APV-Bot

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Introduction

Agrivoltaics is the simultaneous use of land for agricultural food production and solar power generation.
It increases land efficiency and allows PV expansion while conserving agricultural land at the same time. One of the ways that agrivoltaics can be implemented is through an autonomous Computer Numerical Controlled robot.

The **APV-Bot** is a three-axis robot that incorporates linear guides in three X, Y and Z axes. Its special design allows precise positioning of injectors, nozzles, sensors and weeders. It can be remotely controlled via a computer, tablet or smartphone to manage the garden using a web application interface.[1] A key feature of the bot is its ability to be integrated with a PV system to power it.

Motivation

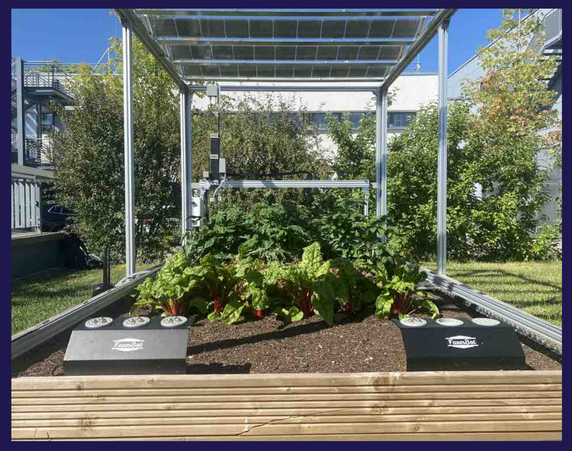
The APV-Bot has benefits that piques the institute's interest.

- There is no need for heavy machinery.
- Lower height of the system reduces costs.
- Substructure can be used as infrastructure for suspension and rails.
- The assistance from computers allows for Intercropping which increases biodiversity.
- Automated weed removal and 24/7 crop monitoring.

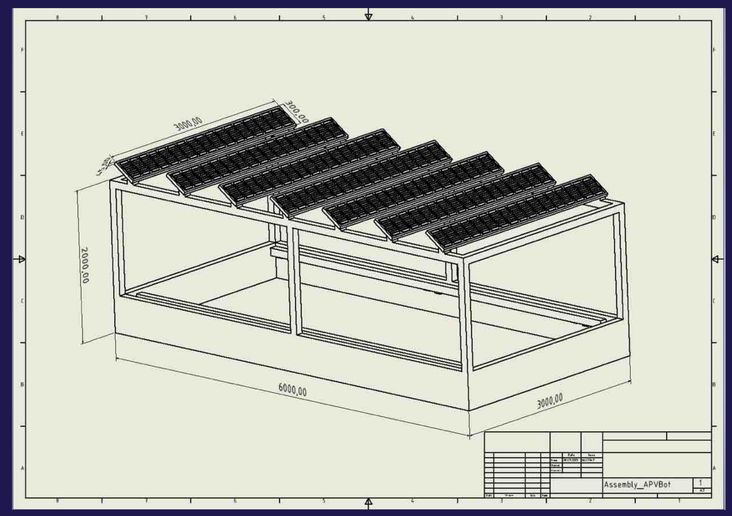
[1] Gorjan el al.

Machine controlled farming powered by the sun leads to **Automated** dual land use

APV-Bot 1.0



APV-Bot 2.0



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Design and optimization

Following the successful construction of the pilot, research is underway to further optimize the design. The aim is to develop the APV-Bot demonstrator into a complete stand-alone system. The following optimizations are being researched:

- All functions of the field cultivation system will be powered by solar energy with an integrated storage system.
- Full development of rainwater harvesting
- Integration of the APV-Bot tracks into the substructure to increase material savings.

APV-Bot 2.0

In collaboration with University Freiburg, the institute is planning to offer students a course on the basics of agrivoltaics.

The goal of this course is for students to learn about the development, application, and technical approaches of dual land use for agriculture & power generation. This includes:

- Integration of smart farming, robotics, and remote sensing elements in agrivoltaic system structures.
- Enhance interdisciplinary skills such as knowledge and methods on agricultural sciences & PV technology.
- Hands on experience in developing an off-grid agrivoltaic system.

Based on the findings from Fraunhofer ISE, students will further develop an off-grid system.

- PV module design.
- Integrated battery system
- Rainwater capture and storage

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