Internship project: Arm movement tracking and 3D visualization.

Introduction

For having collaborative robots sharing their working environment with humans (operators), they must follow specific and well defined movement (paths) and behaviors. Safety is the main research topic when having a robotics collaborative working environment where operators can freely interact with the robots.

At the moment, the existing collaborative environments based their safety solutions in the principle that if the operator gets into the robot working environment, then the robot will stop. Although this behavior is intrinsically the safest, it does not let the robot continue with its task, which translates in a possible reduction of production and lose of capabilities.

Making the operators wear body motion trackers, brings the possibility of immersing the operators 3D models into the robots world, then the robots could have a real-time feedback of the operators current positions letting them re-plan their movement/path avoiding the operators body positions. Having the bodies 3D models giving feedback to the robots is not enough, operators, opposite to robots, can move in unpredictable ways, also, the 3d models kinematics must be as accurate as possible, otherwise the robot could collide with the operator.

ROS (robot operating system) is extensively used for robotics research, the developed solution must be able to visualize the arm movements in ROS (Rviz).

Description

This internship aims in researching, developing, and documenting a solution that:

- Tracks arm movements using IMU's (Accelerometer, Gyroscope and magnetometer) information.
- Visualizes the arm movements in ROS (Rviz) 3d model while making sure that the kinematics and movements match in real-time as accurately as possible.

For developing this tasks the mathematics behind the kinematics model and the filtering of the IMU's measurements must be properly implemented and well documented.

Deliverables

Must:

1. Working solution that visualizes in ROS (Rviz) the arm movements in real-time.
2. Research documentation where the accuracy of the developed solution is measured.
3. Report with all the decisions and calculations applied.
4. Integrating a 2d camera as a source of extra measurements for obtaining a more accurate and reliable solution. (Use Deep Neural networks for the 2D camera body tracker and integrate it using extended filters as Kalman.)

Could:

1. The developed solution is used to control the movements of a robot manipulator.
2. Extend it to having 2 arms/robots sharing the same work environment.

About the company

The Fontys mechatronics laboratory main goal is to recreate and solve industrial challenges while contributing to the education of Fontys students. The challenges that students face in the lab, are developed following strict use case scenarios that company partners face in a daily basis, because of that, students get to work in the most innovative topics, giving to our company partners a proof of concept before implementing new technologies. We are located at Rachelsmolen 1, 5612 MA Eindhoven , building R1 room 0.205.