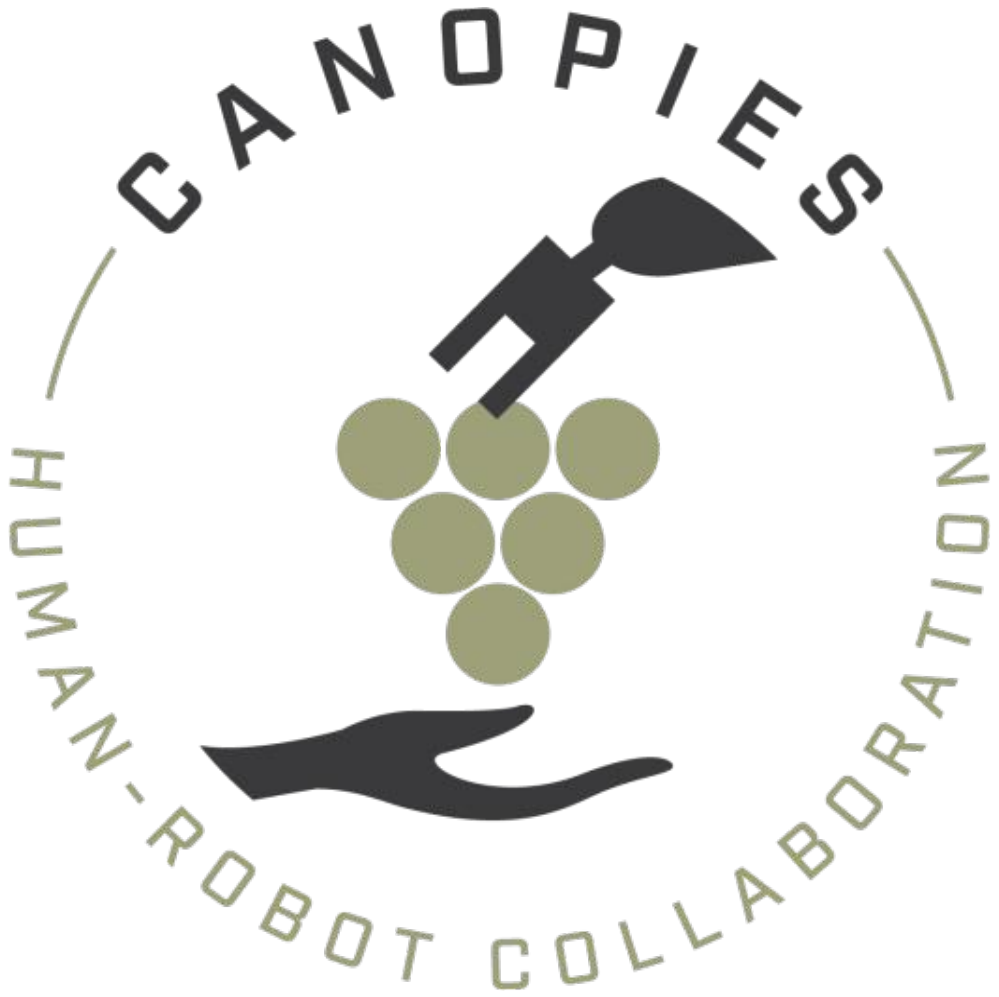

A collaborative paradigm for human workers and multi-robot teams in precision agriculture systems.

Team:

- Giuseppe Valenzano

- Francesco Messina

La nascita di Canopies

FIRA

INTERNATIONAL FORUM OF AGRICULTURAL ROBOTICS

10 & 11 december 2019

Toulouse, France

- *Dicembre 2018 1° FIRA;*
- *Incontro a Dicembre 2019 con Prof. Andrea Gasparri;*
- *Giugno 2020 sottomissione della Proposal;*
- *Settembre 2020 vincita bando H2020.*

CANOPIES

HUMAN-ROBOT COLLABORATION

- Finanziamento complessivo di 7 milioni di €;
- Durata di 4 anni (2021 – 2024);
- 10 partner europei di cui:
  - 4 università;
  - 4 aziende private;
  - 2 istituti di ricerca.

ROMA TRE UNIVERSITÀ DEGLI STUDI

KTH VETENSKAP OCH KONST

STVDIVM VRBIS

UPC

UNIVERSITÀ DEGLI STUDI DI CASSINO E DEL LAZIO MERIDIONALE – 1979 – SOL PER NOCTEM

DANISH TECHNOLOGICAL INSTITUTE

PaleBlue

PAL ROBOTICS

agriMessina

RSA

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G.A. No 101016906

Obiettivi di Canopies

Fronteggiare l’elevata carenza di manodopera a livello globale

Riduzione dei costi di raccolta

Effettuare una raccolta selettiva: raccogliere un prodotto che abbia le caratteristiche qualitative desiderate

