# Plan of approach



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Date: 21-3-2017

## The project description

The multi robot transport project will be using decentralized control in the form of swarm behavior. In the project the transferring of parts between the robots will be researched. This can be used to optimize the flow of the products through the process.

The swarm will be a non-homogeneous set of robots, for example a reconnaissance robot equipped with a LIDAR or a robot specialized for transporting large parts and a robot specialized for transporting small parts. The standard parts of the robot shall not be adjusted.

The scrum method will be used in this project but there will also be a general planning.

For all the implementations safety will be researched using a risk identification and risk analysis.

The project will produce the following deliverables:

* Risk identification
* Risk assessment
* Risk reduction methodology
* Robot design
* Robot control system
* Description of robot logic
* Product loader
* Robot to robot transfer (simulated)
* Simulation

If it is possible within the timeframe of the project, then the following deliverables will also be produced:

* Robot to robot transfer with physical objects
* Safety measures according to ISO standards
* Product loader with physical objects

## Requirements and wishes

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| **Requirements** |
| Passing objects between robots in simulation. |
| Products have to be transported in the most efficient time. |
| Robots have to operate using swarm behaviour. |
| Product transfer has to be more efficient than re-routing the robot. |
| Robot has to have the possibility to transport objects. |
| Robot has to be subject to a risk analysis. |
| There has to be a structured docking/charging sequence. |
| The products are able to be transported with 0.7m/s. |
| The project has to use the scrum method. |
| The robots have to be able to autonomously dock/charge. |
| The robots have to be able to map the environment. |
| The robots have to be able to avoid obstacles. |
| The swarm has to share data between robots. |
| The swarm has to have specialized robots for specific tasks. |
| The documentation in this project have to be written in the English language. |
| The project is documented on GitHub. |
| The standard parts of the Turtlebots are not to be tampered with. |
| The Turtlebot's max payload is 5kg. |
| The maximum load to be moved will be +/- 2 kg. |

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| **Wishes** |
| Transferring physical objects between robots. |
| The robot and its systems have to comply with ISO-norms. |
| The robot has to load and unload objects. |
| The swarm behaviour has to be based on ants and/or bees. |
| Physical objects are not allowed to fall off the robot. |
| The project group has to be better than the other group. |

## Planning

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| --- | --- | --- | --- | --- |
| Task | Description | Start date | Days for the task | Deadlines |
| 1 | Plan of approach | 20-3-2017 | 7 | 1 |
| 1A | Project description | 20-3-2017 | 2 |  |
| 1B | Requirements and wishes | 22-3-2017 | 2 |  |
| 1C | Planning | 24-3-2017 | 3 |  |
| 2 | Simulation swarm + loader | 21-3-2017 | 31 | 1 |
| 2A | Simulation swarm | 21-3-2017 | 14 |  |
| 2B | Simulation loader | 31-3-2017 | 14 |  |
| 2C | Simulation swarm + loader | 10-4-2017 | 11 |  |
| 3 | Robot loader design | 21-3-2017 | 31 | 1 |
| 3A | Robot designconcepts | 21-3-2017 | 3 |  |
| 3B | Prototyping | 24-3-2017 | 7 |  |
| 3C | Rough design | 31-3-2017 | 7 |  |
| 3D | Testing | 7-4-2017 | 7 |  |
| 3E | Final design | 14-4-2017 | 7 |  |
| 4 | Risk identification | 31-3-2017 | 3 |  |
| 5 | Risk reduction methodology | 7-4-2017 | 14 |  |
| 6 | Swarm with robot to robot transfer | 20-4-2017 | 50 | 1 |
| 6A | Swarm with leds | 20-4-2017 | 20 |  |
| 6B | Robot to robot transfer | 30-4-2017 | 20 |  |
| 6C | Swarm with robot to robot transfer | 10-5-2017 | 30 |  |
| 7 | Robot control system | 12-6-2017 | 7 | 1 |
| 8 | Description of robot logic | 12-6-2017 | 7 | 1 |
| 9 | Buffer time | 19-6-2017 | 12 |  |
| 10 | Buffer time | 30-6-2017 |  | 1 |

