

# Kamaro Engineering e.V.

University Club 7.11.2023



# Introduction

Students group and nonprofit organization at KIT

Founded in 2008

20 - 40 Members

Field Robot Event participant since 2010



# 2022



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## Germany fears seasonal labour shortages as Ukraine war rages on

By Julia Dahm | EURACTIV.de | translated by Daniel Eck Apr 4, 2022



Germany also signed mediation agreements with Georgia and Moldova. Workers are expected from both countries this year, according to the ministry. [Shutterstock]

Languages: Français | Deutsch

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**Supporter**



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**From Twitter**

[1] Source: <https://www.euractiv.com/>

# Problems in agriculture

Labor costs on the rise

Small margins and desire for  
cost reduction

Increased demand

Climate change

SWR >> / SWR Aktuell / Rheinland-Pfalz



Umgang mit Saisonarbeitskräften

**Zu wenig Erntehelfer in RLP - Gewerkschaften kritisieren Arbeitsbedingungen**

Stand: 28.9.2023, 14:46 Uhr

[2]: [www.swr.de](http://www.swr.de)



# Aegaeon

Very, very, low cost automation



# Typical solutions in automation



## **Out of the box:**

Expensive

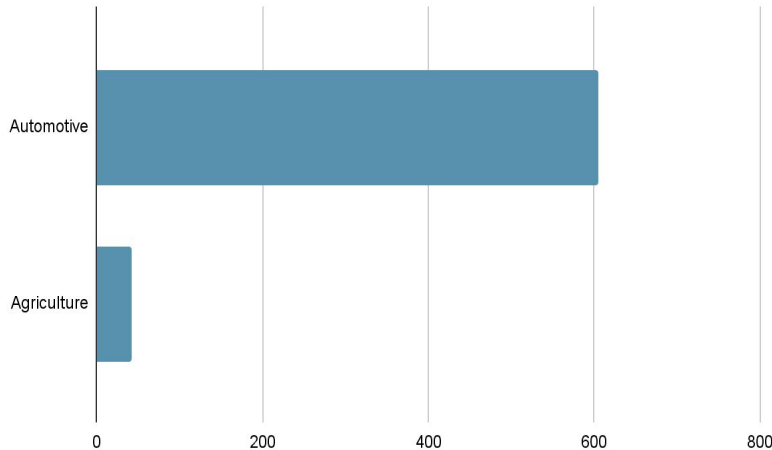
Heavy

Strong

Precise

# Robotics in the Agriculture sector

Revenue by Industry and in Billions of dollars



[2] Source: [www.statista.com](http://www.statista.com)

