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| **DESIGN PROJECT 2013** | **People** | **Plan of Work** |
|  |  | **Every group has to make a presentation about their project proposal.** |
| **I welcome all teams to discuss projects and homeworks with me during office hours on Friday or at any time.** |  | **You can propose changes to specializations within the teams.** |
| **Superproject = MCECSBOT – the Guide Robot for engineering buildings****Ask Mathias and Omar for keys to the room that the robot is located.****No standard Homeworks** | U - undegraduate | See separate documents, ask Mathias Sunardi and Omar Mohsin, especially Mathias.These teams should have their presentations soon. |
|   | Jeffrey Whissen U |  I know you. |
|   | Wisam Abdulkadir PHD | Background: Control, programming.Robot control. Motion control, microcontrollers. MC? |
|   | Michael Walton U | GA, sensor, interfacing, AI, embedded systems, sonar (possible laser range finder?) |
|   | Benjamin Huntsman U | Vision, autonomous vehicle, motion |
|   | Prachi Pai Asnodkar U | Good programmingWants to work with Atwood. Human-robot interface |
|   | Richard Atwood U | GA, robot programming, guide bots. |
| **Superproject = MOTORCYCLE\_VISION.****Medical Imaging Cornell Cup – Intel****You do not need a robot for this project but you still need a lab access. You may use any other lab for this project as well. I have a microscope camera if you need it.** **No standard Homeworks** |  | See separate documents, This team should have their presentations soon.This team should become vision and pattern recognition experts – top knowledge in the whole class. They have more team members not registered for the class but welcome to attend some class lectures and especially project meetings. |
|   | Matt Stehr U | Learn OpenCV, read documentation of previous projects that I gave you. |
|   | Nik Davis U | Learn OpenCV, read documentation of previous projects that I gave you. |
| **Project = COUNTESS\_QUANTA – Humanoid Robot with vision-based interaction.****Mostly software, good animation and use of AI.****Vision-based behavior – KINECT gesture recognition.****Standard homeworks mandatory. Should be all used on the robot.**1. **IGA**
2. **Search**
3. **Vision**
4. **Kinematics**
 | The robot is in the Robot Theatre in front. This team has to start learning KINECT and vision (OpenCV or Matlab) as early as possible. | 1.Add more degrees or improve the right arm to allow play two instruments.2. Add Kinect in front of body3. The left hand should also play a drum or other document that will be located on a separate pole. See drum in theatre.4. Adapt the editor to play music.5.Use existing software for Kinect vision to interact about music and gestures.6. Add big screen near robot with information about ECE for robot conversation.7. Integrate base motions, head motions and hand motions for music, interaction and presentation. |
|   | Brad Pitney (Mostly software) | Interested in ML and adaptive behavior, great for this project. Good background in programming, GA, NN, MATLAB, Vision. This student will be OpenCV specialist. |
|  | Yin Shi | Interested in sensor interface, knows the robot. This student will be programming and interfacing and motion specialist.This team should have their robot demonstration and presentation very soon. |
|   | Cale (Chal) McCollough (Some hardware, mostly software) | Good programming, AI, philosophyInterest in music vs robots. GREAT for this project. This student will be AI and interaction specialist. |
| **Project SONBI – Humanoid Robot for Orchestra that balances in the air****The scope of this project and its specific sub-project will depend on the number of people who registered for class and take project.****The project in first phase requires assembling a robot (most exists) and adding legs. In second phase this is human-robot interaction project based on natural language and artificial intelligence. Speech and music processing.****Standard homeworks mandatory. Should be all used on the robot.**1. **IGA**
2. **Search or fuzzy or NN**
3. **Vision**
4. **Kinematics**

