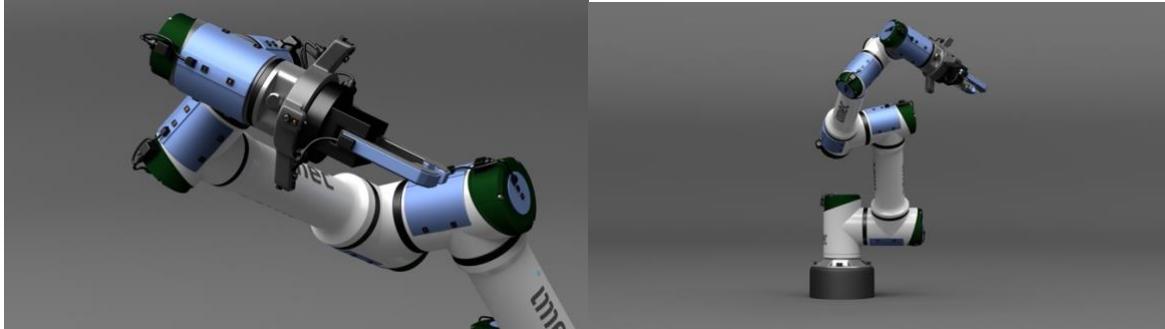# SAFEBOT: Development of an on-robot safety system enable safe human-robot interaction

Promotor: Bram Vanderborght
Supervisor: Constantin Scholz (constantin.florian.scholz@vub.be)(main contact),
Emil Imrith (emil.imrith@vub.be)

Background:
Collaborative-robots (cobot) is the fastest-growing category in robotics. However, their potential within the factory floor and outside has not fully been realised due to safety, usability and productivity considerations when working collaboratively with humans due to lower speeds. The current safety solutions to protect the operator and the surrounding area are causing workflow interruptions that cause lower speeds and productivity loss of the cobots. Furthermore, the solutions still pose a clamping risk, reduce the payload of the cobot, or must be installed externally, prevent flexible movement within the factory space, and result in limited viewpoints. Current solutions need to be certified by an Integrator which poses and additional barrier, cost and impact on the adoption time.

Use case:
Safebot aims to revolutionise an on-robot safety sensor system to enable secure contact-free collaboration with CoBots, rapid CoBot deployment and enable on-robot speed and separation monitoring. Our vision is to develop an on-cobot safety solution that will be installed initially as an attachment and later integrated into the CoBot Housing and with that is out of the box. SAFEBOT will enable cobot capabilities, productivity, and adoption. SAFEBOT would be an "out of the box" safety system in an ideal case. It would significantly lower the barrier to installing and using robots in the industry. The SAFEBOT technology is not exclusive to cobots but can also be utilised, e.g. Last-Mile Delivery, VR Headsets, Home and Social and Assistive Robots, Car Interiors.
Shortcomings of existing solutions:
Current safety solutions based on TS/ISO 15066 are not allowing for advanced collaborative robotics since they only allow for Coexistence (No fence but no shared workspace) or Sequential Collaboration (Robot and worker are both active in the workspace, but their movements are sequential). The goal of SAFEBOT is to overcome this stagnation and enable cooperation and responsive collaboration, where the robots respond in real-time to the worker's movement and always ensure worker security and maximise productivity and short cycle times.

Description MA2 thesis work: The project's aim includes the design of filtering algorithms, voxelisation of point cloud data, design of robot controllers, hardware fixtures to place LiDAR, RaDAR and StereoVision Cameras. The project is very versatile and interactive and well guided, students can work on hardware and/or software. The project can be tailored to the students' interests, and we expect the students to bring initiative and drive to join our exciting journey together with imec.

Technology Used: RaDAR, LiDAR, StereoVision Cameras, Universal Robot, RTDE Protocol, Simulink, Matlab, Nivida GPU, Xilinx FPGA

Number of possible students: 3-4 (Student groups are appreciated, that work well together.)