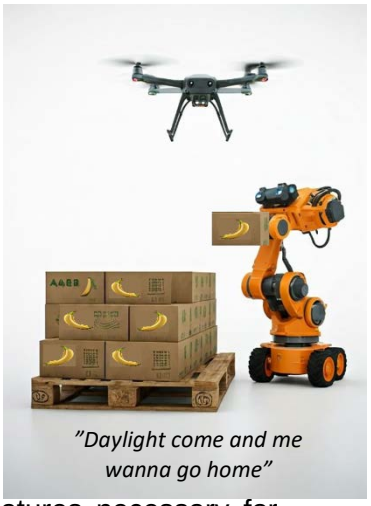
Tally Me Bananas, AI!



1. Introduction

"Six foot, seven foot, eight foot bunch !"

Why can't automation already carry those banana boxes ?

Why is so much hard manual labor needed still in the '20s ?

For ChatGPT's sake, it is already high time for the AI to take on the Warehouse World and liberate humans from hard labor for once & all !

2. Project Goals

The Project will build a set-up that includes all the core features necessary for developing a radically new approach to logistics automation: multimodal, coalescing and orthogonal robotics & automation.

What this means is that the Project will achieve something with modern technology that has been already manifested in numerous life forms, including the Hominidae, that are able to decrease the entropy in their surroundings by systematic manipulation of objects into a collection with intended volume, shape and order.

In other words, the goal of the Project is to play 3D-Tetris with "orthogonal automation components" including drones, AMRs and articulated robots by developing "a Multimodal Palletizing System" that

1) Utilizes a mobile robotic manipulator as the "hands & feet" of the System capable for picking up, transporting and placing an item into a stack of items on a pallet.
2) Utilizing drone(s) as the free-moving "head" of the System acquires necessary spatial and logical information on the items and moving equipment, and for ensuring safe and collision-free operation of the System.
3) Utilizes data acquisition technologies as the "eyes and ears" of the System for collecting sufficient information for real-time analysis and logical decision-making.
4) Utilizes local and cloud-based resources (and "AI") and communication technologies as "the brain and nerves" of the System for planning, monitoring, control and real-time fine-tuning of the robotic manipulator's palletizing motions.

3. Technologies

Since the Project aims at keeping this on lab-level, and emulating and miniaturizing the real-life scenario where possible, all the core equipment required to implement the scenario is basically available as kits, extensions, components and accessories.

Pixhawk drone products might do. Or another with a more sophisticated controller, such as *Nvidia Jetson Orin.* Or a miniature drone with only a small camera/LiDAR mostly relying on computing resources behind the System's master controller. As the AMR-platform depends a lot on the Team's Pre-Design, the product gets selected accordingly.

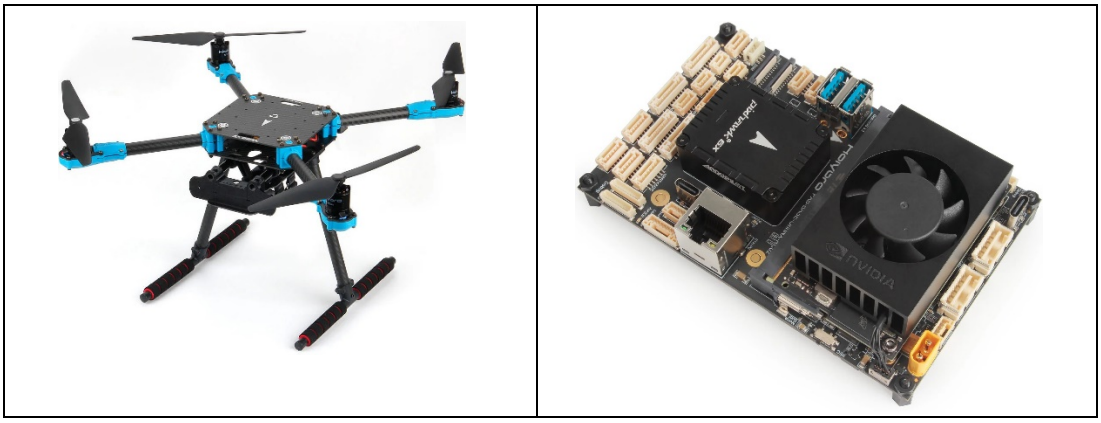


Figure 1. HolyBro X500 V2 drone frame (left); Pixhawk 6X autopilot with NVIDIA Jetson Orin NX (right)

Figure 2. Numerous AMR kits with components, sensors and accessories to choose from

4. Requirements for the students

The students are expected to possess:

- A research-oriented & investigative mindset with high tolerance to trial & repeated error !
- Python or C/C++; Linux; perhaps CUDA and 3D modeling / simulation environments
- Capability to read technical specification documents and guidelines (or to learn what it means to design automation system) and to produce Project documents in English
- Interest in all things that buzz around and make funny noises as they go busted !

5. Legal things/IPR

The results are subject to a permissive free software license such as BSD or MIT.

6. Client

The project will be executed under the Department of Computer Science, Aalto University. The project is guided by the Product Owner (PO) Antti Nurminen. The PO will provide a short introduction to robotics and drones, basic control algorithms, and neural networks at the beginning of the project.

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