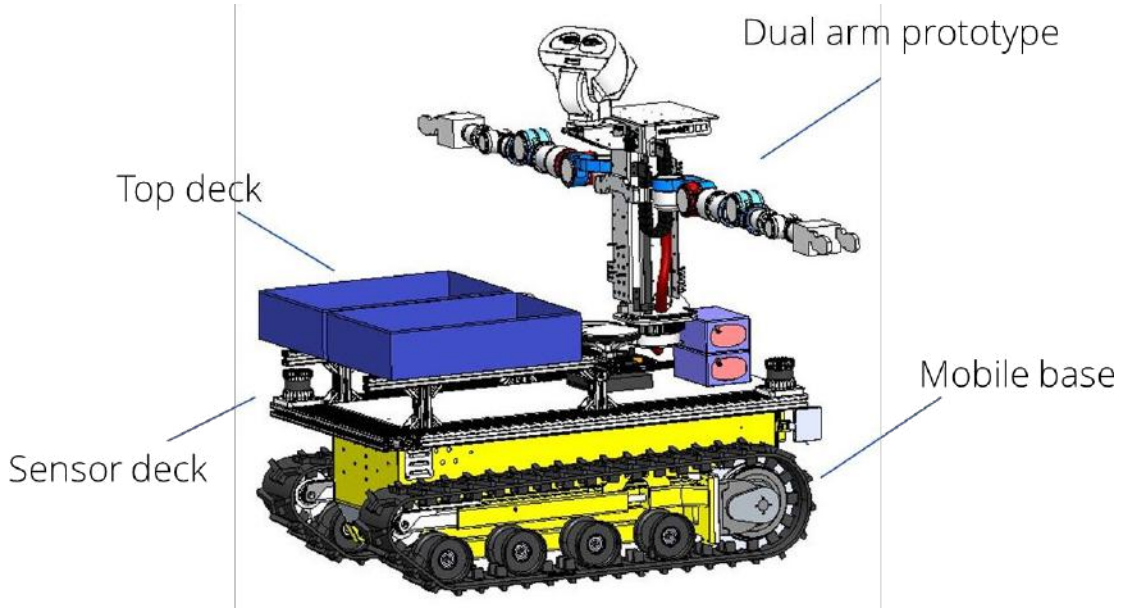
La Vision di Canopies

2 Robot che lavorano in maniera collaborativa fra loro e con gli operatori.

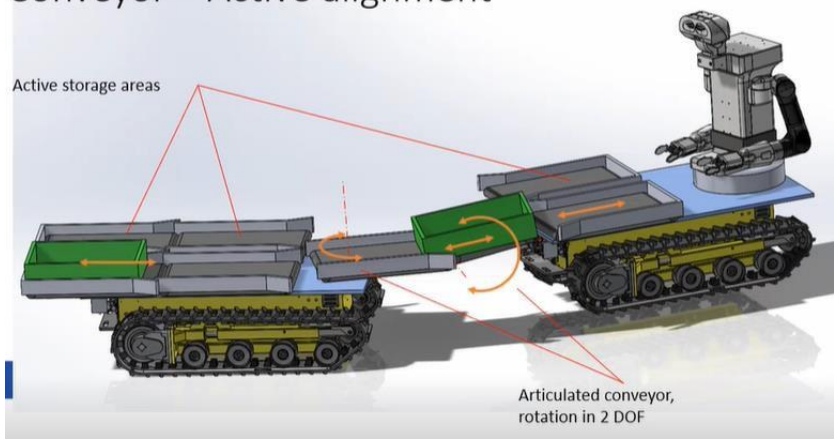
Harvest Robot

Logistic Robot

Robot - Overview



Conveyor – Active alignment



- Mobile base;
- Reachability study;
- Dual Arm system;
- Torso;
- End effector;
