מכון טכנולוגי חולון
Holon Institute of Technology

Software Development for Human & Robot Humanoid Interaction

Faculty Name: Science
Department: Computer Science
Lecturer name: Dr. Roi Yozevitch
Course Format: Lecture + Lab
Teaching mode: Lecture –3 h., Exercises / Laboratory - 1 h.
Year of Study: Third
Credits points: 3.5
Prerequisite: Operating Systems 61206; Object Oriented Programming 61307; Data Base Systems 61303

A. Course Objectives (Specific Objectives / Objectives):

- Knowledge of basic principles in human robot programming / Human Robot Programming.
- State of the Art today. Trends in Research.
- Software development in Embedded Linux work environment under Raspberry Pi (RPI)
- Familiarity with Embedded OpenCV
- Introduction to Embedded DL - and the difference between it and standard DL methods.
- Introducing to ROS (Robot Operating System) as an environment, which provides libraries and tools to help software developers create robot applications.

B. Course Rational:

In a world where robots take control of various aspects of modern life, it only makes sense that the share of human robots will increase. Humanoids will serve in the future as the UI to the digital world and a good portion of human communication will be done through them. Already today, there are extraordinary advances in the physics and mechanics of these robots through the Boston Dynamics Company and upgrades are being made in the field of PERCEPTION and AGI (Artificial General Intelligence). In order to take part in the revolution, this area should be broken down into small components and looked at each one individually and in a focused form. That is the idea and importance behind this course.

C. Theoretical Subjects addressed in the Course:

- Image and voice processing in an embedded environment
- Face Detection and face recognition through ANN
- Introduction to emotion recognition through image and / or voice.
- Foundational principles in mechatronics,
- ROS programming and the ROS environment.
- Raspberry pi for Embedded CV.

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D. Concise description of the course and method of instruction

In the course framework we will learn to develop applications in the RPI environment, for a robot environment as well as a robot humanoid. Learn how to operate and interact with sensors including camera by using single-board computer (Raspberry Pi) in embedded software environment under RPI.
The teaching method in this course will be based on the implementation of practical projects involving a variety of robots including humanoid robots (human robots), with a wide range of built-in capabilities. It will be an interdisciplinary course, which will mainly be based on knowledge areas such as: voice and speech processing, computer vision, robotics and intelligent systems, machine learning, artificial intelligence and their application in computer science.
During the course, students will perform learning and data operations in a Linux embedded environment and a Java based service environment with open source robotics with creative machine control - myRobotLab.

E. Teaching program detailed by subjects

Lesson unit	Lesson Subject	Remarks
1	**Introduction to robot humanoid, different types. The development over the years. Problems and challenges in the field. Ethical and research issues in such robots.**	
2-3	**Embedded Computer Vision openCv**	
4	**Introduction to Mechantronics**	
5	**Sensors and arduino**	
6	**myRobotLab**	
7	**עבודה עם מצלמות**	
8	**זיהוי אנשים עייפים**	
9	**Face recognition**	
10	**Face tracking**	
11	**Emotion detection**	
12	**Gesture Recognition (Arduino)**	
13	**People Counter/Measuring object sizes**	

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F. The final grade will be determined according to the following criteria

Course requirements	Requirements	Grade [%]
Laboratory exercises	Submission 4 Lab exercises during the semester	30 %
Final Project	Submission of a final project + protecting it.	70 %

Required student participation: 80%,
Mandatory attendance Lab exercises and presentations

G. Bibliography: (required / permission) - arranged by course topics

ISRAEL, DAVID, and GONZALEZ AGUIRRE. VISUAL PERCEPTION FOR HUMANOID ROBOTS: *Environmental Recognition and Localization from Sensor Signals to Reliable 6d Poses*. SPRINGER INTERNATIONAL PU, 2018.

Vernon, David, Claes Von Hofsten, and Luciano Fadiga. *A roadmap for cognitive development in humanoid robots.* Vol. 11. Springer Science & Business Media, 2011