

**ECE 5330/6397: Intro to Robotics Project Ideas**

2019: Project ideas

1. Inverse Kinematics of UR3 robot & Mathematica/Matlab visualization, identify the Jacobean Singularities and show them on the real robot
2. Kinect + UR3 + Electric Toothbrush:
3. Two-arm shirt folding robot
4. Light-saber duel with two robots (convert the last link into a rotational joint)
5. Yogurt feeding OWI Edge robot + camera (might need to 3D print a container for the yogurt and a special spoon
6. Two-arm OWI Edge piano player
   1. play slowly, and then speed up video by 2x to get sound higher by 1 octave or 4x for 2 octaves – put the arms on low notes
   2. better on a keyboard, must be able to input a music file (perhaps a list or Matlab array) and have the robots play it.)
7. **The robot sculptor: Carving Styrofoam with a robot arm**
   1. ***Scope:*** add a motor to the hand and attach a Dremel bit (or similar)
   2. ***Description:*** replace the LED with a motor.
   3. ***Outcome:*** the robot can carve your name into a block of Styrofoam
8. **Lucky Dice-rolling Robot**
   1. ***Scope:*** Two robot arms take all dice in their workspace and flip to show the number 6. Must use at least 1 camera and at least 2 arms.
9. Make the OWI edge point a laser pointer at the ISS. (must integrate a GPS chip and a compass)

Some Links from previous years:

1. Luke Haskins & Micah Bullock, Srijani Mukherjee, Akshay Gollapalli: BB-shooting robot
   1. Video: https://www.youtube.com/watch?v=6suuDnY7Xi0 Files: https://github.com/NachtErfinder/Robotics-Final-Project/tree/master/Final%20project
2. Nima Eskandari: tank robot + camera
   1. https://nimakerllc.wordpress.com/tank-robot-with-camera/
   2. I wrote all the embedded code myself from scratch. That was the largest part of the project all the code is available at: https://github.com/nimeskan/RobotTankWithCamera
   3. Finally the 5min demo video is at: <https://www.youtube.com/watch?v=tSWKPRld7F8>
3. Andrew Smith, Mohak Bhatia, Israel Ilagan: robot grader using OCR & custom end effector
   1. <https://www.youtube.com/watch?v=J4Y32Fu-fDg>
   2. Final Project for Dr. Aaron Becker's ECE 6311 Introduction to Robotics class at University of Houston. Completed By: Andrew Smith Mohak Bhatia Israel Ilagan. The projects goal was to create a robot that is capable of recognizing text through optical character recognition code, grade the free response questions (advantage over a "scantron"), and stamp the correct grade on the paper. Be sure to watch to the end of the video to see the Grademaster in action, as well as some recommendations we have for future work/improvements! All Printed parts printed with PLA, 3 Layer Wall Thickness, 18% infill. Code and wiring schematic are posted in "Documentation and Code" section, Additional Components Required: - 3X MG946R Servos - HAVIT HV-N5086 Camera and Webcam - 10K Potentiometer - 12V Rocker Switch - Momentary Push Button Switch - ExcelMark Ink Pad for Rubber Stamps 2-1/8" by 3-1/4" - Red - Educational Insights Alphabet Rubber Stamps - Uppercase 5/8" - Male to Male Jumpers - Sparkfun RedBoard (or Arduino Uno) - 6V Battery Source - 11X 2 Hole Mini Nutstrip - 2X 3 Hole Mini Nutstrip - 43X 6-32 Machine Screws - #4 Plastite Screws - Piano Wire to create linkage for Ink Tray - 3/4" PVC Piping to create camera stand (Left to viewer discretion based on webcam selection, we found a camera height of ~30 cm to work well)
4. Xinxiang Zhu , Aaron Wu, Isaac Lingenfelter:  3D configuration space for first 3 joints of OWI robot, shortest path calculation.
   1. https://youtu.be/9-ksJvz\_sMo
   2. (All codes are available on GitHub, check video description for details or visit https://github.com/xiaoxiaozhu007/Intro2Robotics\_FinalProject )
5. Zanne Soliz,  Huy Hua  PID controller of OWI arm (balancing a car)
   1. <https://youtu.be/a-U43hkmr_A>
6. Dominic Lebron, Yuan Tian, Binh Duong, Praneeth Reddy,   Kinetic+Toothbrush robot
   1. Youtube Video Link:  <https://youtu.be/ojtaUKRF9Ww>
   2. Github Link:  <https://github.com/binh0206/Robot_6311_Final_Project_Brushing_Teeth_Robot_Dominic_Yuan_Praneeth_Binh.git>
7. Ankur Lad, Gayatri Repalle, Alicia, Dan: Maze recognition and solving with OWI
   1. https://youtu.be/AKGEKGZG4ls
8. Javier Perez, Eric Todd, Sohil Shah, and Murtaza Jiniyawala:  Balloon Popping custom robot
   1. https://vimeo.com/304058323
   2. Sentinel is a two-axis robot that uses real-time camera color recognition to shoot a laser at things.
   3. https://github.com/jperez52/Ballon\_Popping\_Sentinel
   4. https://www.thingiverse.com/thing:3255206
   5. <https://drive.google.com/open?id=1IKuZ7q-5LuGguFIq8IWii0XvltWiuOOg>
9. Robert Phu: Connect-4 robot  (OWI arm)
   1. <https://www.youtube.com/watch?v=z_uBRQgi_jQ&feature=youtu.be>
10. Hamid, Shreyas, Shubhum & Rafiul: robot that draws a logo with points.

