Rutgers University

Department of Mechanical & Aerospace Engineering

2022-2023 Senior Design Projects

14:650:467/468 Design and Manufacturing I/II

Mechanical Engineering Projects

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ME PROJECT 1

Mechanical Fish

Advisor: Prof. Prosenjit Bagchi

Email: pbagchi@soe.rutgers.edu

Project Abstract: Conceptualize, design and build a device that swims like a fish

Project Goals: Building mechanical fish-- an underwater device that can swim like a fish using body undulations.

Project Envisioned Outcomes: Design and fabrication of soft swimming devices.

Students Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Design		☑			
Analysis		☑			
Hand tools		☑			
Traditional Machining		☑			
CNC machining		☑			
3D printing		☑			
Welding		☑			
Wiring		☑			
Simple analog or digital electronics (e.g., resistors, capacitors, op-amps)		☑			
Microcontrollers (e.g., Arduino)		☑			
Bonding		☑			
Processing (e.g., vacuum bag, autoclave)		☑			

Software Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Matlab		☑			
Comsol		☑			
Python	☑				
Ansys		☑			
SolidWorks			☑		
Other CAD packages	☑				
Siemens NX	☑				
LabView	☑				
E-Calc	☑				
AVL	☑				
Xfoil	☑				
Machine vision program	☑				

ME PROJECT 2

Wheelchair Modification

Advisor: Prof. Haim Baruh

Email: baruh@soe.rutgers.edu

Project Abstract: Wheelchair Modification

Project Goals: Giving a complex wheelchair capability to clean its wheels

Project Envisioned Outcomes: Using motorization and scraping techniques to make a wheelchair that has traveled on muddy surfaces clean itself before going indoors.

Students Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Design				☑	
Analysis				☑	
Hand tools			☑		
Traditional Machining			☑		
CNC machining			☑		
3D printing			☑		
Welding			☑		
Wiring			☑		
Simple analog or digital electronics (e.g., resistors, capacitors, op-amps)			☑		
Microcontrollers (e.g., Arduino)			☑		
Bonding			☑		
Processing (e.g., vacuum bag, autoclave)	☑				

Software Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Matlab			☑		
Comsol			☑		
Python			☑		
Ansys			☑		
SolidWorks			☑		
Other CAD packages			☑		
Siemens NX		☑			
LabView		☑			
E-Calc		☑			
AVL	☑				
Xfoil	☑				
Machine vision program	☑				

ME PROJECT 3

Multi-Mode Hybrid Unmanned Delivery System: Combining Fixed-Wing and Multi-Rotor Aircraft with Ground Vehicles

Advisor: Prof. Onur Bilgen

Email: o.bilgen@rutgers.edu

Project Goals: The goal of this project is to investigate novel concepts for a multi-mode unmanned aerial system. For example, a VTOL vehicle attached (docked) to a fixed-wing (i.e. STOL) vehicle. In this case, the fixed-wing aircraft does the long-distance "cruising." Once the system within the vicinity of the delivery location, the multi-rotor will detach and will take care of the vertical movement for a controlled delivery to the ground. Navigation, planning, logistics, policy issues, docking/undocking, platforms etc. are all very interesting and relevant problems – such issues will be looked at by the design team.

Previous Success: The 2020 team received a research award from the highly competitive NASA USRC program. (https://mae.rutgers.edu/news/senior-design-team-captures-nasa-research-challenge).The new team will apply to the same program in June. In addition, the 2020 Team presented a paper at the AIAA 2021 Region I Conference, and received the 3rd place prize in the team category.

All team members are expected to have an exceptional work ethic and dedication to the project. Students from all backgrounds who are interested in continuing to graduate school are highly encouraged to join. Please contact Dr. Bilgen via email (o.bilgen@rutgers.edu) with the subject line starting with "Senior Design: Project Name – Your Name".

Project Envisioned Outcomes: See above.

Students Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Design				☑	
Analysis				☑	
Hand tools			☑		
Traditional Machining			☑		
CNC machining				☑	
3D printing				☑	
Welding				☑	
Wiring				☑	
Simple analog or digital electronics (e.g., resistors, capacitors, op-amps)				☑	
Microcontrollers (e.g., Arduino)				☑	
Bonding	☑				
Processing (e.g., vacuum bag, autoclave)	☑				

Software Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Matlab				☑	
Comsol	☑				
Python			☑		
Ansys	☑				
SolidWorks				☑	
Other CAD packages				☑	
Siemens NX		☑			
LabView		☑			
E-Calc				☑	
AVL		☑			
Xfoil		☑			
Machine vision program		☑			

Additional Requirements and Information:

Please send an email to Dr. Bilgen (o.bilgen@rutgers.edu) with the subject line starting with "Senior Design: " and include the following content:

1) A brief statement indicating interest

2) Project(s) of interest (primary and secondary can be indicated)

3) Cumulative GPA (in major)

4) Theoretical (subject) strengths (i.e. dynamics, solids, fluids, control, design, etc.)