**Vision can be done as the second project and be next used in interaction.** | Mostly hardware design and controllers. This project is for people who like mostly hardware design. But want to learn some simple motion control. | This robot is located in small room. Ask me to take it. It will be located in Robot Theatre.1.Fix the panel covering the balancing machine.2. Attach the panel to the balancing machine.3. Cover panel with some nice material and attach robot fishes to it.4. Add legs to the robot (new)5. Add head to the robot (it exists).6. Fix hands (if necessary)7. Add balancing motion controller.8. Synchronize robot motion, balancing machine and fishes.9. Take behavior software from some other robot to demonstrate some behaviors, such as playing drums or quitar. |
|  1 | Booshik Ryu | Background: microprocessors, Computer ArchitectureInterest: Space scanning, Walking robot.This student will be general motion design specialist. Motion Editing. Interface to Vision. |
| 2 | Harley Mc Waters | Good backgroundTracking and navigation. Software/hardware 50.50This student will be responsible for leg design and programming. |
| 3 | New student from India | Software/hardware 50/50This student will be responsible for leg design and programming. |
| 4 | Rob Gaskell | Controls, PID, Aerospace, Vision, Video tracking. |
| 5 Is she still registered? | Beryl Marie Wootton | Good general background.Interest in human thought and social interaction.This student will be interaction specialist. |
| 6 Is she still registered? | Tejaswine Angal | Has software background, Needs help in robot design. |
| 7 Is she still registered? | Yiwei Li | Has software, embedded, FPGA, multi-mediaInterest: ML, Visual. |
| 8 Is he still registered? | Abishek | DSP, programming background goodJava, AI, Speech, brain wave |
| **Project MARIE CURIE – a sitting Humanoid Robot that plays an instrument****First Phase: Improve kinematics, better hands.****Second Phase: Vision and sensor based human-robot interaction. Neural Nets. Artistic expression. Bio-inspired methods.** | Teams 4 and 5 should collaborate on learning motion control and mechanical design. | Similar to project 41. Add rotational motion to the body
2. Add forward-backward motion to the body.
3. Fix and control hands
4. Synchronize head/neck motions with the rest of the body and its motions including rotational and forward/backward linear motion.
5. Dress the robot and make it artistic.
6. The robot should play some instrument
 |
|   | Brett Dunecomb | Good general background.Interest in building robots hardware, vision, control |
|   | Kevin Bedrosian | Good programming background, AI, Logic.Interest in ML, AI, NN. |
|   | Caren Zgheib | Grad student, embedded systems, programming.Interest in artistic robots and human-robot interaction.Also in bio-robots. |

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| **Project HILLARY CLINTON – Humanoid Robot for Orchestra** **Control of base exists.** |  | 1. Control head and hands.
2. Design dancing motions with base, body and hands.
3. Allow arbitrary music be synchronized or to control the robot (I have software for this).
4. Improvise dancing motions with base, body and hands.

Play any instrument – your choice. It can pretend that it plays. |
|  |  Abdullah Ben Nothi  | Good programming backgroundMoving robots, AI, opening a door.I suggest this student be a hand design specialist. |
|   | Hussain AlAmeer | Background: programmingInterest: Motion, obstacles, behavior.Dress for the robot and music from Kuwait? I suggest this student be vision software specialist. |
| **Project MARIONETTE = Jumping and Kicking Marionette****Servos can be inside hands also or only on top of strings****No standard Homeworks, integrate IGA, kinematics into the project.** | One student project. Complete freedom. | Design a marionette attached to strings. Motors can be in the body of marionette and on top of strings. Use the cheapest servos available.1. Build the stage frame
2. Add the linear controller for whole body motion.
3. Add controls of limbs and head – your choice and design.
4. Demonstrate behaviors – no sensors, concentrate on artistic expression.
5. (next quarter) – add vision or other sensors.
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|   | Erik Wright | Very good general background, clear project ideas already. One person project. |
| **Project RHINO\_ARM= Rhino Robot in LISP** |  | Hardware exists – this is a robot arm in main lab– model of an industrial robot. 1. Needs to add Arduino (or similar) controller with simple motions.
2. Add inverse kinematics software (based on search?)
3. Demonstrate “small blocks world” problems like assembling pyramides, Hanoi Tower, Missinaires and Cannibals or similar problems that require search and/or learning.
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| **All homeworks should be integrated to this project** | Greg Stromire | Good software, internet programming, bicycle assistant robot interest.I suggest this student will interface the robot to internet for remote control and will become Lisp specialist for advanced control. |
|  | Scott Lawson Arduino, LISP | He writes: “I will write my code in Lisp and run it on an Arduino DC motor control board to run the robot.”I suggest this student to become motion control specialist and motion design specialist. |
| **Can have a separate project on this robot** | Brian Lambert | Good programming background.I suggest this student will be responsible for vision software. Can work separately from the team and just give them code in final stage. |
| **Project AI NAVIGATION = LISP for Navigation combined with grasping on Bohr Robot.****This project is mostly about AI methods that combine grasping and navigation.** **Much freedom is left to students to demonstrate their creativity.** |  | This project is about navigation combined with grasping. Example can be soccer-like game playing, fencing, or can collecting.1. Add body, raise head.
2. Keep hand near floor to collect items from floor.
3. Demonstrate complete “emotional” behavior using the existing software. Interface to LISP.
4. Learn about navigation of mobile robots.
5. Learn about grasping for mobile robot.
6. Demonstrate navigation+grasping behavior such as can collection from the floor.

