Praktikum: 3

Telebot: first try

Lecturers

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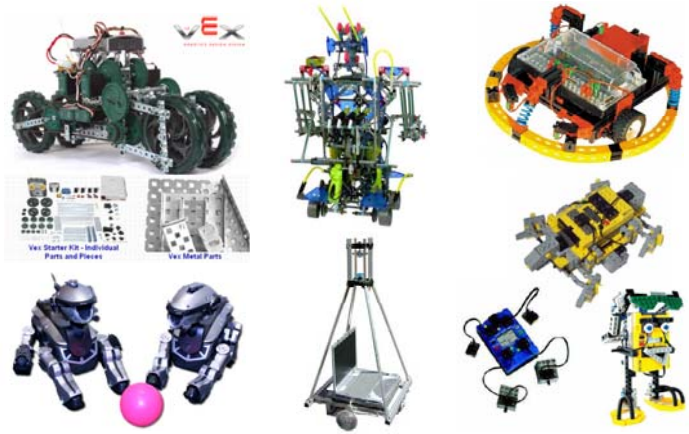


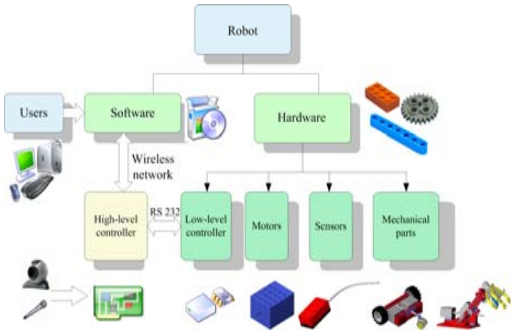
Content of today's lecture

- Introduction to Lego mindstorms
- Telebot system: first experiments
  - Introduction
  - Components
  - Hardware realization
  - Integration
  - Possible tasks
  - Implementation: mechanical system, programming, testing
- Final evaluation

Web links for today

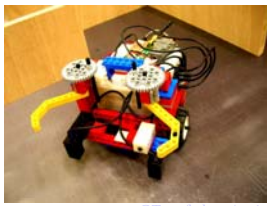
- **Lego mindstorms**
  - http://mindstorms.lego.com/default.aspx?domainredir=www.legomindstorms.com
- **Telebot project**
  - http://tams-www.informatik.uni-hamburg.de/people/hzhang/projects/index.php?content=Telerobot

Overview of the Telebot



Telebot system introduction

- Telebot (TAMS group based on cooperation with BUAA, 2006)
  - 9 channels for sensor inputs; 4 outputs for actuators
  - Communication interface
  - Java and C++ programming easy
  - More flexible and extended functions



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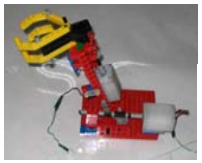
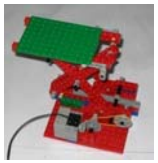
Components

Components (cont')

- Lego 9640 set 1 set
- 1 battery 1 x 8 /set
- Wireless serial interface 1 x 2 /set
- Actuators 1 set
- Sensors 1 set
- Microcontroller 1 set
- A box for all components 1 set

Components (cont')

- Functionality
- Extensibility
- Easy handling
- Low cost

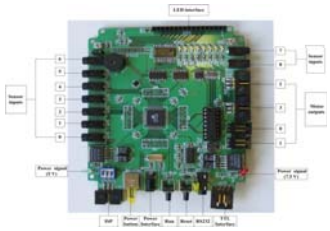




Components (cont')

- Lego 9640 set
- 1 battery
- Wireless serial interface
- Actuators
- Sensors
- Microcontroller
- A box for all components

Hardware realization: controller B

- ATmega16 microprocessor.
- The sensor channels from 0 to 6 can be used as digital or analog inputs; 7 and 8 can only be used in a digital way.
- Power supply should be 8.4V-24V
- Two communication interfaces on board: RS232 and TTL
- ISP for downloading the drivers
- Motor outputs 0 and 1 can be controlled by PWM signals; 2 and 3 are only under the on-off mode.

