

CONFIDENTIAL



BEATRICE PROCOLI

Project proposals

collaboration with La Sapienza di Roma

for innovative projects with industrial robots



PROGETTO NON PIU' DISPONIBILE

Teach-by-show in Augmented Reality

Overview

GOALS

The project is intended to create an intuitive programming of industrial robots through gestures and augmented reality (AR) to teach a trajectory to the robot by using augmented reality (AR). *(required programming knowledge)*

SPECIFICATIONS

The idea is to record a robot trajectory with hand gestures or using a clear handheld marker to ensure a more accurate tracking. The user will be able to teach some targets in Point-To-Point or continuous mode. Thus, the robot should follow the paths accordingly. For this project, you will need the appropriate glasses (e.g. Microsoft HoloLens) or mobile devices to visualize the augmented world.

E.g. <https://www.youtube.com/watch?v=RPn4EnZ4V6M> – Berlin University

MILESTONES

1. Find the exact 3D mapping between the real points and the augmented world
2. Create a Point-To-Point trajectory and test the movements with the real robot
3. Create a Continuous trajectory and test the movements with the real robot
4. Add the singularity and out-of-range check during the recording phase

EGM Robot Programming and Camera integration

Overview

GOALS

In the project, the human should teach the robot movements with a camera-based system and forward them with the EGM control.
(*required programming knowledge*)

SPECIFICATIONS

PROPOSTA (A) NON PIU' DISPONIBILE

The proposal is divided in two sub-projects:

- ~~**PROPOSAL A:** the intention is to exploit the EGM ABB control and the Smart Robot system to replicate online and offline human movements (e.g. <https://www.youtube.com/watch?v=KPO6IO7Tr-Q>)~~
- **PROPOSAL B:** the aim is to explore the accuracy of a camera-based system in order to pursue new future pathways. The idea is to teach the robot movements bypassing the manual coding process.

MILESTONES

- A)
 1. Real-time replication of the human arm movements (joint-level move)
 2. Possibility to save the walked movements and repeat them off-line
- B)
 1. Find the 3D mapping between the camera and the real world
 2. Define a workobject with a handheld marker
 3. If the accuracy is satisfying, try to record some target points and test the robot movements.

ABB Robot controlled by Voice Commands

Overview

GOALS

The project aims at exploring ways to command an industrial robot using the human voice. The operator should be able to control or supervise the robot with voice commands (i.e. wearing headphones and microphone). *(required programming knowledge)*

SPECIFICATIONS

The student is free to decide:

- how to manage voice commands (i.e. the method to be implemented)
- how to use them (e.g. to execute a routine, to supervise the process, to control the robot: stop, start..)

MILESTONES

1. Speech-To-Text algorithm (open sources on GitHub)
2. Task choice: grammar-based (NLP, Microsoft Speech SDK) or key words-based (tree branch) method
3. Communication channel with the robot (EGM, RRI)

Object recognition with ABB Yumi Robot

Overview

GOALS

In the project, the Yumi robot should be able to recognise the objects in the workplace. This is a first attempt, to both introduce AI in quality control and testing the performance of the Yumi standard cameras. *(required programming knowledge)*

SPECIFICATIONS

The proposal includes the development of Computer Vision algorithms by using the cameras mounted on the hands of the Yumi robot.

MILESTONES

1. Find an object recognition algorithm
2. Exchange data between RobotStudio and PC algorithm (SDK)
3. Test and analyse the cameras performance (e.g. how accurately detect borders, distances, light conditions)

— NUOVA PROPOSTA DI PROGETTO

Avoiding Collisions in the Robot Task with Camera Sensor

Overview

GOALS

In the project, the system should be able to recognise the obstacles in the workplace and arrange a “new” path avoiding them. In this way the robot will accomplish the trajectory without collide with objects. *(required programming knowledge)*

SPECIFICATIONS

The proposal includes the development of Optimizing algorithms and Computer Vision skills by using a camera mounted in the workplace.

MILESTONES

1. Find the way to analyse the workplace according to the goal
2. Find the match between the robot programmed trajectory and the objects in the workplace
3. Develop an algorithm to generate a “new” viable path to accomplish the task
4. Optimize the trajectories generated by the previous algorithm.

ABB