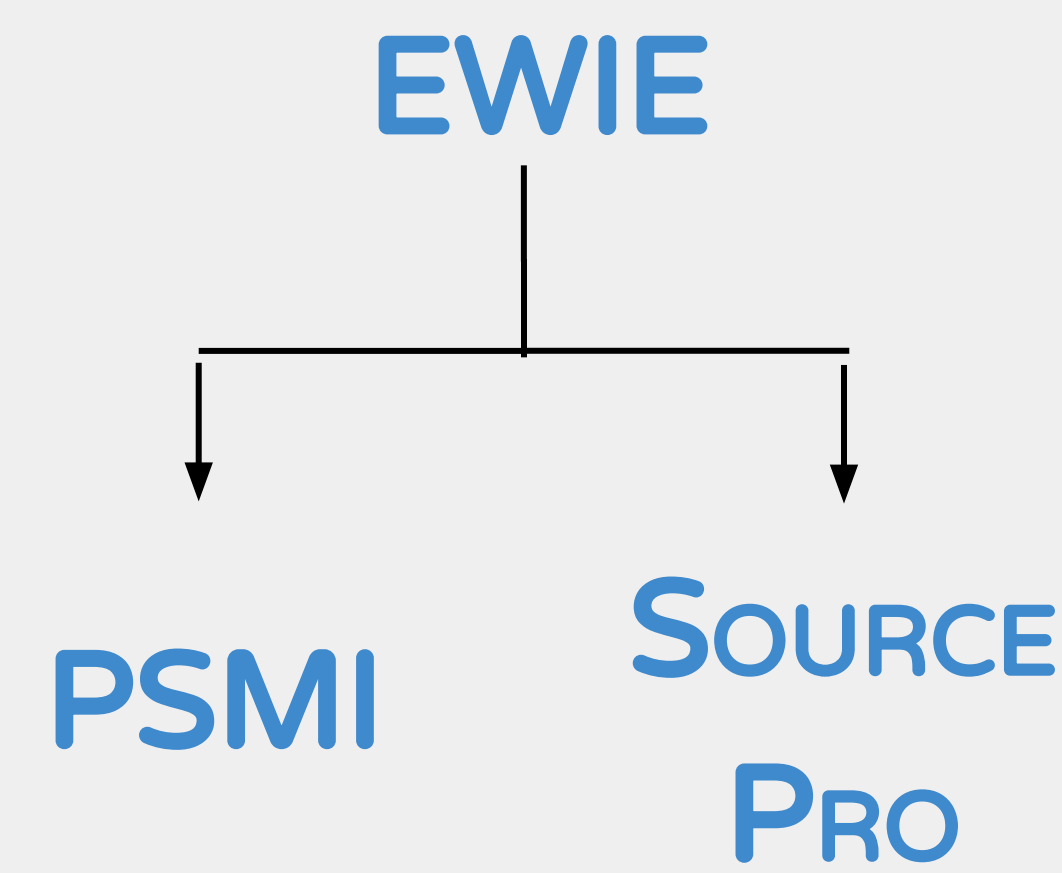# Automated Inventory Management System

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Advisor : Dr. Joseph L. Gabbard | Client : Kevin Bowyer

COMPANY BACKGROUND

EWIE
PSMI
SOURCE PRO

- We are working with Source Pro, a sister company of PSMI.
- They have a global presence and are headquartered in Ann Arbor, Michigan.
- The company provides inventory management services to manufacturing facilities.
- Our project is designed for the Learning Factory at Virginia Tech.