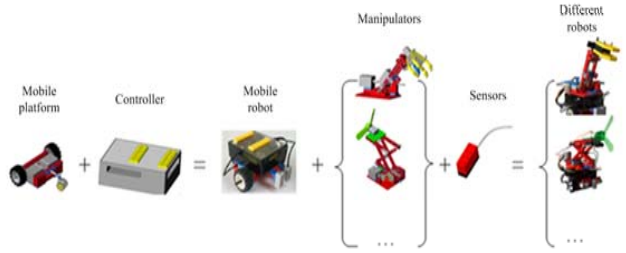


In-System Programming *(abbreviated ISP) is the ability of some programmable logic devices, microcontrollers, and other programmable electronic chips to be programmed while installed in a complete system, rather than requiring the chip to be programmed prior to installing it into the system.*

Hardware realization: sensors

Kinds	***Purposes***	***Number***	***Photo***
Color sensor	*Detect black and white*	*2*	
Object sensor	*Detect objects in front*	*2*	
Light sensor	*Detect an illuminant object such as a candle or a lamp*	*2*	
Touch sensor	*Switch*	*2*	

System integration

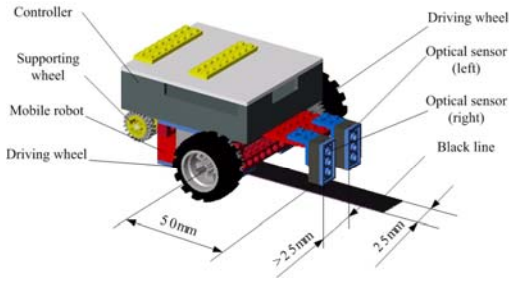


Possible tasks for our practical course

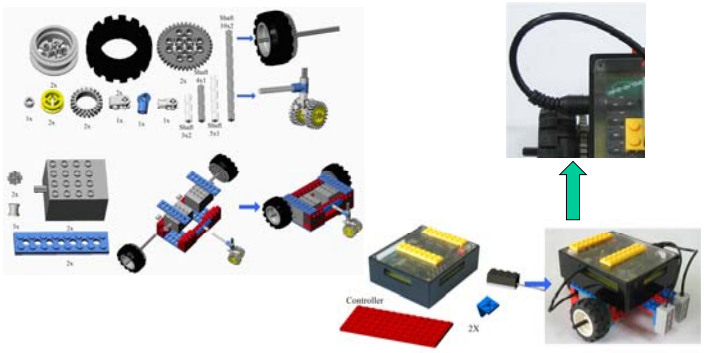
- Moving along a line
- Detecting and moving around an obstacle
- Looking for an object
- Following a moving object
- Mapping the scenario
- …

Implementation

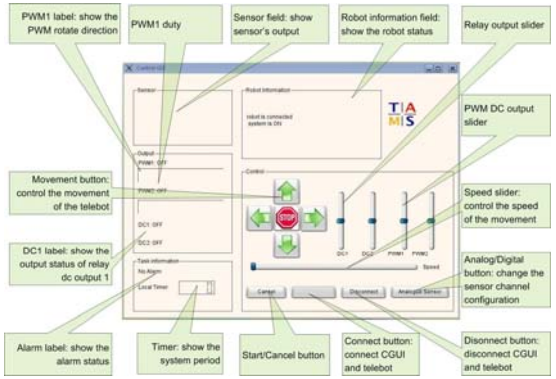
- Building mechanical system
- Programming
- Testing