5) Software strengths

6) Hands-on, fabrication, testing strengths and experiences (outside of courses and labs)

7) Student organizations involved

ME PROJECT 4

Drone Based Water Sampling and Quality Testing – Special Application in the Raritan River

Advisor: Prof. Onur Bilgen

Email: o.bilgen@rutgers.edu

Project Goals: The goal of this project is the design, analysis, fabrication and testing of an unmanned aerial vehicle (UAV) and a ground station, both equipped with 5G transmitters/receivers to evaluate water quality in rivers and other waterways. The system will be tested in the Raritan River. The team will design, fabricate and test multiple iterations of the vehicle, and the ground station, as well as develop necessary control algorithms. The drone will sample water (from the water surface and/or at varying depths in the water column) and bring it back to a testing station near the shore (or within the range of the drone.) This system must be fully autonomous.

This is a collaborative project with Professor Nicole Fahrenfeld of the Civil & Environmental Engineering. Using the drone will significantly increase spatial resolution of sampling while providing improved ability to provide composite samples for analysis. The anticipated outcome will be reducing labor/need for sampling vessels to while generating more representative samples to improve our understanding of contaminant fate and transport in surface waters. Example target contaminants include emerging (e.g., microplastics) or regulated (e.g., pathogens linked to compliance with Section 303d of the Clean Water Act).

The students should be very comfortable with at least one of the following: 1) Design/analysis and programming software such as Matlab, Xfoil, AVL, E-Calc, Mission Planner, Ansys, Solid Works, Siemens NX or other CAD packages, LabVIEW, etc.; 2) Simple analog or digital electronics such as resistors, capacitors, op-amps, microcontrollers (i.e. Arduino, Raspberry Pi), wiring, soldering, etc.; 3) Fabrication techniques such as 3D printing, bonding, vacuum bagging, manual fabrication, etc.

All team members are expected to have an exceptional work ethic and dedication to the project. Students from all backgrounds who are interested in continuing to graduate school are highly encouraged to join. Please contact Dr. Bilgen via email (o.bilgen@rutgers.edu).

Project Envisioned Outcomes: See above.

Students Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Design				☑	
Analysis				☑	
Hand tools			☑		
Traditional Machining			☑		
CNC machining				☑	
3D printing				☑	
Welding				☑	
Wiring				☑	
Simple analog or digital electronics (e.g., resistors, capacitors, op-amps)				☑	
Microcontrollers (e.g., Arduino)				☑	
Bonding	☑				
Processing (e.g., vacuum bag, autoclave)	☑				

Software Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Matlab				☑	
Comsol				☑	
Python				☑	
Ansys				☑	
SolidWorks				☑	
Other CAD packages				☑	
Siemens NX		☑			
LabView	☑				
E-Calc				☑	
AVL				☑	
Xfoil				☑	
Machine vision program				☑	

Additional Requirements and Information:

Please send an email to Dr. Bilgen (o.bilgen@rutgers.edu) with the subject line starting with "Senior Design: " and include the following content:

1) A brief statement indicating interest

2) Project(s) of interest (primary and secondary can be indicated)

3) Cumulative GPA (in major)

4) Theoretical (subject) strengths (i.e. dynamics, solids, fluids, control, design, etc.)

5) Software strengths

6) Hands-on, fabrication, testing strengths and experiences (outside of courses and labs)

7) Student organizations involved

ME PROJECT 5

Solar Powered Terrain Walker I

Advisor: Prof. William Bottega

Email: bottega@soe.rutgers.edu

Project Abstract: Solar Powered Terrain Walker

Project Goals: design, analyze and manufacture a solar powered walking machine

Project Envisioned Outcomes: design and blueprints, analysis and manufacture of a walking machine that can negotiate various terrains. There will be two teams that will compete with one another for the best design. They will "race" against each other at the end of the academic year.