PROJECT BACKGROUND

- The project is an inventory management tool that will be utilized in the learning factory and has the ability to be deployed in other manufacturing facilities.
- The solution is focused on innovation as a basis for further improvement in the future.
- The need for a new solution is due to the high costs and low inventory count accuracy of existing systems.
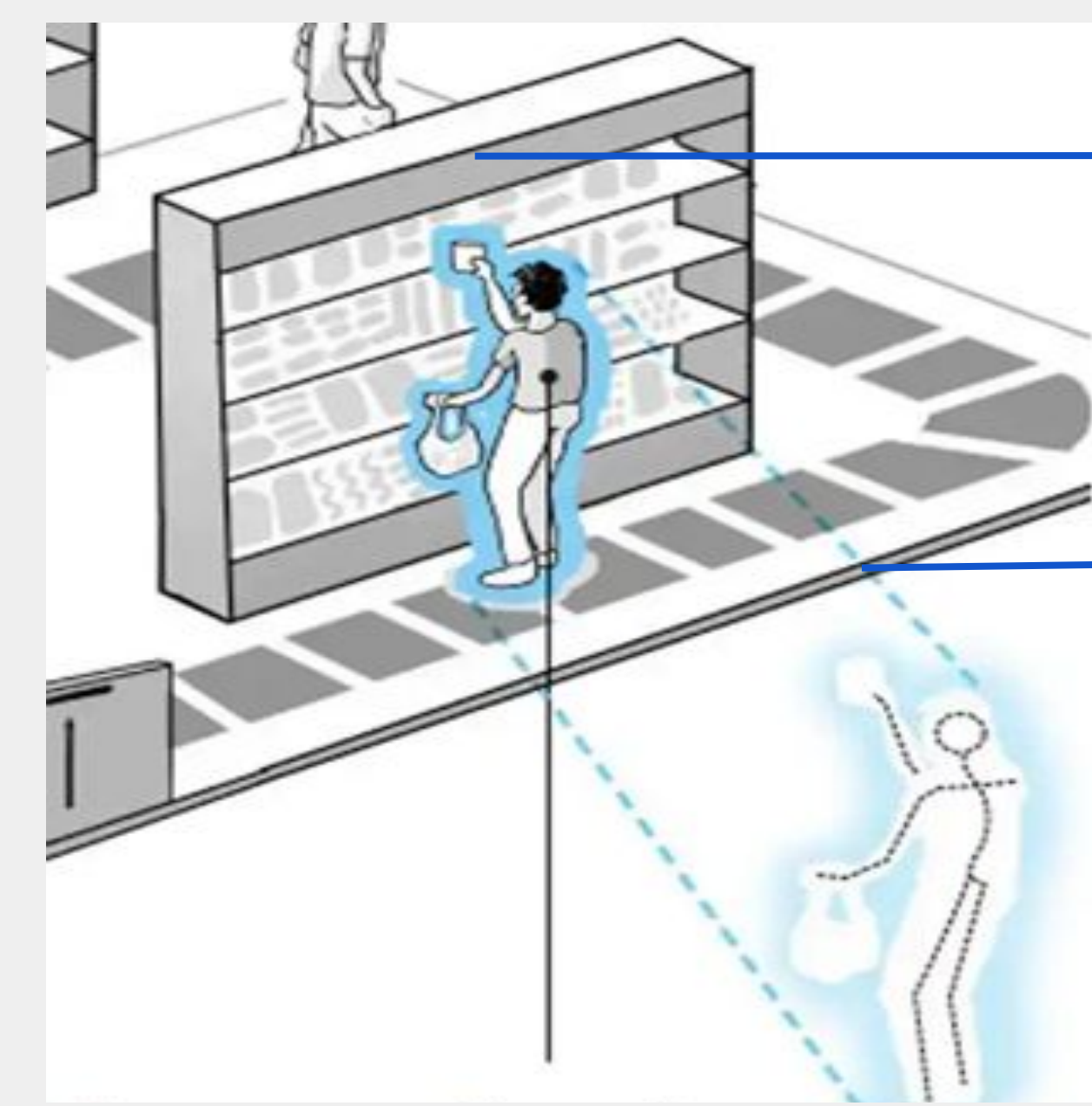
SOLUTION APPROACH

The main function of the solution is to be able to automatically monitor and track transactions

Computer vision and python was utilized to develop the software. Raspberry Pi, a credit card sized computer is used to run the software.

python + OpenCV → Raspberry Pi
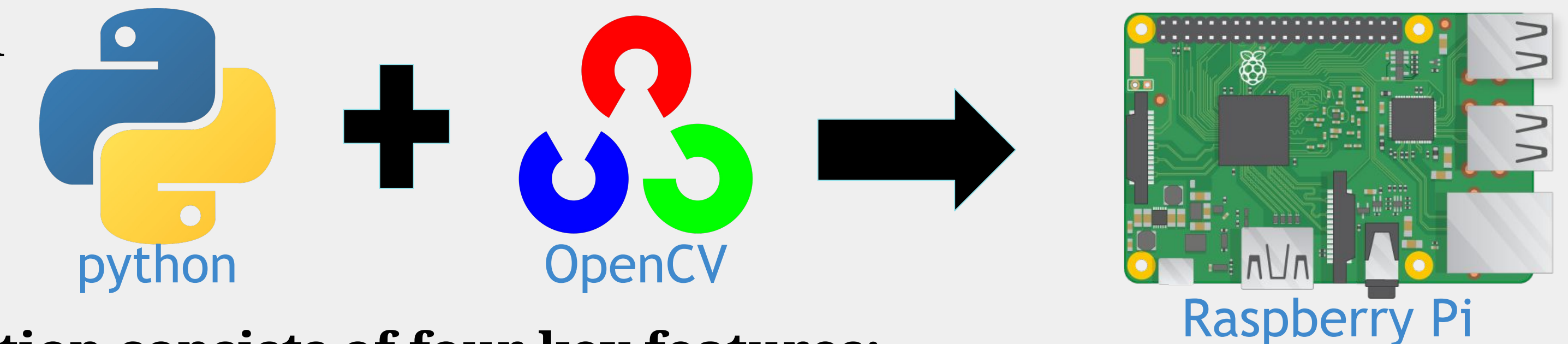
The solution consists of four key features:

Motion Detecting Camera
- Two cameras placed for vertical and horizontal view of the rack.
- The cameras help locate the position of the product.

