Final Report - Mobile Robot of class (3,0)

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Intermediate Project
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Abstract
Main goals

- Build mobile robot of class (3.0)
- Construct the Mecanum wheels.
- Program the robot.
- Implement the 'linefollower' algorithm.

Assumption

- Wheels will be printed in 3D printer.

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1 Introduction

1.1 Background

Main task of the project was to construct the mobile robot of class (3.0) with four Mecanum wheels. Class (3.0) describe the holonomic robots and denote that robots could move sideways without change the orientation. To create omnidirectional platform we can use several kind of wheels like: castor wheels, Swedish wheel and Mecanum wheels. In some case the Swedish and Mecanum wheels are treated as the same wheels, but they differ in structure.
The aim of this project was to complete following points:

- Build mobile robot of class (3.0)
- Construct the Mecanum wheels.
- Choose proper electronic parts and integrated circuits for project purposes.
- Test circuit and find flaws and mistakes made during the design stage
- Write microcontroller software capable of completing project tasks.

2 Project hardware

To design the circuit board I have used open source KiCad. First step was to prepare schematic diagram, that later served as basis to they physical layout design stage. The figure (1) show the final robot. The figure (2) show how robot move.

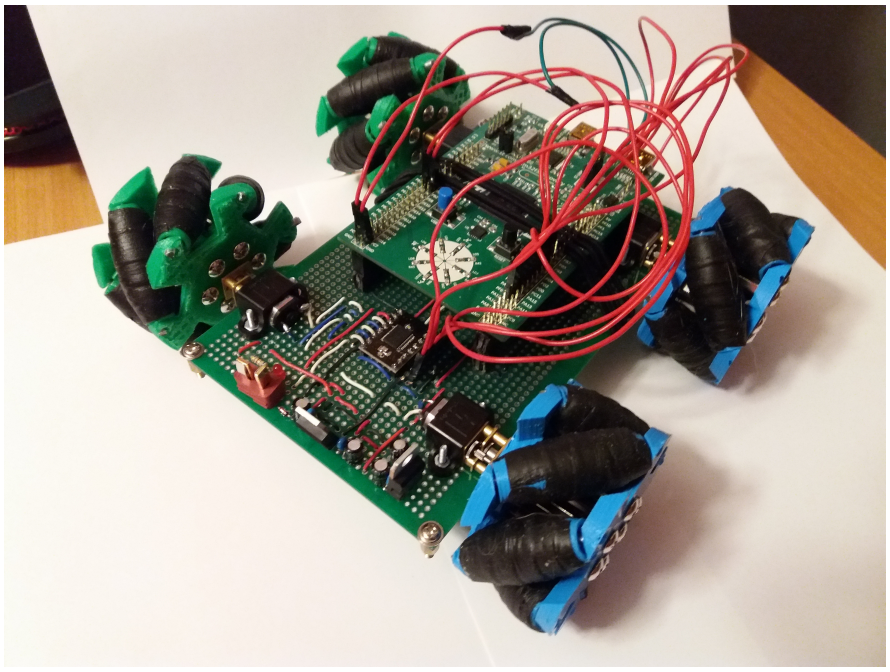


Figure 1: The real platform

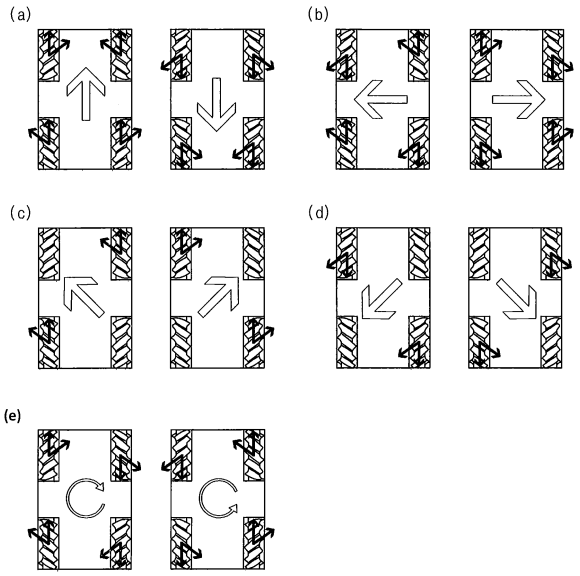


Figure 2: Move of the robot

2.1 Wheels

Wheels are created in program Adobe Fusion 360.
Mecanum wheels possesses roller situated on the edge of wheel and at an angle 45^o to the axis of wheel. The robot need two kind of wheels: left and right. It depend, where the wheels have to be situated and in which direction rollers are situated. The figure (3) show the model of the robot and wheels and rollers position.