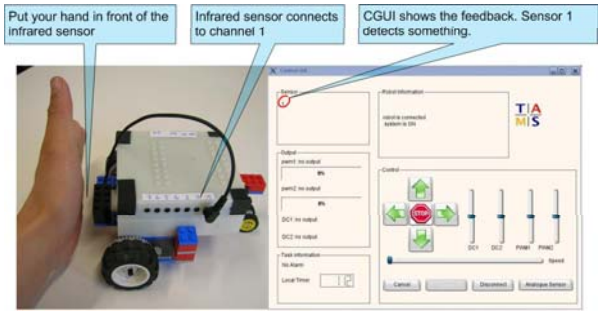
Building the mechanical system



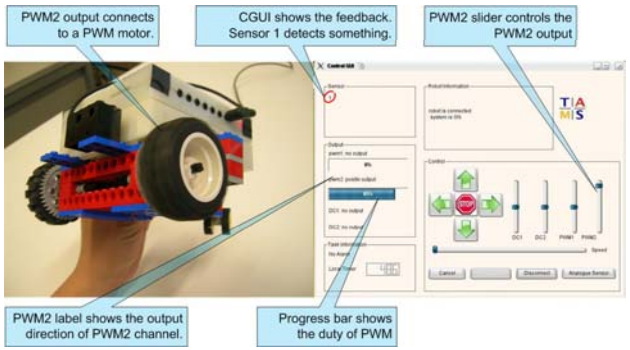
GUI



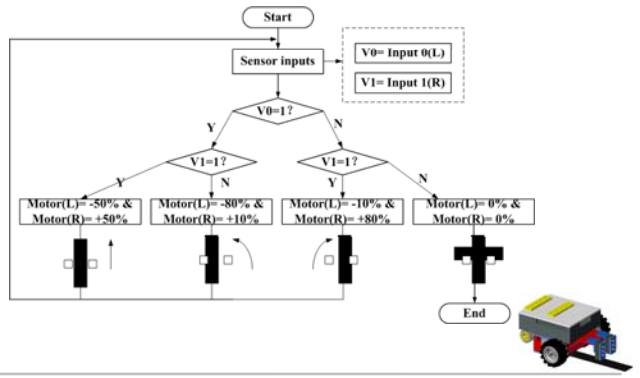
Testing the hardware



Testing the hardware (cont ')



Programming the robot



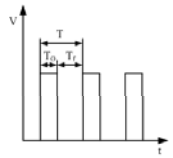
Hint: What is PWM?

- **PWM** Motor. This motor is connected to the PWM output channel of the low-level controller. The rotation speed and the rotation direction are adjustable.
- **Pulse-width modulation** (PWM) of a signal or power source involves the modulation of its duty cycle, to either convey information over a communications channel or control the amount of power sent to a load.

http://en.wikipedia.org/wiki/Pulse-width_modulation

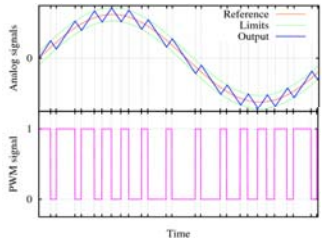
Hint: PWM

- The PWM uses controller to create a high frequency pulse signal to drive on and off of signal. The duty (percentage of On time to PWM period) on the motor will determine the output flow rate or speed to the motor.



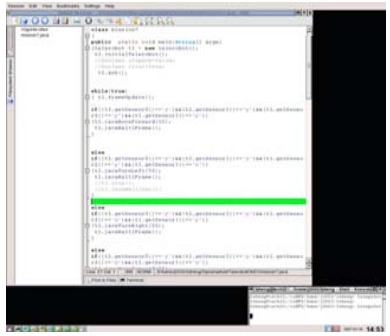
- A typical PWM signal is shown in figure, where T is PWM period, To is On time.

$$\tau = \frac{T_o}{T} \times 100\%$$



- The relationship between the duty of actuator and its output speed is shown in other figure. The bigger the duty, the bigger the output.

C and Java programming environments



Now run a test on you own!

Discussion……

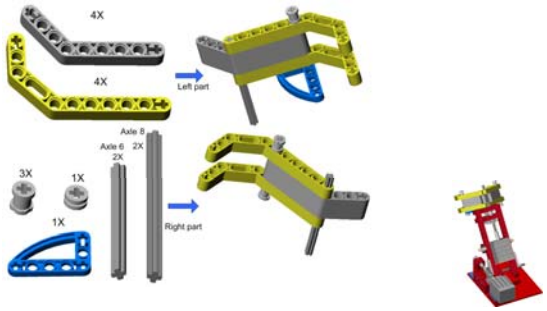
Testing: Mechanical experience

- Task 1. build a robot with a gripper
  - To grasp an object.
  - Please test your mechanical platform.