- Box Exchange mechanism;
- Human - Robot interaction;
- Virtual reality;

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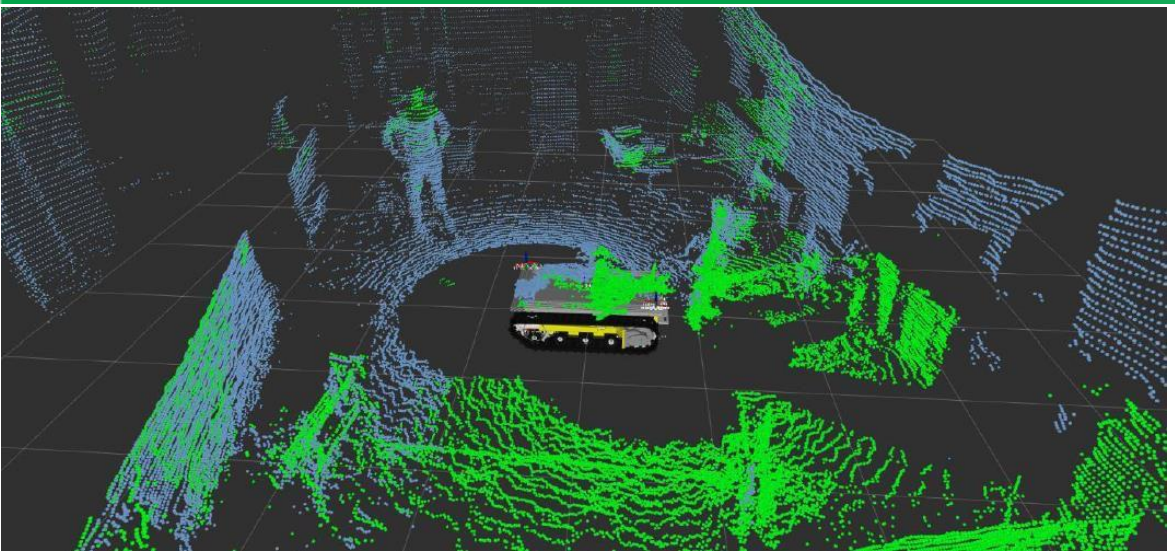
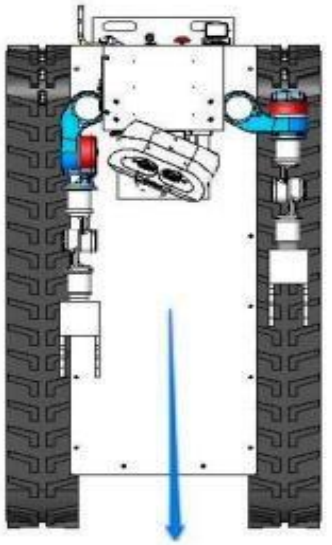
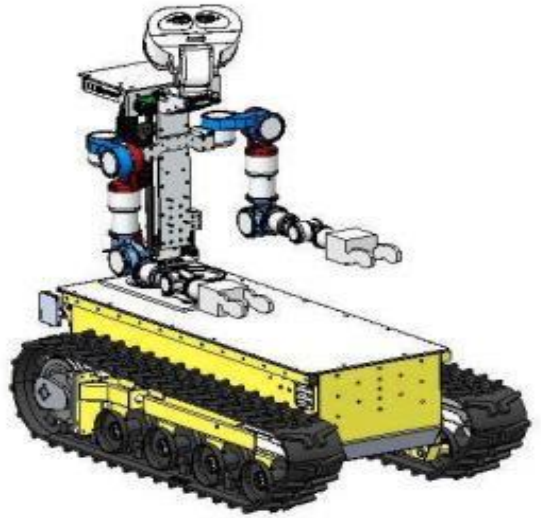
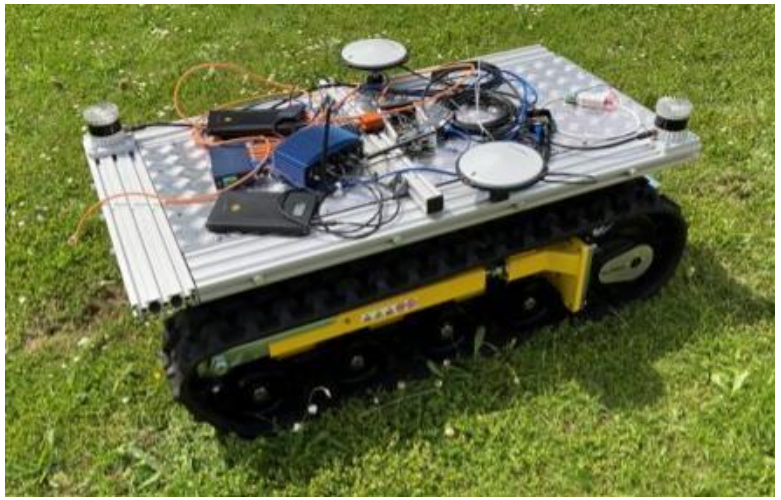
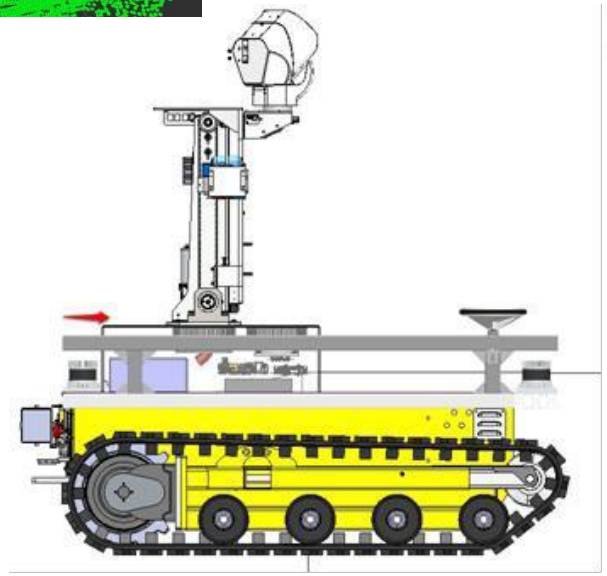
Robot - Mobile base

