Table of Contents

Welcome

Project Willy

Getting started

Build of Willy

Robotic Operating System

Architecture

Hardware nodes

Components

Skylab

Radeffect App

Lessons learned

Archive

Welcome

Project Willy

Getting started

Build of Willy

Robotic Operating System

Architecture

Hardware nodes

Components

Skylab

Radeffect App

Lessons learned

Archive

1. ToDo and Advice

1.1. TODO table

Table 1. List of todo items according group 2018 Q3-Q4

Description	BIM	SE	IDS-ESA
Collecting more sensorinformation. Ie. when Willy drives over a bump this information is collected to analyse if the floor needs maintaince.	X	X	
Create multiple smaller Willies that collaborate and drive around on diffrent locations.	X	X	
DataScience: Collect more data to analyse the input of all topic information. Use more machine learning.	X	X	
Financial planning: Develop more financial resources like sponsorship.	X		
Develop financial ownership and responsibility	X		
Develop sponsoring and donationprogram. Financial funding of Willy needs to improve to be able to invest in newer features.	X		
Marketresearch: The physical hardware will eventually run out of development options. Upgrade to Willy 2.0	X		X
Develop emotion and expression recognition.	X	X	
Develop autonomous driving on other locations than T5 Windesheim without the need of AprilTags or other learning features.		X	X

Description	BIM	SE	IDS-ESA
Implement GPS module for outdoor navigation.		X	
Research navigation in an area with alot of glazing.	X		
Improve autonomous driving specifically for the measurement and movement of Willy.	X	X	
Improve hardware and software for listening. Reduce impact of environmental noise.		X	
Extend Willys speech. Introduce multiple voices and languages.		X	
Extend survey options with open or more difficult questions.	X	X	
Secure Willys webpage.		X	
Integrate Social Interaction without the need of Hello Willy.		X	
Develop speech driving options.		X	
Create new functions like a Robotarm.	X	X	X
Develop AC power features. Willy can be powered on even when not around.			X
Redesign Skylab. Remove a few hypervisors to make it more manageble.			X
Move the Skylab machines to the corperate cloud of Windesheim.			X
Remote power reset for multiple machines on Willy.			X
Adjust VPNtunnel between Willy and Cloud. Make MultiMaster usable in Skylab.			X
React on emotions and expressions.		X	
Improve look and feel of Willy.	X		
Use the outcome of the research of Willys social interaction.	X	X	
Benefit of the communication between Social Interaction and Navigation. Ie. drive around if Willy is happy.		X	

1.2. Advice

The client walks in to Windesheim University of Applied Sciences and is being welcomed by Willy. Willy can drive autonomic inside and outside the University and makes contact to people. During a conversation Willy can recognise human emotions, so he can tell a joke to cheer people up.

Multiple teams have worked on the projects Willy to realise that dream for the client however there is still much work to be done.

We have described a few possible future technology projects for our client and project team in the TODO list. :numbered: :toc: :toclevels: 5 :icons: font

Getting started

Build of Willy

Robotic Operating System

Architecture

Hardware nodes

Components

Skylab

Radeffect App

Lessons learned

Archive

> This pages needs to be up to date. 9-1-2019 latest updated.

2. Lessons Learned

This page contains a list of lessons we learned during the development of Willy during 2018 semester.

2.1. Driving

- It is quite hard to deploy and undeploy the brakes.
- When the battery voltage drows below a certain level, Willy will stop driving at irregular intervals. This is probably an internal security system. The brakes are also deployed causing an abrupt stop.
- When driving manually, Willy uses characters pressed on the keyboard to move. When a lot of characters are pressed in a short time, Willy will try to process the complete list of characters,

seeming to be uncontrollable.

- Willy has difficulty driving through doors when driving autonomously. This is caused by Willy being quite wide and limitations in the software for autonomous driving.
- The ultrasonic sensors have a lot of blind spots. Since the LIDAR can’t scan the back of Willy, the ultrasonic sensors are the only sensors controlling the back of Willy. When Willy is driving backwards, this can cause problems.

2.2. Design

- Because of the width of Willy with garbage bins attached to the side, it is impossible to go through a door without detaching the bins, including the detachable buffers with ultrasonic sensors in it.

2.3. Software

- The motor controller is a device that is used to control the cmd_vel topic created by the ros navigation stack. The ros navigation stack published geometry::Twist messages
- ROS is complicated and difficult to learn. But if everything is setup just right, ROS makes it really easy to communicate between your hardware.
- If you want to create files to start multiple projects? Do not use bash files. ROS can’t handle bash files properly. use ros launch files instead.
- The making of the DrivingController was a complex situation. That is because of the fact every ROS node has only one ROS nodehandler. To make it possible to subscribe and advertise everywhere in the DrivingWilly code, we must send the nodehandler to every subcontroller by using pointers. This request a detailed knowledge of C++ and ROS.
- The setup of the ROS navigation stack is difficult because of the fact that every robot is different. A lot of components needs to be setup on your own. As example the move_base, the transformations and rotations and the cmd_vel topic.

2.4. Hardware

- The current batteries should be powerfull enough to power the current Willy.
- The 230 volt touchscreen in combination with the power converter is replaced by a 19v display.
- The brakes are not easy to deploy. Thats because the levers on the side of willy are to loose to deploy the brake. We can’t tight them because the screw is malformed.
- The GPS sensor and compass only work outside and are controlled using the GPSController.
- The kinect cannot be used outside. The IR camera can’t handle the bright sunlight.

3. Navigation

- Move_base as of this moment is not aware of the shape of the robot. This results in issues where the robot thinks it can pass between objects or rotate while in reality it can’t. It advisable to make move_base aware of the shape of the robot.

- The global planner has not been tuned yet. As of this moment it tries to create a route which is very close to the walls because it wants the fastest route. It would be better for the robot to be driving in the middle of a hallway then hug the wall. The global planner als makes very sharp corners which the robot can't handle very well. A custom planner or tweaking the standard planner can help a lot.
- The the default default planner which is currently in optimized for a robot with powered rear wheels and a steering front wheels like a car. However willy has two powered wheels which steer using differential power and two swivel wheels.

3.1. Social interaction

- The ambient noise can make it hard to speak with Willy. We used the mute function on the microphone provided with Willy.
- The speech of Willy can be rather robotic.