Problem: Advancements in robotics mainly driven by manufacturing

Agriculture is too small to incentivize large manufacturers to offer solutions

We need robots that are inexpensive and reliable but not super strong

# Aegaeon: Robot arm by Kamaro

Fully 3d-printed

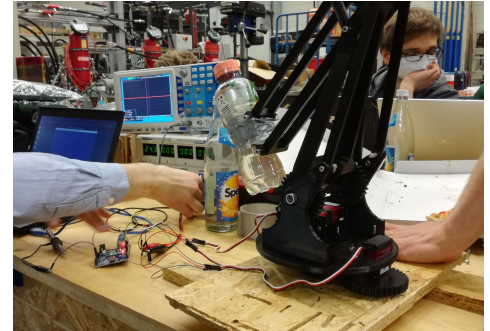
3 axes

Cheap RC servos

Biomechanical gripper developed  
in-house

Connection via hot-swappable  
CAN-Bus

**Cost: Under 170 Euros!**







# Crop detection on a Budget

Finding the strawberry in the haystack



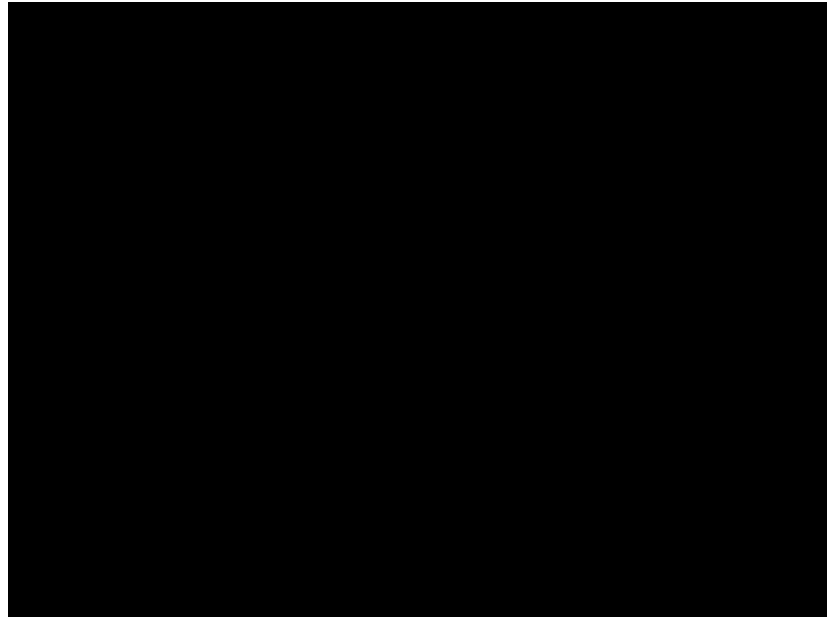
# Computer vision on our robot betelgeuse

Available hardware:

Nvidia Jetson Xavier NX

Running at 3-7 FPS **on Battery Power** and concurrent to arm and robot motors

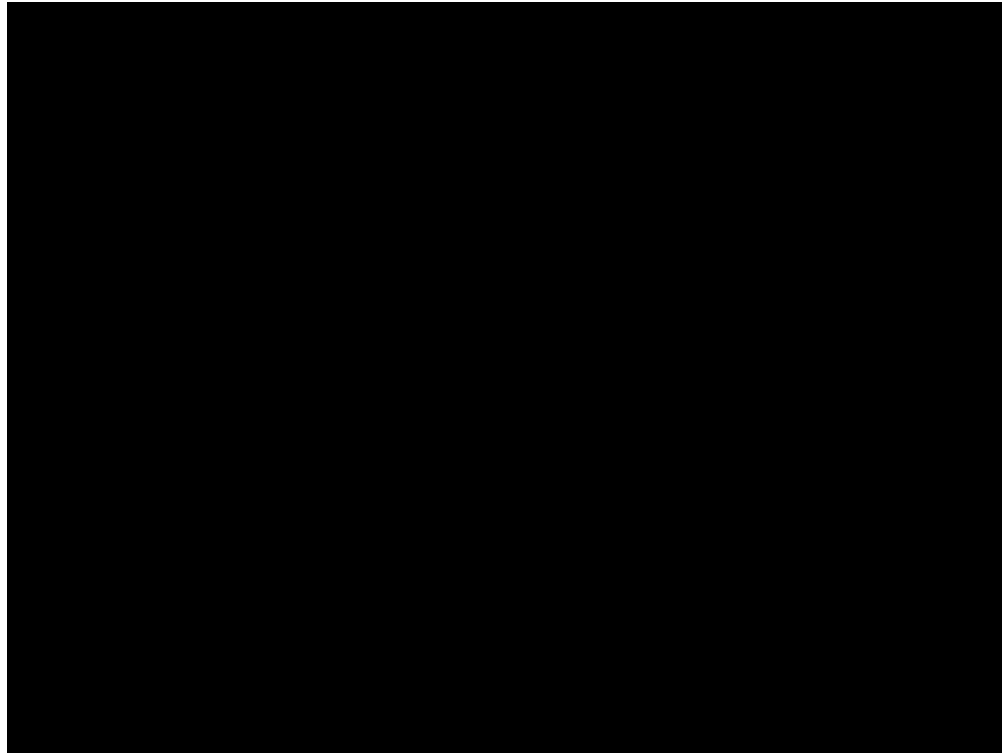
Images are generated from an Intel realsense