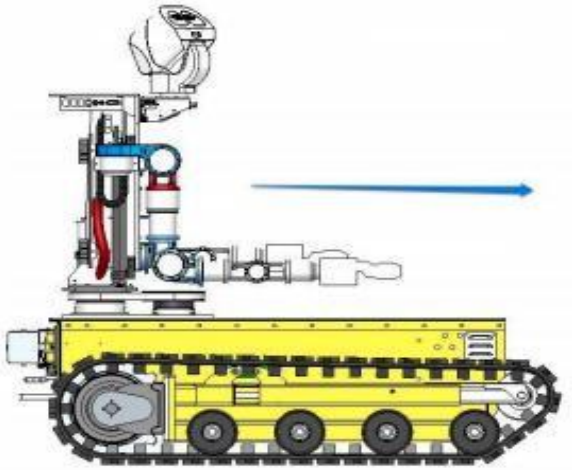












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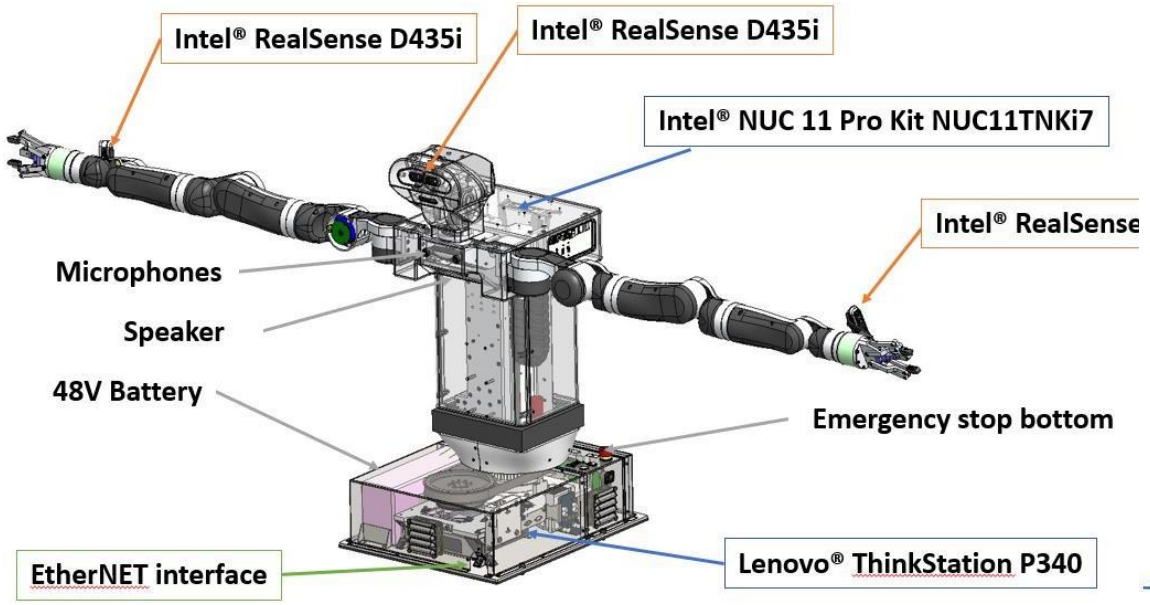
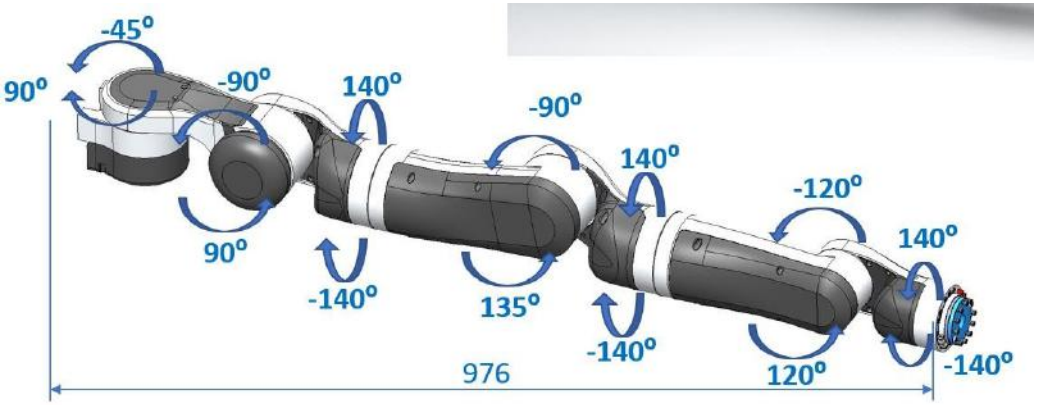
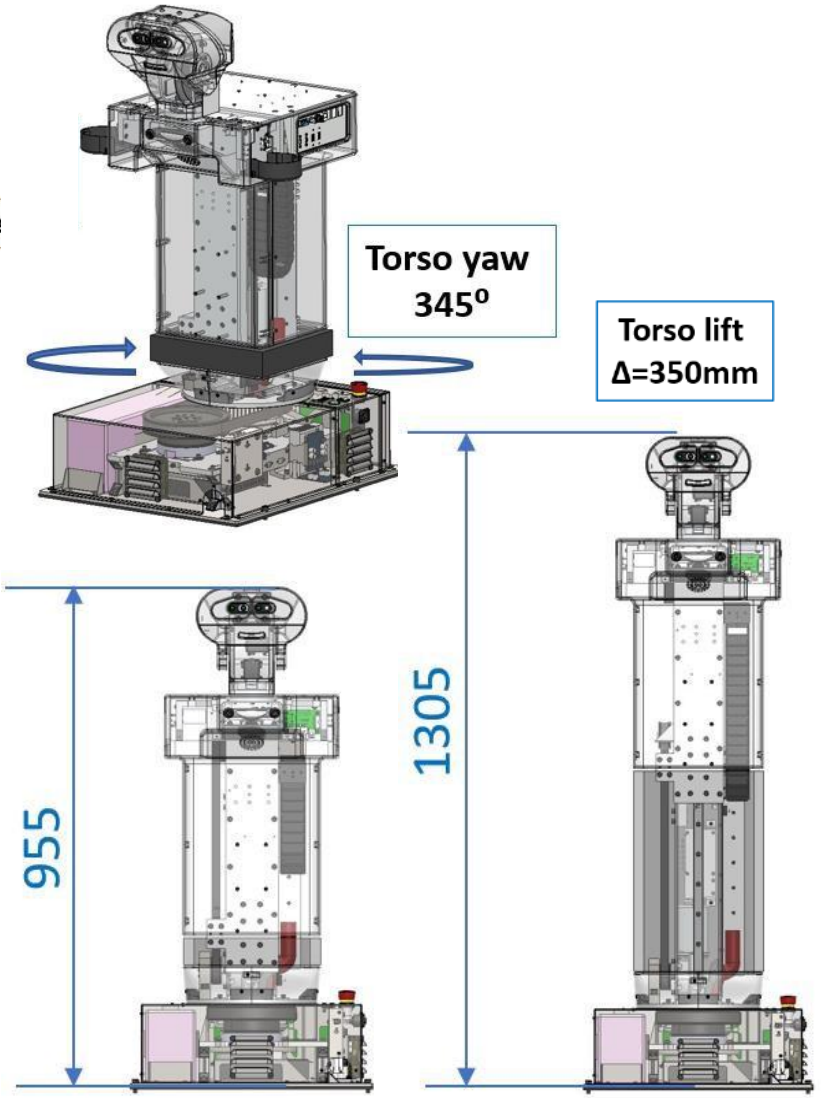
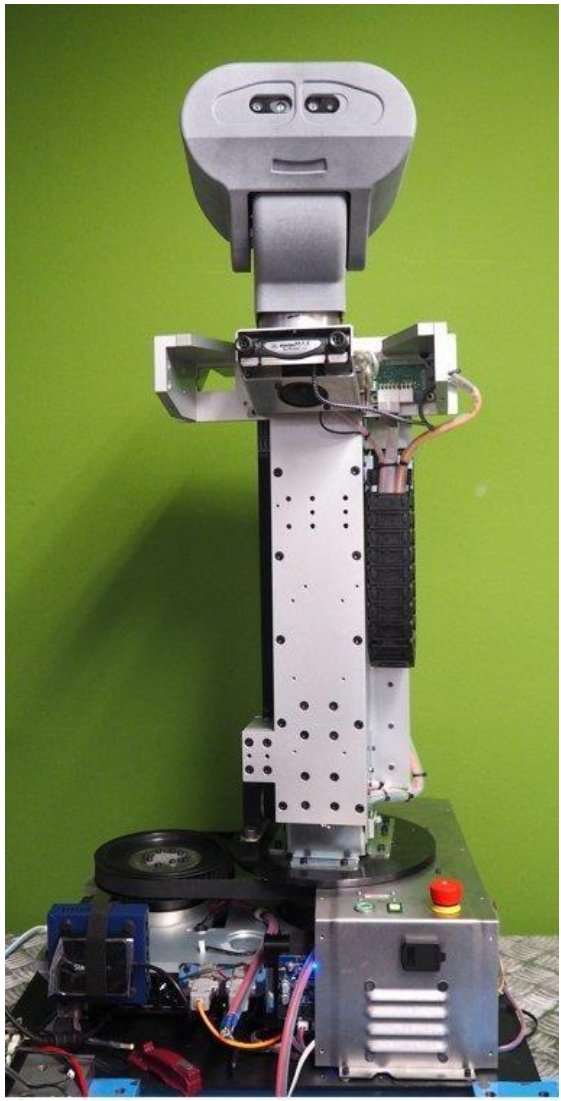
Robot - Dual arms system & Torso