Task 1: Build a robot with a gripper

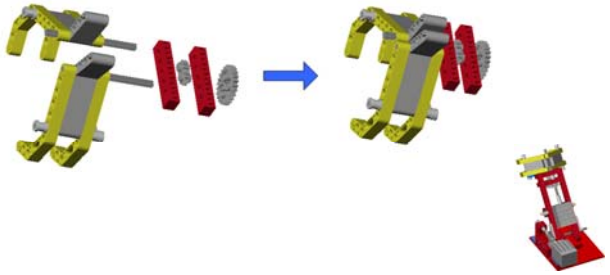
Task 1: Build a robot with a gripper

- Step 1



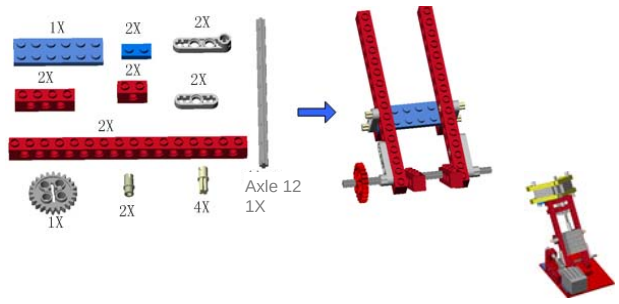
Task 1: Build a robot with a gripper

- Step 2



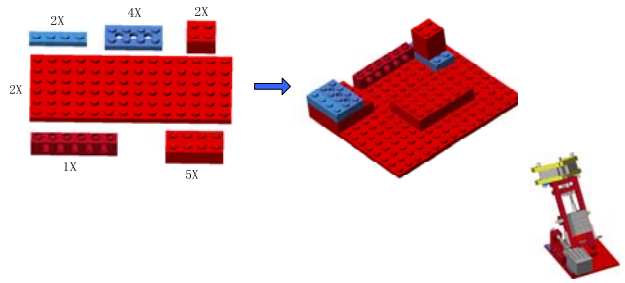
Task 1: Build a robot with a gripper

- Step 3



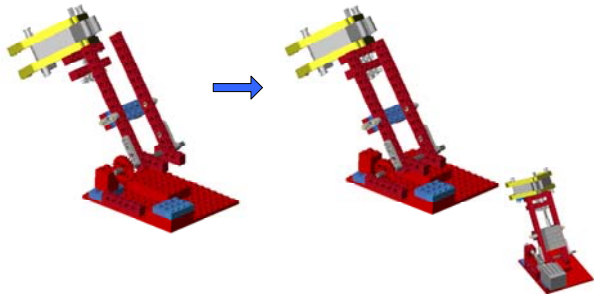
Task 1: Build a robot with a gripper

- Step 4



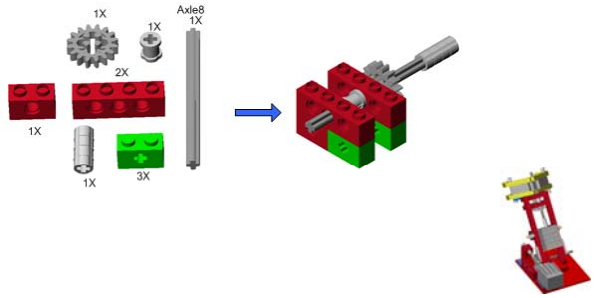
Task 1: Build a robot with a gripper

- Step 5



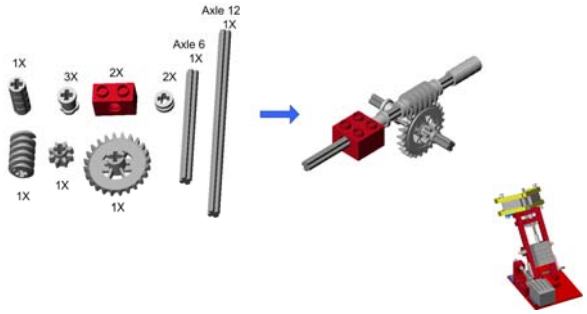
Task 1: Build a robot with a gripper

- Step 6



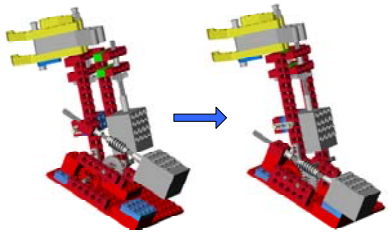
Task 1: Build a robot with a gripper

- Step 7



Task 1: Build a robot with a gripper

- Step 8



+ ( + ) *2

Do it by your own…

18.272 Praktikum: 4

Telebot system environment

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Thanks for your attention!

Any questions?

Praktikum: 5 & 6

Telebot sensors and actuators

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Praktikum: 7 & 8 & 9

Telebot system integration

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