Students Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Design			☑		
Analysis			☑		
Hand tools			☑		
Traditional Machining			☑		
CNC machining					
3D printing	☑				
Welding	☑				
Wiring	☑		☑		
Simple analog or digital electronics (e.g., resistors, capacitors, op-amps)			☑		
Microcontrollers (e.g., Arduino)			☑		
Bonding	☑	☑			
Processing (e.g., vacuum bag, autoclave)	☑	☑			

Software Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Matlab			☑		
Comsol			☑		
Python	☑				
Ansys			☑		
SolidWorks			☑		
Other CAD packages			☑		
Siemens NX	☑				
LabView	☑				
E-Calc	☑				
AVL	☑				
Xfoil	☑				
Machine vision program	☑				

ME PROJECT 6

Solar Powered Terrain Walker II

Advisor: Prof. William Bottega

Email: bottega@soe.rutgers.edu

Project Abstract: Solar Powered Terrain Walker

Project Goals: design, analyze and manufacture a solar powered walking machine

Project Envisioned Outcomes: design and blueprints, analysis and manufacture of a walking machine that can negotiate various terrains. There will be two teams that will compete with one another for the best design. They will "race" against each other at the end of the academic year.

Students Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Design			☑		
Analysis			☑		
Hand tools			☑		
Traditional Machining			☑		
CNC machining					
3D printing	☑				
Welding	☑				
Wiring	☑		☑		
Simple analog or digital electronics (e.g., resistors, capacitors, op-amps)			☑		
Microcontrollers (e.g., Arduino)			☑		
Bonding	☑	☑			
Processing (e.g., vacuum bag, autoclave)	☑	☑			

Software Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Matlab			☑		
Comsol			☑		
Python	☑				
Ansys			☑		
SolidWorks			☑		
Other CAD packages			☑		
Siemens NX	☑				
LabView	☑				
E-Calc	☑				
AVL	☑				
Xfoil	☑				
Machine vision program	☑				

ME PROJECT 7

Design of a Biomechanical Hand

Advisor: Prof. Kimberly Cook-Chennault

Email: cookchen@soe.rutgers.edu

Project Abstract: Design of a Biomechanical Hand

Project Goals: To design a robotic hand that incorporates both mechanical and electrical functioning.

Project Envisioned Outcomes: Incorporate of electronics for programmable execution of movement of fingers.

Students Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Design			☑		
Analysis			☑		
Hand tools				☑	
Traditional Machining				☑	
CNC machining		☑			
3D printing				☑	
Welding	☑				
Wiring			☑		
Simple analog or digital electronics (e.g., resistors, capacitors, op-amps)				☑	
Microcontrollers (e.g., Arduino)				☑	
Bonding				☑	
Processing (e.g., vacuum bag, autoclave)	☑				

Software Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Matlab		☑			
Comsol		☑			
Python		☑			
Ansys		☑			
SolidWorks				☑	
Other CAD packages				☑	
Siemens NX		☑			
LabView		☑			
E-Calc		☑			
AVL		☑			
Xfoil		☑			
Machine vision program		☑			

Additional Requirements and Information:

Students will need experience with CAD and using arduino. Students will have ideally had a circuits class or similar experience to excel in this project.

ME PROJECT 8

Bio-Inspired Flapping Wing Energy Harvester I

Advisor: Prof. Mitsunori Denda

Email: denda@rutgers.edu

Project Abstract: Built on the latest in flapping flight research, the patent-pending technology at the core of this project has been shown to produce efficiencies higher than the best wind turbines on the market.

How? Recently, scientists discovered that birds use advanced flapping aerodynamics to move through the air up to 5 times more efficiently that man-made aircraft. The goal of this project is to use these recently discovered phenomena to efficiently harvest energy from the wind. Team members will design and construct their own wind energy harvester, then test its performance under different conditions. They will have access to CAD models of working prototypes that have been previously built and tested, and they will also have access to proprietary MATLAB programs which can predict efficiency before building the device.

Project Goals: The goal of this project is to use these recently discovered phenomena to efficiently harvest energy from the wind.

Project Envisioned Outcomes: Team members will design and construct their own wind energy harvester, then test its performance under different conditions.

Students Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Design			☑		
Analysis			☑		
Hand tools			☑		
Traditional Machining			☑		
CNC machining	☑				
3D printing	☑				
Welding	☑				
Wiring			☑		
Simple analog or digital electronics (e.g., resistors, capacitors, op-amps)		☑			
Microcontrollers (e.g., Arduino)		☑			
Bonding		☑			
Processing (e.g., vacuum bag, autoclave)	☑				

Software Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Matlab			☑		
Comsol		☑			
Python	☑				
Ansys		☑	7		
SolidWorks			☑		
Other CAD packages	☑				
Siemens NX	☑				
LabView	☑				
E-Calc	☑				
AVL	☑				
Xfoil	☑				
Machine vision program	☑				

ME PROJECT 9

Bio-Inspired Flapping Wing Energy Harvester II

Advisor: Prof. Mitsunori Denda

Email: denda@rutgers.edu

Project Abstract: Built on the latest in flapping flight research, the patent-pending technology at the core of this project has been shown to produce efficiencies higher than the best wind turbines on the market.