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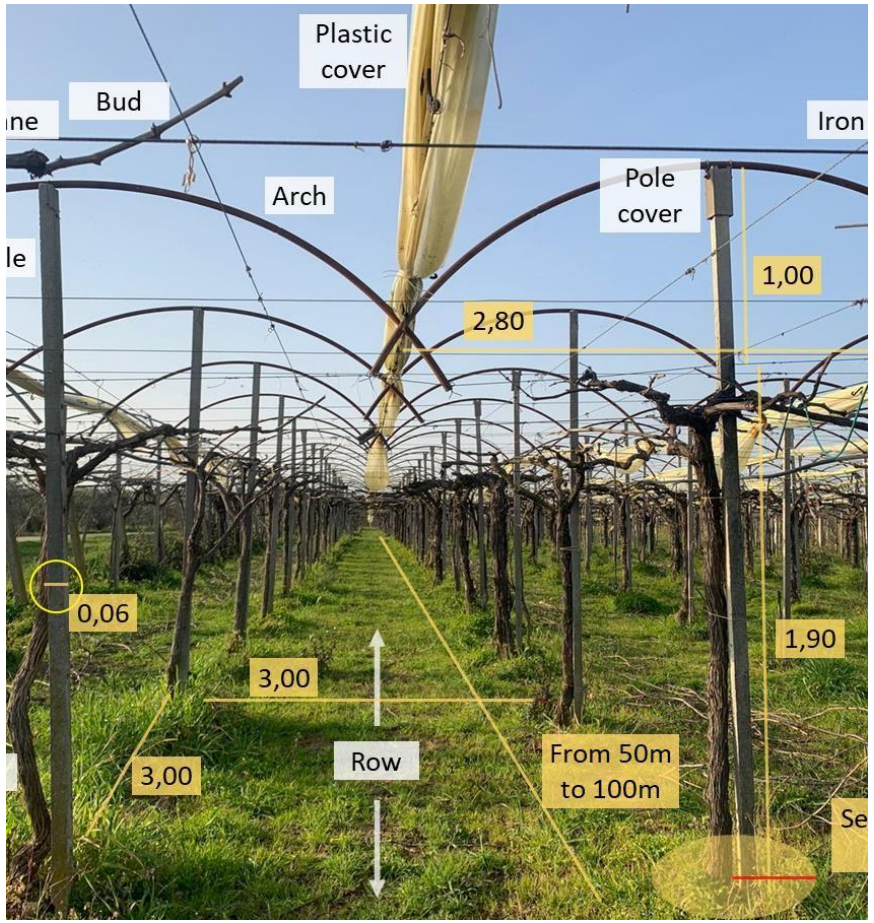
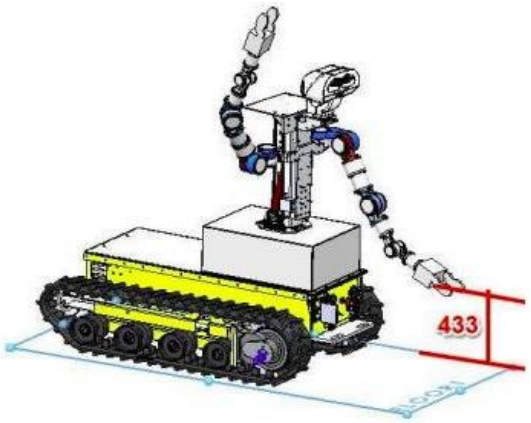
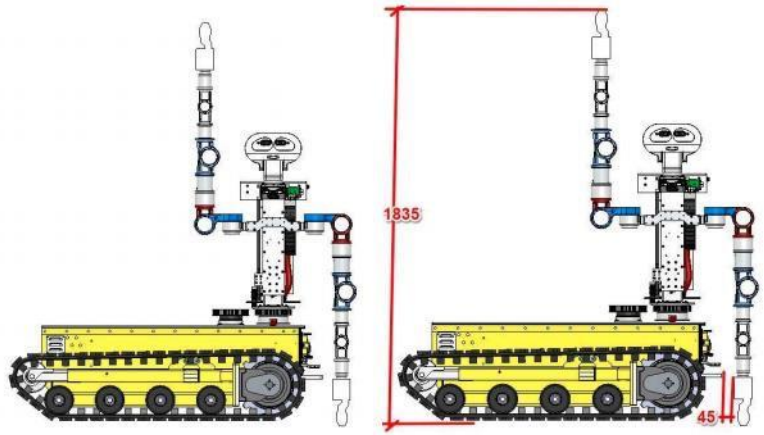
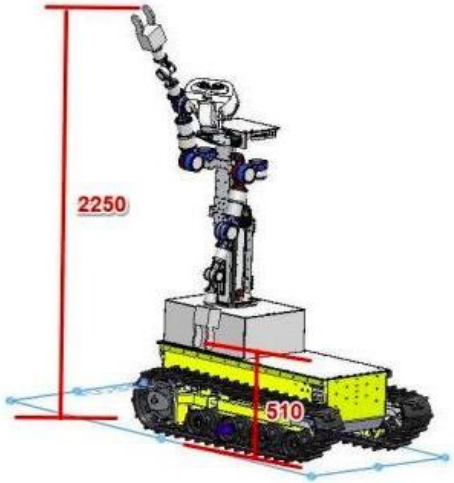
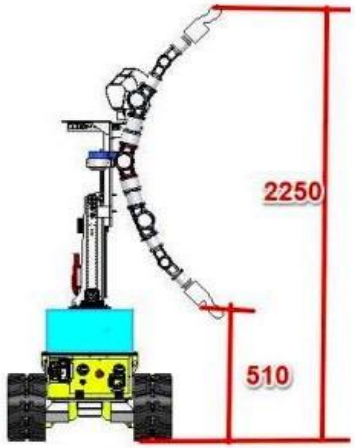
Robot - Reachability study