Recording of Transaction
- Based on location, the software recognizes the product taken.
- The data of the transaction is then stored in a database.

Notification System
- Transaction data per shift is sent to management via email.

Calibration Tool
- A software tool is also created to help designate locations within a specific area to a particular product.
- The markings can be adjusted based on the rack measurements and product positions.

Up to **$100,000** savings per facility
24/7 monitoring of transaction
Inventory count accuracy above **95%**

RESULT

The tool was implemented and tested on a bookshelf at home. Two cameras were placed on the top and the side of the shelf for a horizontal and vertical view. The two camera locations create a plane to the entrance of the shelf, and when that plane is broken motion is detected, and location of motion is determined.

The calibration tool helps the user set the grids based on the shelf measurements. In the figure, the tool is used to divide the shelf horizontally.

The two cameras help give the accurate location information for the coordinate direction. In the figure, the camera locates the y-coordinate direction.
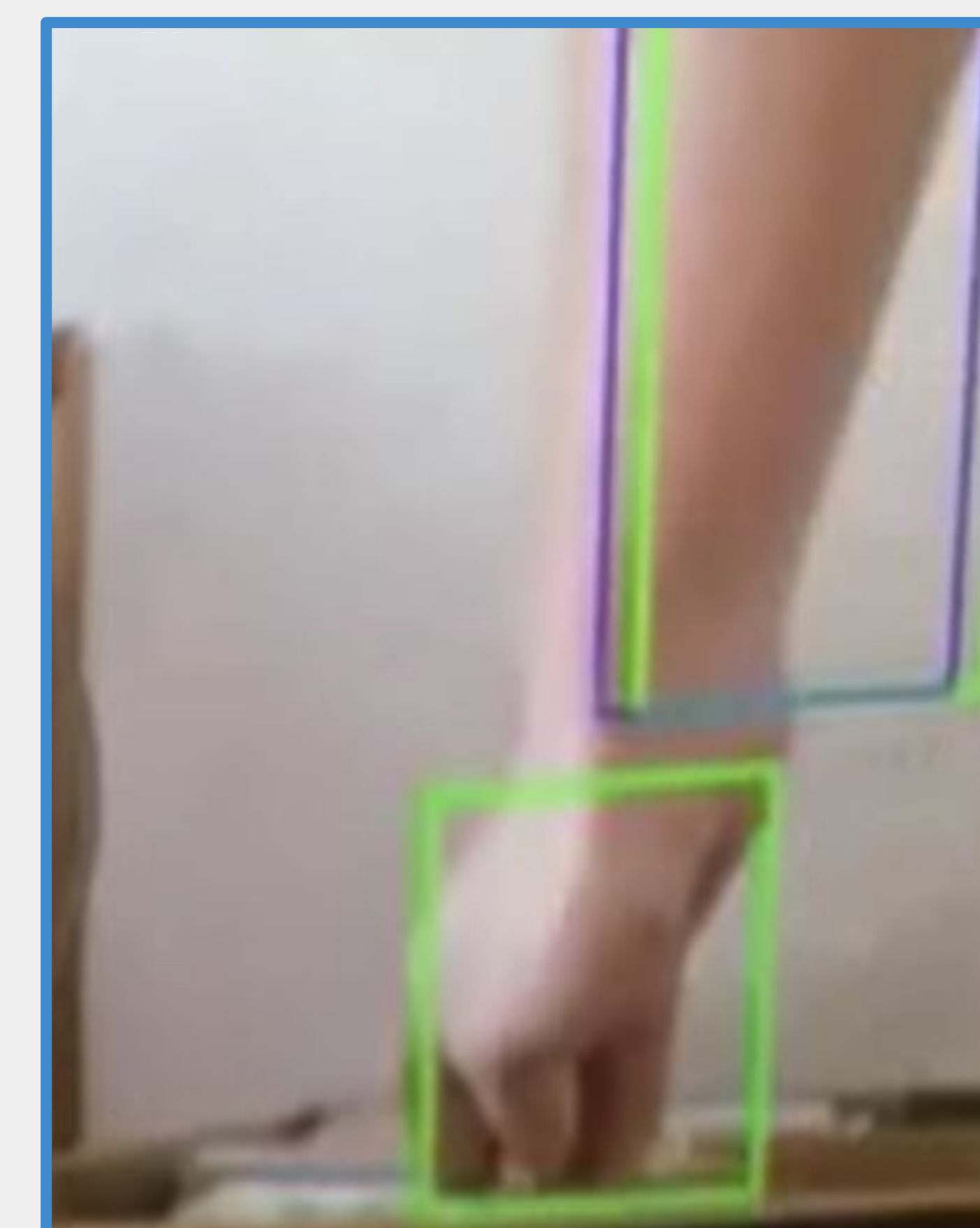
The software utilizes an algorithm to compare the first frame of video with no motion to the subsequent frames. That determines the rate of change of pixel coordinates when motion is detected. When this velocity is zero it can be expected that a person has reached into the shelf to grab an object. Coordinate values at that point provide the location which then helps determine the product taken.