    2. Youtube Video Link - https://youtu.be/iOlXNFJ43wY  Files Link : <https://uofh-my.sharepoint.com/:u:/g/personal/srpoyrek_cougarnet_uh_edu/EQfSiFoXcHJMnVGSNqRiH2IByIWNe0zqcEpd1zyX1iSK0A?e=P93VRM>
11. Arifa Sultana, Divesh Pednekar, Manojna Sistla, Surya Teja: Recycling robot
    1. <https://www.youtube.com/watch?v=VKHn0r2QGV8&feature=youtu.be>
    2. https://github.com/SSVSuryaTeja/Robotics\_FinalProject
12. Tian Tong & Yuzhu Zhang: mobile robot that avoids obstacles.
    1. .  https://youtu.be/k4SnEDCL0zQ
13. Group Member: Ochuko Adiotomre Project Name: Robotic Arm Surveillance System using image segmentation  Description:  In this project, the Robotic Arm Edge is used to perform surveillance on a red brick. The robot detects the red brick using image segmentation by thresholding, the robot is moved using two degress of freedom to keep the camera at the centroid of the brick as the brick is moved. At the point where the robot lose track of the brick, an alarm starts buzzing.
    1. <https://youtu.be/_M8KnytZSWw>
    2. The aim of this project is for the Robotic Arm Edge to perform surveillance on a red brick. The robot detects the red brick using image segmentation by thresholding, the robot is moved using two degress of freedom to keep the camera at the centroid of the brick as the brick is moved. At the point where the robot lose track of the brick, an alarm starts buzzing.
14. Andrew & Ali:  robot that sorts legos using camera
    1. The YouTube link: https://youtu.be/nXPGjlD94wY Also, Andrew will upload the other project files including the ROS files and another document from his Blackboard. Thank you, Ali Alrifai and Andrew Blanchard,
15. BB-shooting robot
    1. GitHub link with all of the project files I used. <https://github.com/NachtErfinder/Robotics-Final-Project/tree/master/Final%20project>
    2. The YouTube link for the project is here: [https://www.youtube.com/watch?v=6suuDnY7Xi0](https://www.youtube.com/watch?v=6suuDnY7Xi0" \t "_blank)

Older projects:

1. Painting Robot: <http://www.thingiverse.com/thing:2305426>, https://www.youtube.com/watch?v=SxXDuxckDxI
2. Speed control robot: Link 1: Project Video https://youtu.be/ee5iMPa5XjI Link 2: Square Code https://www.mathworks.com/matlabcentral/fileexchange/62881-owi-robot-arm-code-to-draw-a-square Link 3: Triangle Code https://www.mathworks.com/matlabcentral/fileexchange/62920-owi-robot-arm-code-for-drawing-a-triangle
3. Delta Robot! https://youtu.be/yBe4Lp54yVM
4. Tic Tac Toe:
   1. https://www.mathworks.com/matlabcentral/fileexchange/62867-tic-tac-toe-robot-arm-code
   2. https://youtu.be/pq\_yHAgujLY
5. Robo-Call Delta robot: Youtube: https://youtu.be/WNSVh2rca6A
6. Stacking robot: https://youtu.be/mXUXarS2thU Github link: <https://github.com/ashvr91/Block-stacking-robot>
7. a robot that picks up blocks https://youtu.be/9L15uyuGvME