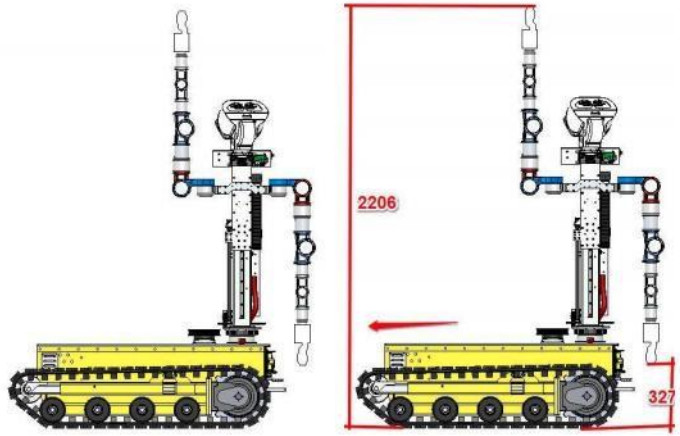












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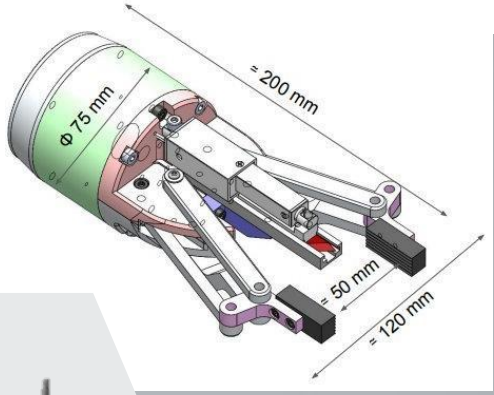
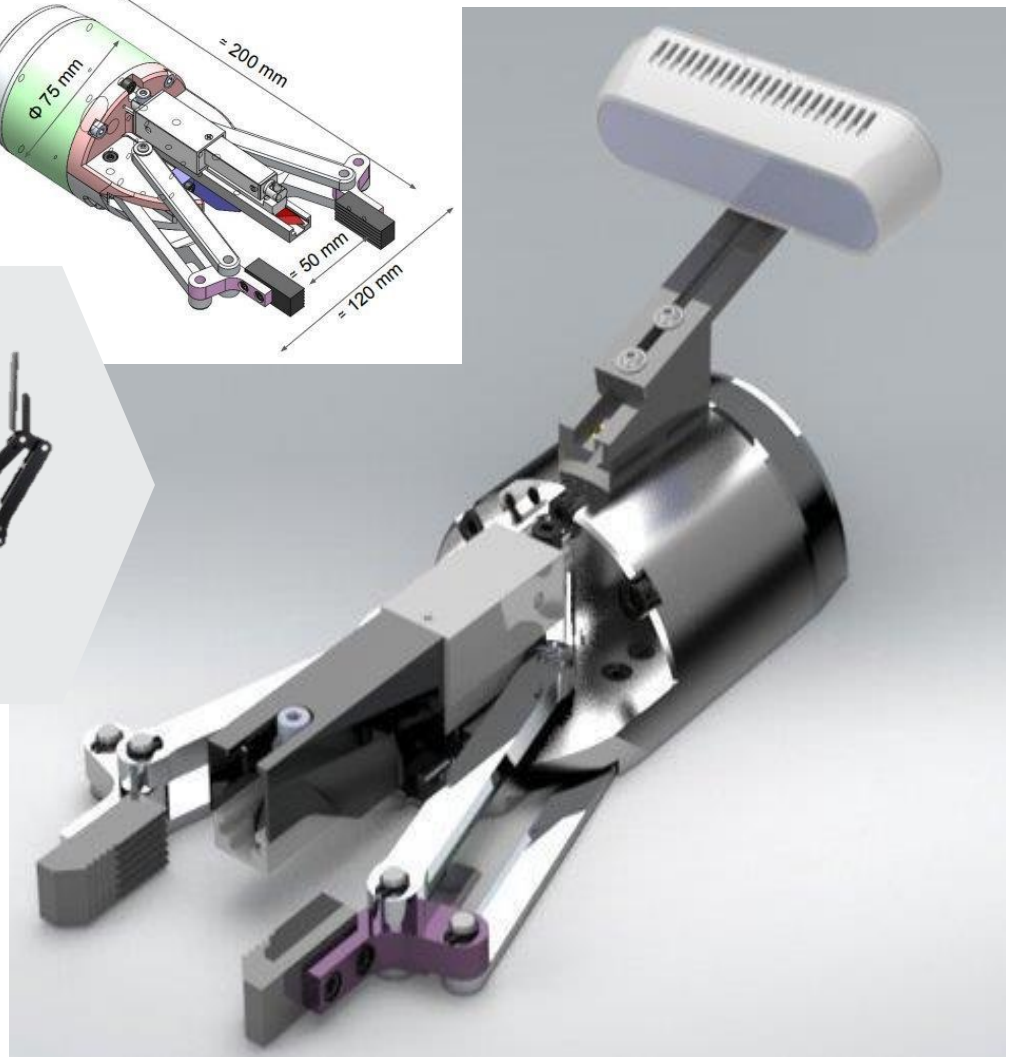
Robot - End Effector

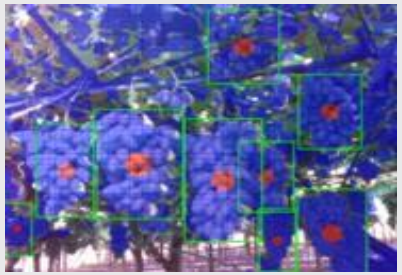


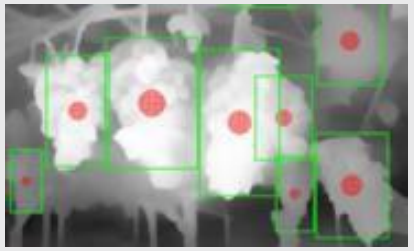


Agronomic perception

- Rilevamento grappolo e peduncolo
- Rilevamento tralci;
- Determinazione della qualità dell'uva, relativa maturazione e presenza di difetti/imperfezioni.