A second arm can be added if students are interested. This arm should be humanoid and should grab items from desks.You can go as deep to theories from the class as you want. Try to find some interesting combination of GA, search, fuzzy logic and navigation methods other than Kalman Filter. It would be interesting to combine Particle Filter with GA or NN. |
|  | Veran Jones | Good software backgroundInterests. Software mostly. Rasperry Pi, GAI suggest this student will be the motion control specialist for the team. |
|  | Jordan Fluth | Likes Arduino, hardware, partner in 411., software LISP. Learning.I suggest this student will be AI and Machine Learning specialist for the team. |
| **Can have a separate project on this robot** | Derrick Streng | Good Programming background. Works as programmer. AI. Deep Learning. NOT ROBOT THEATREI suggest this student be OpenCV and vision specialist. |
| **SuperProject LISP\_CAD = LISP language for Computer Aided Design using Artificial Intelligence.****No standard homeworks. This is a large project, part of an even bigger project that relates CAD to robotics.** | This is a large project about using AI and ML for advanced project. One person | Learn Lisp. Learn simulation and verification of digital logic circuits. Learn memristor scheduling and reversible logic notations. Write software to process circuits from IMPLY gates. Simulation. Verification. Synthesis. Power analysis. Decomposition of large data-flows to serial processors. Interface to Verilog and Matlab. Use of search in synthesis on various levels. |
|   | Muayad Al Jafar  | C, MATLAB, filters, control.Lisp, Artificial Intelligence, Digital Design. |

**ROBOTS FOR HOMEWORKS**

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| Number | Robot Name | Remarks | Software |
| 1 | Countess Quanta | This robot is ready to use and there is a student Yin Shi who knows it well. Ask him. | **Available from Yin Shi.** |
| 2 | simulated |  |  |
| 3 | Niels Bohr | Software available in 478 class page at bottom | **Available from my webpage** |
| 4 | Albert Einstein | Software available in 478 class page at bottom. Bohr’s software or Additya Editor can be easily adapted. | **Available from my webpage** |
| 5 | KHR-1 | Software available in 478 class page at bottom. It may have a name like “Little robot theatre” or similar. We have two copies of this robot | **Use “Additya Editor”. Available from my webpage. Mathias has a new version** |
| 6 | iSOBOT | Software available in 478 class page at bottom We have two copies of this robot | **Use “Additya Editor”. Available from my webpage. Mathias has a new version** |
| 7 | Hexapod | **This robot has good software available on internet but needs some mechanical fixing and adding of processor for control. You can use Arduino , Lego Brick ,e tc** | **Available from my webpage** |
| 8 | Any other robot that you have or build | You can add Rhino or any other robot from Project, if you want | **Available from my webpage** |

**Order of presentations in the class.**

In yellow are human-robot interaction and advanced motion generation projects.

In red are advanced robot vision and pattern recognition projects.

In blue are grasping, navigation and kinematics projects.

In pink are CAD and AI projects.

Please use the names of the projects when you are referring to them in emails and communication with me.

1. **Project = COUNTESS\_QUANTA**
2. **Superproject = MOTORCYCLE\_VISION.**
3. **Superproject = MCECSBOT**
4. **Project =Marie\_Curie**
5. **Project AI NAVIGATION**
6. **Project RHINO\_ARM**
7. **Project MARIONETTE**
8. **Project Hillary\_Clinton**
9. **Project SONBI**
10. **SuperProject LISP\_CAD**