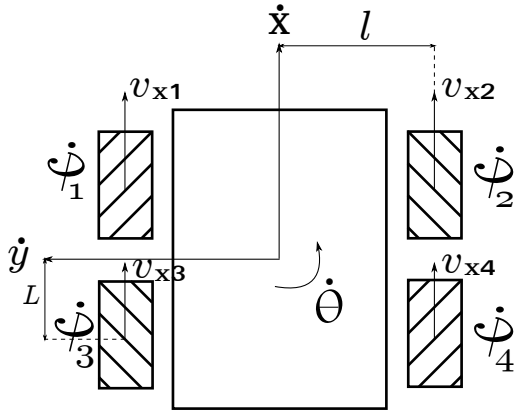


Figure 3: Model of the robot

- Roller - each of wheels need six rollers. To avoid slide rollers are en winded by self-vulcanizing tape.

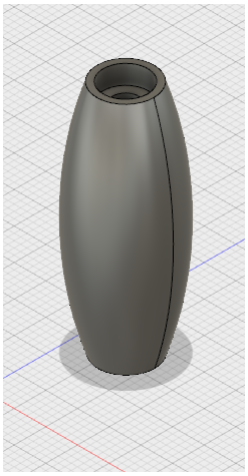
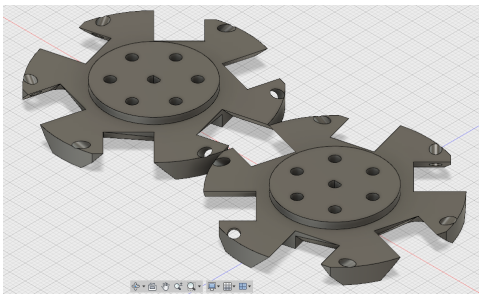
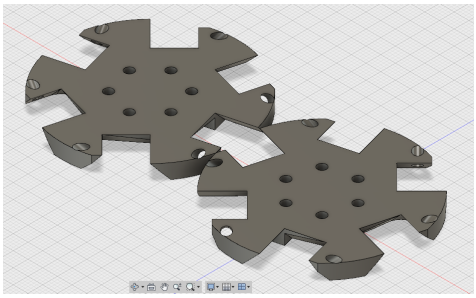


Figure 4: Roller - project

- Hub

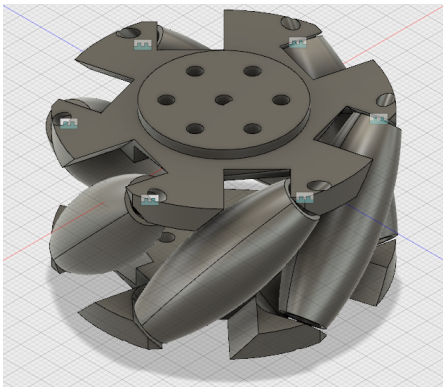


(a) Internal hub

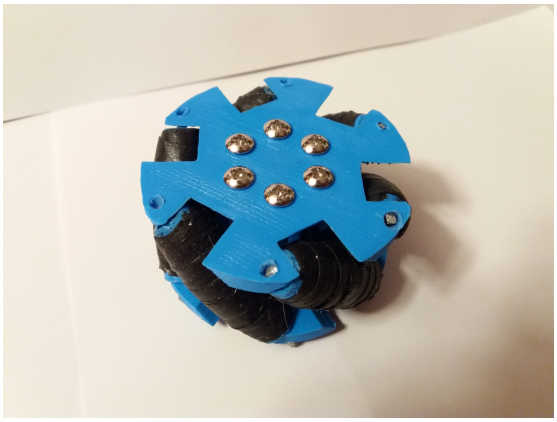


(b) External hub

Figure 5: Hubs



(a) The wheel model



(b) The real wheel

Figure 6: Wheels

2.2 Microcontroller

The STM32F3DISCOVERY board with STM32F303VC MCU was used as a main control unit. It was used so powerful unit, because the project will be expand to move on a line, avoid obstacles and move autonomously in the future. The second reason why I use DISCOVERY board was desire to learn how to program such board and get information about it.
Software for the microcontroller was developed in System Workbench for STM32, STM32 ST-LINK Utility - to program microcontroller, STM32CubeMX. Edition - free licence under certain constraints like non commercial use. All begun with the processor configuration and input/output configuration.

2.3 Motor controller

Two H-bridges TOSHIBA TB6612FNG driver IC for dual DC motor was used. One TB module could control two motors. I decide to use this module because of their simplicity and common in use. Some advantages: power supply voltage VM=15V (Max), output current Iout=1.2A(ave) / 3.2A (peak), standby (power save) system.

2.4 Motors

I chose to use POLOLU motors with gear 10:1.

3 Results

Main goal of the project was accomplished. The robot and the four Mecanum wheels were build. It is no problem for platform to drive straight ahead. Problem occurs when robot has to drive sideways. Motors are too weak to rotate the wheels on the ground. Small summary:

1. It turned out that motors was bad chosen, because they sometimes cannot rotate the wheels, when robot was on the ground.

2. Implement the 'linefollower' algorith fail because lack of time.

4 bibliography

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