RGB-D sensors + GNSS + Multispectral sensor





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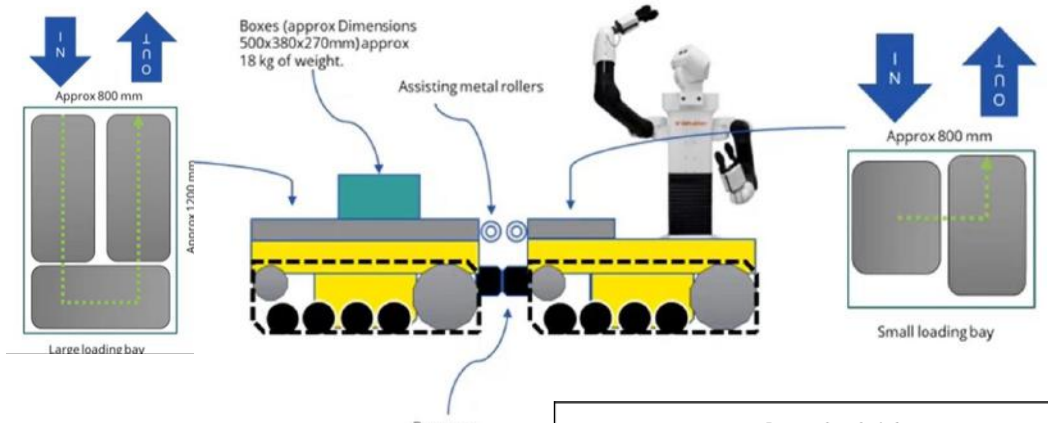
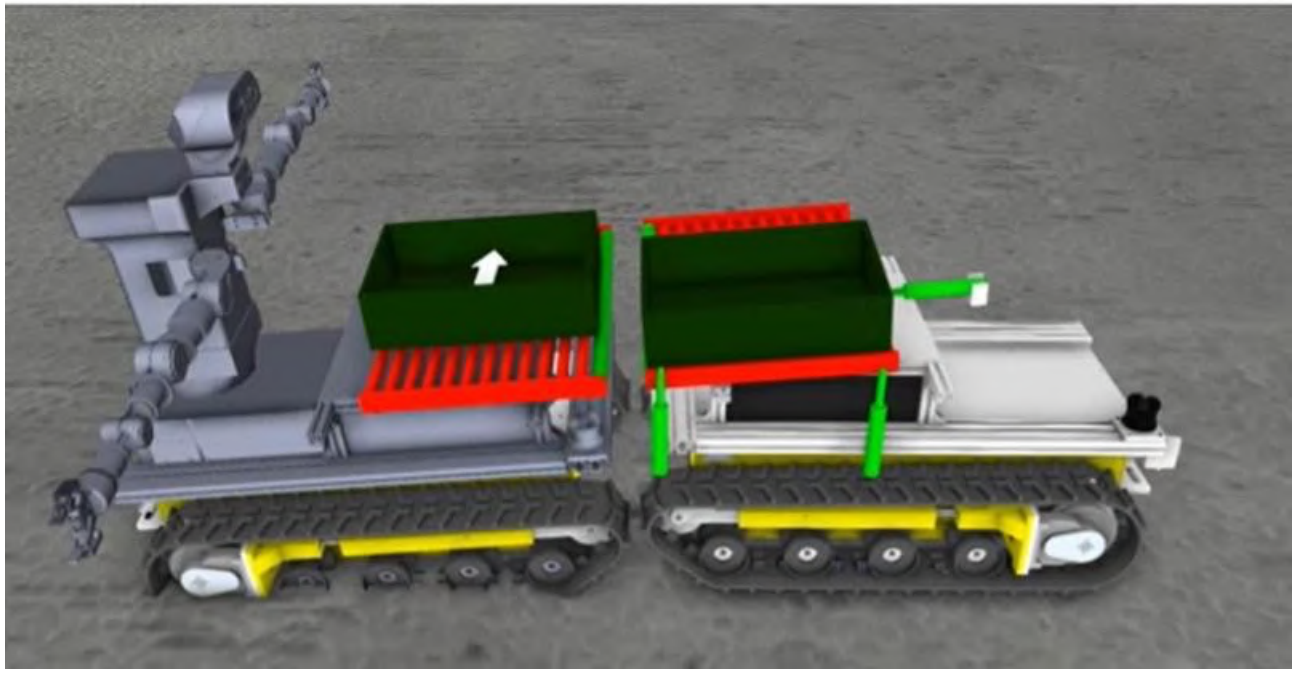
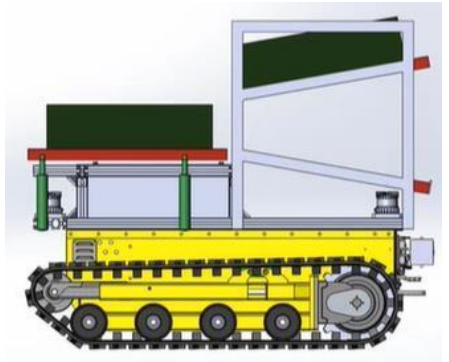
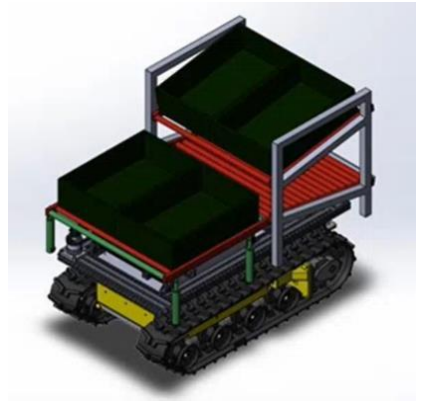
Robot - Box exchange mechanism



		Conveyor based solutions	
		mechanical alignment	articulated conveyor
misc			
Docking orientation		head-to-head	1 of any
# empty slots for exchanging full for empty box		2	2
KPIs			
hardware complexity		medium	high
software complexity		low	medium
overall robustness		?	?
which platform required an active mechanisms		both	both
off-the-shelf-components		medium	few
number of active mechanisms		4+	4+
Requirements			
max. footprint on farming robot	850x900 mm	+	+
max. footprint on logistic robot	850x1500 mm	?	?
max. Height on logistic robot	1.5 m	?	?
TRL	6	+	?
min. boxes on farming robot	2	+	+
min. boxes on logistic robot	4	o	o
ingress protection (IP rating)	IP54 or better	+	o
max. Price of modules	budget is 12k€ for farming, 24k€ logistic robot	+	?
max. roll alignment error	±10 deg	+	+
max. yaw alignment error	±20 deg	+	+
max. Out-of-horizontal alignment error	±10 deg	+	+
max. Horizontal alignment error	±100 mm	+	?
max. Vertical alignment error	±50 mm	+	+
max. gap between robots	±150 mm	+	+
sensor types	rugged enough for environment	+	?
box weight	up to 10 kg	+	+
distribution of mechanisms	active components only on one robot	-	-