2017 Fall:

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| 1. Resistor Sorting robot with Dr. Trombetta |
| 1. Implement potential field obstacle-avoidance control with your robot and a camera. If an object(human hand or other) enters the workspace of the robot, the robot tries to keep its end effector at the goal location while moving its other joints away from the intruder. |
| 1. Lucky Dice Rolling Robot: resets all dice to show '6'. You may need to order large dice. Does Amazon have 1-inch dice? |
| 1. Hyperloop: must build/design component with feedback control |
| 1. Ping-pong robot: Integrating vision and distance measurement into robot to augment available velocity and acceleration abilities to maneuver custom end effector. |
| 1. Robotic arm operated by gesture control: Human robot interface |
| 1. Implement optical encoders (yay!) |
| 1. Feeding robot |
| 1. Drawing robot |
| 1. Part 1: Using time-lapse photography, map out the workspace of our robot with the LED. Part 2: help Dr. Becker make a new mathematica demo showing the workspace of 5 cannonical 3-joint robots. |
| 1. 1.) High school Outreach robot & Curriculum, (2.) give 5th DOF to robot arm to do a lightsaber duel |
| 1. Adding mobility to arm: add at least 2 wheels to the base, have the robot arm pull itself on the table to move around.  Team must generate turning and translating primitives, and make a video where the robot pulls itself to a toy, picks up/plays with the toy, and then returns home. |
| 1. Choose between (1) a stacking robot that stacks all blocks placed in the workspace or (2) robot cook: use two robot hands to make something edible. Must use at least two arms and two utensils. |

2017 Spring

**1. Program a Delta robot to dial a phone number**

***Description:*** The robot is in n386, and project members may have it for the semester. Robot:

<http://test.reverb-marketing.com/shop/delta-robots/3-arm-delta-robot-v3>

***Outcome:*** A robot that can type in a number into a cell phone. User specifies the number; the robot unlocks the phone, and dials the number.

***Means:***

***People:*** Erich McMillan Josh Weibling <weiblingj@gmail.com>

**2. Optical Encoders on robot joints**

***Outcome:*** Implement optical encoders as in <http://www.instructables.com/id/Modifications-to-Robot-Arm-for-Opto-Coupler-Feedba/?ALLSTEPS>

***Means:***

**3. Optical Potentiometers**

***Scope:*** Print circular discs on transparency with different levels of black ink so that an LED, Photodiode pair can sense the orientation of the robot joint.

<http://coolrobotprojects.blogspot.co.at/?m=1>. Run this as

<https://hackaday.io/project/1452-reactron-material-transporter-owi-535-robotic-arm>

**4. Painting Robot**

***Scope:*** Use robot arm to paint a picture (using watercolors or acrylic paint).

***Description:*** robot arm can paint the same picture multiple times.

***Outcome:*** handles for paintbrush, jig to hold canvas, paint, and water

**5. PWM speed control of robot arm**

***Scope:*** Use H-bridges and the PWM outputs to control the speed of multiple motors on the arm.

***Description:*** demonstrate and create a tutorial for speed control of motors on our robot arm

***Outcome:*** robot can draw circles and squares on paper at different speeds.

**6. The robot sculptor: Carving Styrofoam with a robot arm**

***Scope:*** add a motor to the hand and attach a Dremel bit (or similar)

***Description:*** perhaps replace the LED with a motor.

***Outcome:*** the robot can carve your name into a block of Styrofoam

**7. MATLAB GUI for robot**

***Scope:*** GUI with sliders for each joint, a 3D display of the robot arm, tools for tuning each potentiometer, stepping motors, saving positions, moving between saved positions, running a sequence of movements with timing.

***Outcome:*** shared code for the class

**8. Videographer robot**

***Scope:*** robot points camera to track a person for Skype calls

***Outcome:*** shared code and demonstration

**9. Cleanup robot**

***Scope:*** combine depth camera with robot to make a robot that makes neat stacks of all blocks placed in its workspace.

***Description:*** <https://software.intel.com/en-us/realsense/r200camera> is a 3D camera that has a color camera with depth information. We have two in the lab that can be loaned out for the semester.

***Outcome:*** shared code and demonstration

**10. Bilateral object manipulation: two robots pass an object between themselves and reorient it.**

***Scope:*** Some sensing must be done to ensure the object is passed

***Outcome:*** Specify a rotation, and thetwo arms work together to reorient the object

**11. Lucky Dice rolling robot**

***Scope:*** Two robot arms take all dice in their workspace and flip to show the number 6. Must use at least 1 camera and at least 2 arms.

**12. Robotica update**

***Scope:*** fix robotica so that it can **draw the robot** (see code at

<http://demonstrations.wolfram.com/DenavitHartenbergParametersForAThreeLinkRobot/>  )

and the **manipulability ellipses**:

( <http://demonstrations.wolfram.com/ManipulabilityEllipsoidOfARobotArm/> )

Also update the code so that outputs are formatted in a modern style, add a few missing Trig simplifications, handles matrix input, produces matrix output of the FKin data.

Potentially make a Mathematica demo that draws a robot based on a table to DH parameters and prints the simplified forward kinematics.

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