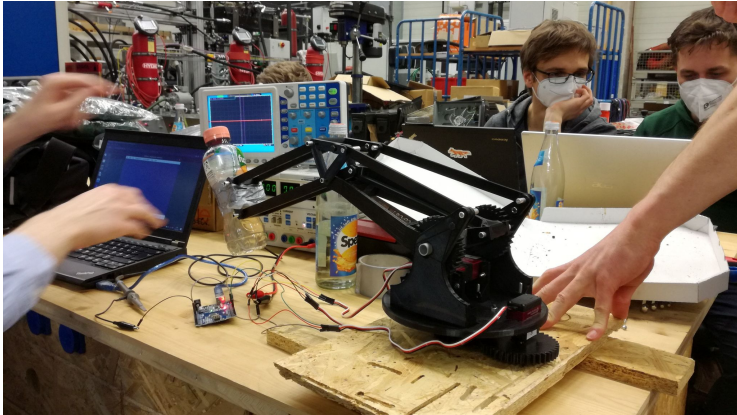


The system in action

# Arm in action



# Conclusion



Total Cost:

+ Arm (170 €)

+ Realsense (350 €)

+ Nvidia Jetson Xavier Nx (600 €)

= **1120 €**

Grabber works really well

Servos don't have linear response

Redesign of arm necessary

Realsense is inaccurate at low distance



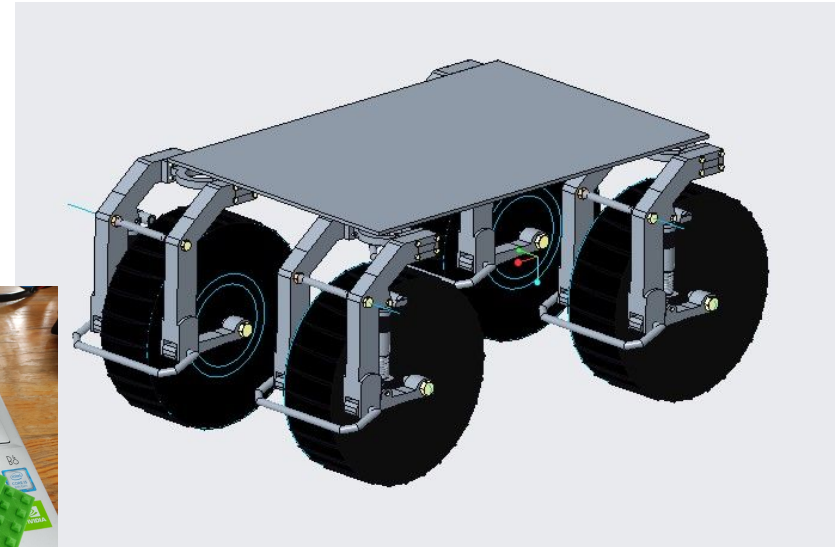
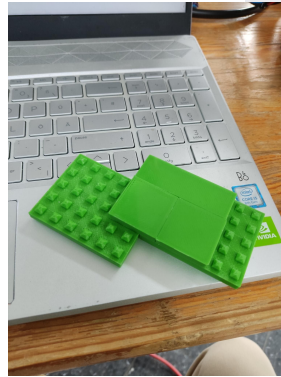
**What's next for Kamaro?**

# Kamaro Engineering: Outlook

Explore new vehicle designs

Reduce tech debt/Improve  
technology stack

Human-Robot-Collaboration



# Kamaro Engineering e.V.

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Our website with semi-regular blog posts

[www.kamaro-engineering.de](http://www.kamaro-engineering.de)



# Sources

[1]: <https://www.euractiv.com/> - Accessed 2. April 2022

[2]: <https://de.statista.com/statistik/daten/studie/323340/umfrage/umsatz-der-landwirtschaft-in-deutschland/> - Accessed 2. Nov 2023

[3]: <https://www.swr.de/swraktuell/rheinland-pfalz/erntehelfer-ehlen-gewerkschaft-probleme-rlp-100.html> - Accessed 2. Nov 2023