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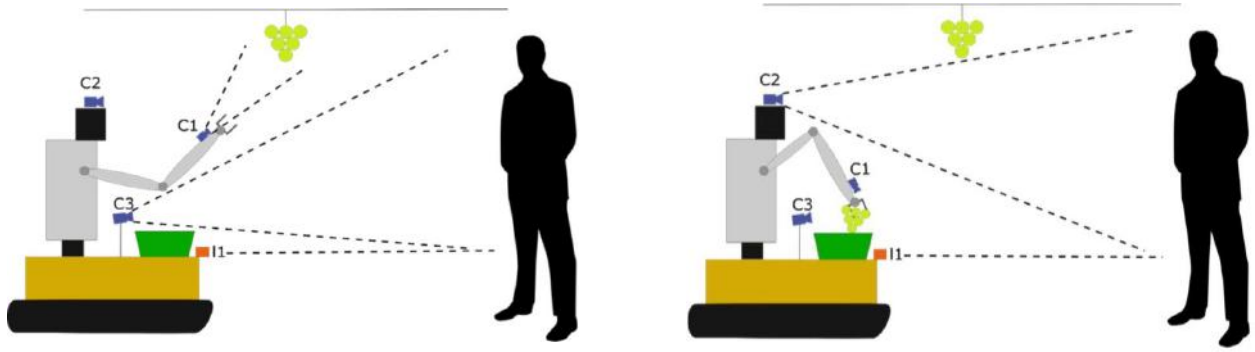
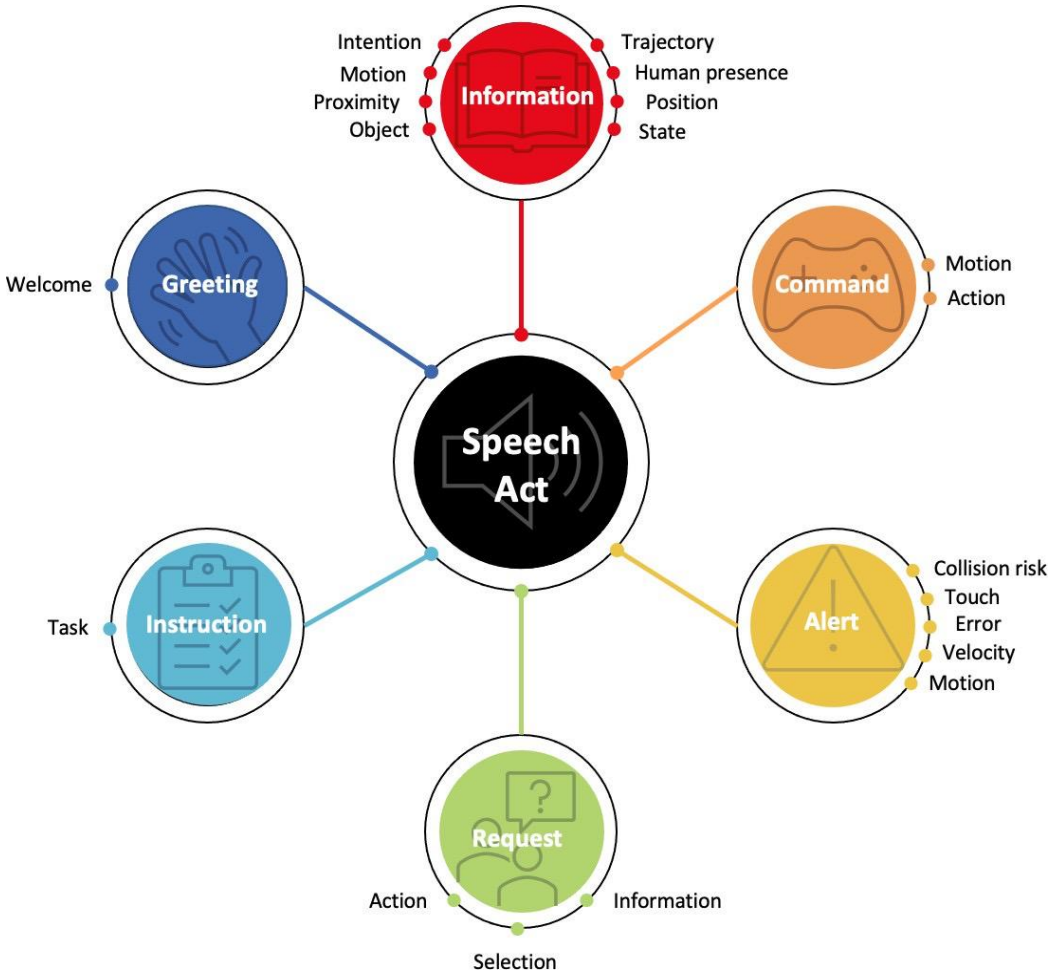
Robot - HR Interaction

	Information	Command	Alert	Request	Instruction	Greeting
Voice	✓			✓		✓
Gesture		✓				
Sound			✓			
Visual Signals	✓		✓		✓	





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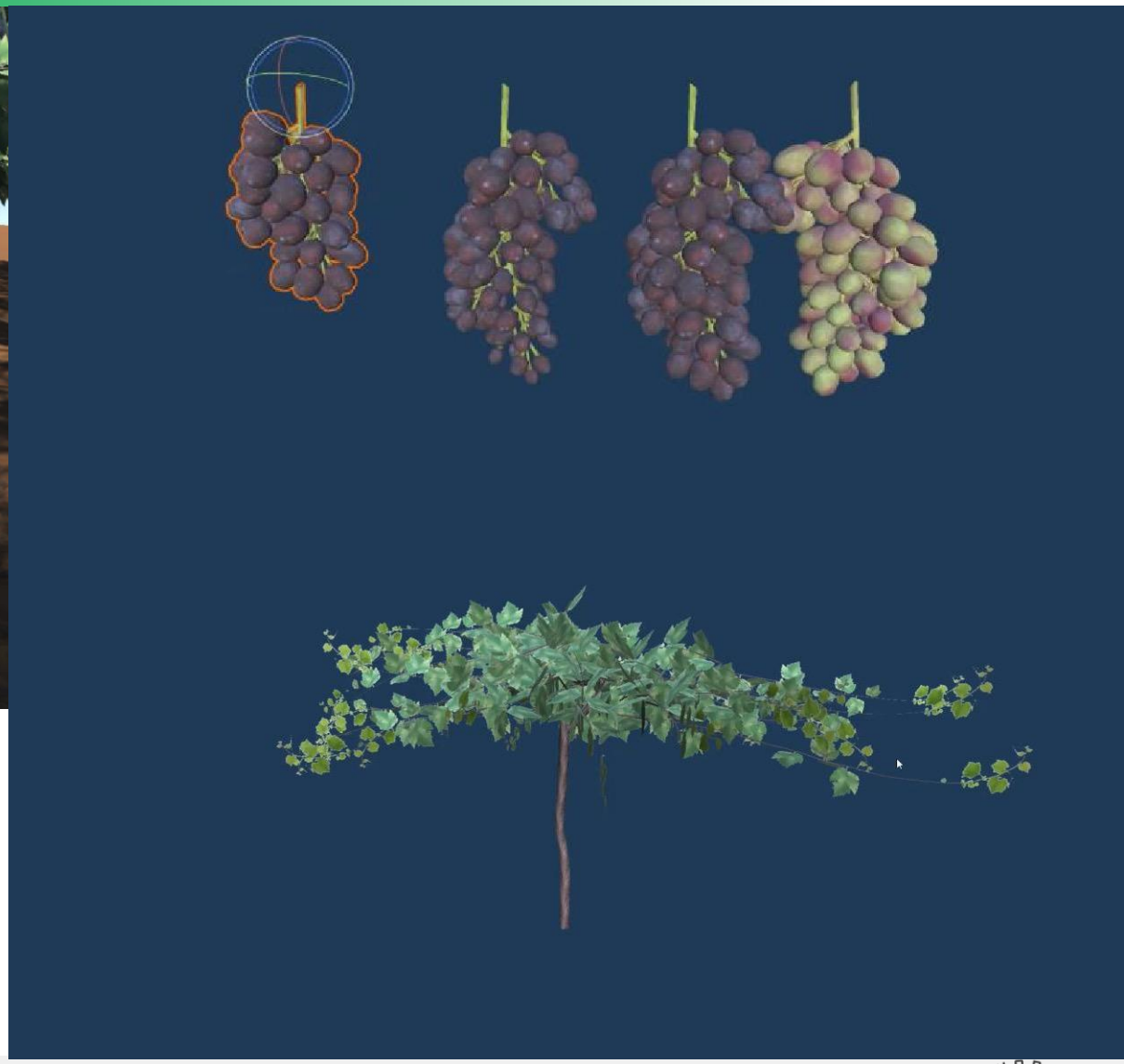
Robot - Virtual Reality



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