MASTER’S THESIS
PROJECT PLAN

August 2014

Robot control by user tracking with a laser range scanner

Author:
Ivo STEINMANN

ID: 02-906-519
Semester: 6th
EMail: ivost@ethz.ch

Supervisor:
Jiwon SHIN
1 Project Description

1.1 Overview

SmartWalker is a high-tech extension of a walker that aids people of reduced mobility in moving around. The walker is equipped with sensors and actuators and is designed to function both autonomously and non-autonomously. This project addresses the challenges in the non-autonomous mode, in particular, controlling the walker’s velocity according to its user’s movement. The goal of this project is to develop a human detection and tracking algorithm and use the information to control the walker. The work will involve processing laser data to detect and track the user’s leg movement, writing a control loop for the walker to move accordingly, and testing the algorithms with real people in various environment.

1.2 Scope of the work

Non-autonomous-Mode (primary)

- Description of different leg shapes
- Leg movement/walking characteristics, especially of older persons
- Leg detection behind the walker
- Walking detection
- SmartWalker wheel control in coordination with leg movement/walking

Autonomous-Mode (secondary)

- Leg detection in front of the walker (automatic mode)
- Walking detection
- SmartWalker follows the walker

1.3 Intended results

A person behind the walker is detected by its legs. The moving of the SmartWalker is controlled by following the leg movement.

2 Background Material

2.1 Reading list

- A novel system for tracking pedestrians using multiple single-row laser-range scanners [8]
- Detection and tracking of multiple pedestrians by using laser range scanners [6]
- People Tracking Using a Robot in Motion with Laser Range Finder [5]
- Multisensor-Based Human Detection and Tracking for Mobile Service Robots [1]
- Detection and tracking of human legs for a mobile service robot [4]
- Fast line, arc/circle and leg detection from laser scan data in a player driver [7]
- Detection, motion planning and control of human tracking mobile robots [3]
- Detection of Human Pairs of Legs in 2D Laserscans [2]
3 Project Management

3.1 Objectives and priorities

1. collect laser scanner data from different situations (high)
2. human leg and walking detection by two legs, eg. wearing shorts or pants (high)
3. human leg and walking detection when wearing a skirt (mid)
4. find a model to translate the walking detection into SmartWalker movement (Non-autonomous-Mode) (high)
5. include the environment into the movement control, eg. obstacle avoidance (mid)
6. report (high)

3.2 Criteria for success

The SmartWalker’s movement can be controlled by the person behind the walker just by walking.

3.3 Method of work

- Use well know Software Engineering concepts, like Design Patters, Testing Suites
- Continuously write down a log book (makes writing the thesis simpler at the end)

3.4 Quality management

- Permanent testing of the source code
- Tests with real people

4 Plan with Milestones

4.1 Project steps

1. leg detection
2. walking detection
3. SmarkWa

4.2 Deadline

February 2015

4.3 Tentative schedule

5 References