How? Recently, scientists discovered that birds use advanced flapping aerodynamics to move through the air up to 5 times more efficiently that man-made aircraft. The goal of this project is to use these recently discovered phenomena to efficiently harvest energy from the wind. Team members will design and construct their own wind energy harvester, then test its performance under different conditions. They will have access to CAD models of working prototypes that have been previously built and tested, and they will also have access to proprietary MATLAB programs which can predict efficiency before building the device.

Project Goals: Design of Bio-Inspired Flapping Wing Energy Harvester

Project Envisioned Outcomes: The students will have access to CAD models of working prototypes that have been previously built and tested, and they will also have access to proprietary MATLAB programs which can predict efficiency before building the device.

Students Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Design			☑		
Analysis			☑		
Hand tools			☑		
Traditional Machining			☑		
CNC machining	☑				
3D printing	☑				
Welding	☑				
Wiring			☑		
Simple analog or digital electronics (e.g., resistors, capacitors, op-amps)		☑			
Microcontrollers (e.g., Arduino)		☑			
Bonding		☑			
Processing (e.g., vacuum bag, autoclave)	☑				

Software Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Matlab			☑		
Comsol		☑			
Python	☑				
Ansys		☑	7		
SolidWorks			☑		
Other CAD packages	☑				
Siemens NX	☑				
LabView	☑				
E-Calc	☑				
AVL	☑				
Xfoil	☑				
Machine vision program	☑				

ME PROJECT 10

Virtual Reality Cycling for Patient Rehabilitation

Advisor: Prof. German Drazer

Email: german.drazer@rutgers.edu

Project Abstract: This project will integrate mechanical engineering and rehabilitation science. We want to design the next generation of the VRACK (virtual reality cycling kit) system. It will contain sensorized pedals, handlebars and a heart rate monitor that are interfaced with a virtual environment. The objective is to create an inexpensive integrated solution that is tailored for persons who have had a stroke and would use it in rehabilitation. For this project we collaborate with J. Deutsch, a professor of physical therapy in the Department of Rehabilitation & Movement Sciences at Rutgers.

Project Goals: Design and manufacture a pedal that can be integrated into any bike

Project Envisioned Outcomes: A fully functional prototype to test in rehabilitation bicycles

Students Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Design		☑			
Analysis		☑			
Hand tools		☑			
Traditional Machining		☑			
CNC machining	☑				
3D printing		☑			
Welding	☑				
Wiring		☑			
Simple analog or digital electronics (e.g., resistors, capacitors, op-amps)		☑			
Microcontrollers (e.g., Arduino)		☑			
Bonding	☑				
Processing (e.g., vacuum bag, autoclave)	☑				

Software Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Matlab	☑				
Comsol	☑				
Python	☑				
Ansys	☑				
SolidWorks		☑			
Other CAD packages	☑				
Siemens NX	☑				
LabView		☑			
E-Calc	☑				
AVL	☑				
Xfoil	☑				
Machine vision program	☑				

ME PROJECT 11

Automated Gantry System for Individualized Products

Advisor: Prof. Xi Gu

Email: xg107@soe.rutgers.edu

Project Abstract: Development of an Automated Gantry System for Individualized Products

Project Goals: The objective of this project is to design and construct a fully automated and flexible gantry system for individualized manufacturing/assembly. The system should be capable of picking, moving, and placing different items requested by individual users (by controlling the speed of movement, etc.) The students will have the flexibility to formulate the design problem with specified applications.

Project Envisioned Outcomes: A built gantry system with control.

Students Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Design				☑	
Analysis				☑	
Hand tools			☑		
Traditional Machining			☑		
CNC machining			☑		
3D printing			☑		
Welding	☑				
Wiring			☑		
Simple analog or digital electronics (e.g., resistors, capacitors, op-amps)			☑		
Microcontrollers (e.g., Arduino)				☑	
Bonding	☑				
Processing (e.g., vacuum bag, autoclave)	☑				

Software Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Matlab				☑	
Comsol		☑			
Python		☑			
Ansys		☑			
SolidWorks				☑	
Other CAD packages			☑		
Siemens NX	☑				
LabView	☑				
E-Calc	☑				
AVL	☑				
Xfoil	☑				
Machine vision program	☑				

ME PROJECT 12

Solar Energy Harvesting or Water Desalination Device

Advisor: Prof. Zhixiong Guo

Email: zguo@rutgers.edu

Project Abstract: The amount of solar irradiation on earth's surface is gigantic, but most of which remains unutilized while we keep depleting traditional fossil fuels. Photovoltaic (PV) or solar cells convert light energy into electricity. The yearly installation capacity of solar photovoltaic facilities has seen a continuous significant increase worldwide in recent years. Solar energy is also used for natural illumination and water and space heating. 97% of the water on the Earth is salt water. Water scarcity is among the major problems to be faced by human beings. Solar desalination is a technique to desalinate water using solar energy.

