Mechatronics and robotics facultative course

Robotics abc (4 h)

Lessons 1.-2.

Introduction/lecture

History of robotics, using it everyday basis, programming, main terms, introduction of sample robotic platforms, safety

Learning outcomes: definition of robot, robotics, manipulator, mechatronics, sensor, actuator and controller. I. Asimov laws

Lessons 3.-4.

Robotics system: sensor-controller-actuator /lecture-practice

Sensor-controller-actuator system, microcontroller, programming it, debugging program and compilation of program

Links: physics and mathematics (making connections), biology (comparison to human being) and informatics (programming and algorithms)

Learning outcomes: student knows mechatronic systems, it’s parts and structure. Can explain functionality of a controller and digital signal.

Actuators (4 h)

Lessons 5.-6.

Display / lecture- practice

Learning different display types: alphabetical, graphical, 7-segment number display

Links: Math (graphics, x, y coordinate system), informatics (programming, algorithms)

Learning outcomes: students knows visual information transmitting devices. After reading the part, knows how to choose right device for the robot.

Lessons 7.-8.

Motors / lecture- practice

Learning different motors: electrical motors, DC (direct current) motors, servo motors, stepper motors. Overview of alternative actuators (linear motor, solenoid, artificial muscle)

Links: math, physics (electrical motors, -generators, transmission, friction, inertia, acceleration) informatics (programming, algorithms)

Learning outcomes: students knows different electrical motors and their differences. Can choose optimal motor solution according to the circumstances of the robot and environment.

Sensors (8 h)

Lessons 9.-12.

Sensors / introduction

Analog sensors / lecture- practice

Learning analog sensors and getting to know examples. A/D converter

Links: physics (sound waves, sonar, light reflection, informatics (programming, if-sentences, switch, loop).

Learning outcomes: student knows analog sensors work principles, A/D converter, voltage divider.

Lessons 13.-16.

Digital sensors / lecture- practice

Learning digital sensors and getting to know some examples.

Links: physics (sound waves, sonar, light reflection, informatics (programming, if sentences, switch, loop)

Learning outcomes: student knows easier digital sensors, work principle and digital signal. Student can select suitable sensors for the robots and make the robot to navigate with those sensors.

Robot driving bases and positioning (2 h)

Lessons 17.-18.

Robot driving bases / lecture- practice

Learning different robot driving bases: differential, omniwheel and car. Practicing simple robot positioning algorithm.

Links: math (equations, trigonometry), physics (electric motors, generators, transmission, friction, inertia, acceleration), informatics (programming, algorithms)

Learning outcomes: student knows different driving bases and their features. Student know which driving base to select according to landscape.

Data processing (8 t)

Lessons 19.-22.

Data communication / lecture- practice

Students will learn most common data communication ways Bluetooth, cable, sequential and parallel connections.

Links: physics (radio waves, radio, telecommunication, measuring, data transmission)

Learning outcomes: digital communication and it’s principle. Data communication and knowledge how to make communication schemes.

Lessons 23.-26.

Collecting and processing data / lecture- practice

Explanation of reasons for data collection, principles, ways and data processing.

Links: informatics (loop), math (statistics, graph)

Learning outcomes: knowing robots that collect data. Knows how to reason robots for data collection. Knows how data is stored and where transmitted after the robot.

Project (9 h)

Lessons 27.-35.

Intelligent robotics system / practice

Assignment that puts together everything learned before and consist of following activities: project management and organizing, inquiry, team work, iterative development, wireless communication, documenting, reporting, presenting, defending ides

Learning outcomes: student can implement gathered knowledge when developing mechatronics and robotics system in project based workflow.

Summary

Target is to gather all learned knowledge and analyze Mars rover based on these knowledge.