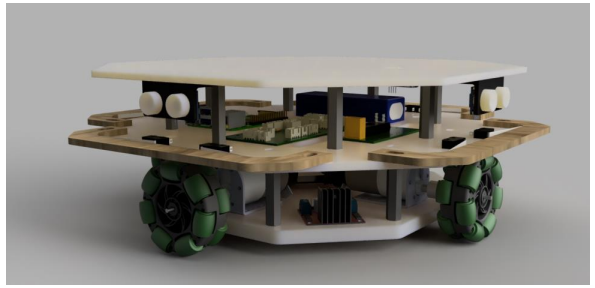
Towards self-learning robots (English version)

For robots to execute robust behavior, they need the ability to adapt to new environments and (changes in) their environment. This project aims to implement this adaptability in our already existing robotic software, which we use for sensor calibration and state estimation. The goal is to achieve a level of self-learning by which the robot:

- learns the effect of its actions on its state and environment
- can distinguish different situations
- can achieve a predefined goal, by choosing the right action in a certain situation
- …

Since we aim for a generic software framework, the methods should be able to be used on any kind of robot. The student will also set up experiments on (one of) our robots to evaluate the implemented methods.



<u>The work includes</u>

- Literature study
- Getting acquainted with the robot and current framework (python)
- Develop software for self-learning
- Evaluating the effectiveness
- Testing in our robotic sensing lab (Building K, 5th floor)

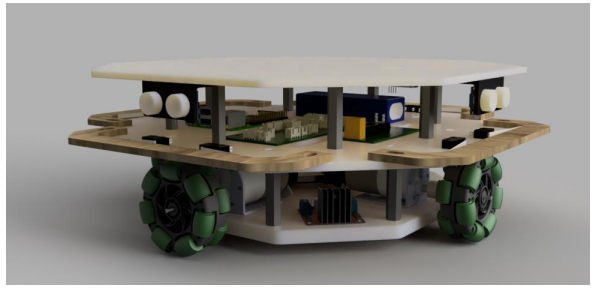
Supervision - Jan Lemeire, Nick Wouters

Onze robots zelflerend maken

Om robuust te zijn, moeten robots zich kunnen aanpassen aan (veranderingen in) hun omgeving. Dit project heeft als doel om dit aanpassingsvermogen te implementeren in onze reeds bestaande robotica-software, die we gebruiken om sensoren te kalibreren en voor staatestimatie. Het doel is om een bepaalde mate van zelflerendheid te bereiken waarbij de robot:

- leert wat het effect is van zijn acties op toestand en omgeving
- verschillende situaties kan onderscheiden
- een vooraf bepaald doel kan bereiken, door in een bepaalde situatie de beste actie te kiezen

Omdat we streven naar een algemeen framework, moeten de methodes gebruikt kunnen woorden op verschillende soorten robots. De student zal ook experimenten opzetten op (een van) onze robots om de geïmplementeerde methoden te evalueren



Het werk omvat

- Literatuurstudie
- De robot en ons framework leren kennen (python)
- Software voor zelflerendheid ontwikkelen
- De doeltreffendheid evalueren
- Testen in ons robotlab (Gebouw K, 5de verdiep)

Supervisie - Jan Lemeire, Nick Wouters

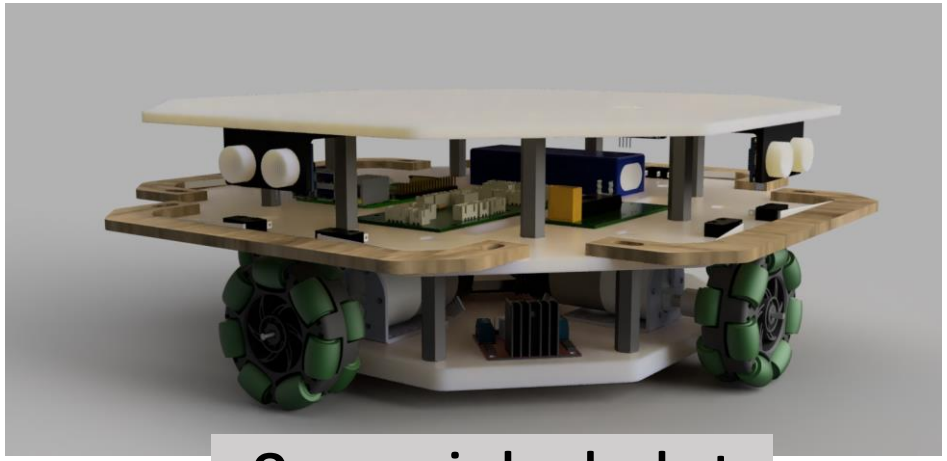
Improving the autonomy of mobile robots

For mobile robots to operate autonomously and reliably in uncontrolled environments, they need to be able to detect and recover from *expected and unexpected problems* that might arise while performing their tasks. Possible problems are obstacles, wrong estimation of position, broken sensor, wrong sensor values, etcetera.

To solve this problem, we propose a ‘smart’ Fault Detection, Isolation and Recovery (FDIR) architecture: the robot continuously monitors its own behavior to detect errors. Then the robot tries to find out what the problem is (called active diagnosis) and tries out several recovery strategies.

To develop algorithms, we will *emulate faults* and create problematic situations which the robot must solve.

The student will have the opportunity to work in our new robotics lab which has a testing environment, robot prototypes, various sensors and software to analyze the sensed data and implement the algorithms.



Our omniwheel robot

The work includes

- Literature study
- Getting acquainted with the robot and current framework (python)
- Implementing a real-time fault-handling process
- Setting up case studies
- Testing in our robotics lab (Building K, 5th floor)

Supervision - Jan Lemeire, Nick Wouters