In this project, you could bring in some "wild" ideas to harvest or use solar power. For example, you may consider harvest solar energy for illumination and water heating via a smart window, build a small solar cell power generator, or design a solar desalination device. The objective of this project is to design, build, and analyze a device for solar energy harvesting or water desalination for engineering practice of natural renewable resources.

Project Goals: Idea, analysis, design, device build, and test.

Project Envisioned Outcomes: A device with some innovative or practical idea

Students Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Design			☑		
Analysis			☑		
Hand tools			☑		
Traditional Machining			☑		
CNC machining	☑				
3D printing	☑				
Welding		☑			
Wiring			☑		
Simple analog or digital electronics (e.g., resistors, capacitors, op-amps)		☑			
Microcontrollers (e.g., Arduino)	☑				
Bonding			☑		
Processing (e.g., vacuum bag, autoclave)	☑				

Software Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Matlab			☑		
Comsol			☑		
Python	☑				
Ansys			☑		
SolidWorks			☑		
Other CAD packages		☑			
Siemens NX	☑				
LabView		☑			
E-Calc	☑				
AVL	☑				
Xfoil	☑				
Machine vision program	☑				

ME PROJECT 13

Hybrid Manufacturing of Customized Knee Implant

Advisor: Prof. Yuebin Guo

Email: yuebin.guo@rutgers.edu

Project Abstract: Students will design, manufacture, and testing a Customized Knee Implant through an integrative method.

Project Goals: Learn and practice comprehensive knowledge in design concept, CAD/CAM, numerical simulation, manufacturing, and testing. Oral and written communication and team skills are also emphasized.

Project Envisioned Outcomes: Customized Knee Implant and written report

Students Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Design				☑	
Analysis				☑	
Hand tools			☑		
Traditional Machining			☑		
CNC machining					☑
3D printing				☑	
Welding	☑				
Wiring					☑
Simple analog or digital electronics (e.g., resistors, capacitors, op-amps)		☑			
Microcontrollers (e.g., Arduino)		☑			
Bonding		☑			
Processing (e.g., vacuum bag, autoclave)		☑			

Software Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Matlab			☑		
Comsol				☑	
Python			☑		
Ansys				☑	
SolidWorks					☑
Other CAD packages				☑	
Siemens NX				☑	
LabView		☑			
E-Calc		☑			
AVL		☑			
Xfoil		☑			
Machine vision program		☑			

ME PROJECT 14

Low-Cost Ventilators for COVID-19 Patients

Advisor: Prof. Yuebin Guo

Email: yuebin.guo@rutgers.edu

Project Abstract: Students will design, manufacture, and testing a Low Cost Ventilator for COVID-19 Patients through an integrative method.

Project Goals: Learn and practice comprehensive knowledge in design concept, CAD/CAM, numerical simulation, manufacturing, and testing. Oral and written communication and team skills are also emphasized.

Project Envisioned Outcomes: Functional Low Cost Ventilator and written report.

Students Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Design				☑	
Analysis				☑	
Hand tools					☑
Traditional Machining			☑		
CNC machining			☑		
3D printing				☑	
Welding		☑			
Wiring					☑
Simple analog or digital electronics (e.g., resistors, capacitors, op-amps)				☑	
Microcontrollers (e.g., Arduino)				☑	
Bonding		☑			
Processing (e.g., vacuum bag, autoclave)			☑		

Software Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Matlab				☑	
Comsol			☑		
Python	☑				
Ansys				☑	
SolidWorks					☑
Other CAD packages	☑				
Siemens NX			☑		
LabView				☑	
E-Calc			☑		
AVL			☑		
Xfoil			☑		
Machine vision program			☑		

ME PROJECT 15

Hybrid Solar and Wind Energy for a Practical Use Plus Storage

Advisor: Prof. Yogesh Jaluria

Email: jaluria@soe.rutgers.edu

Project Abstract: Use of hybrid solar and wind energy for a practical use plus storage

Project Goals: Develop and test the designed system

Project Envisioned Outcomes: Fabricate and test the system and the design

Students Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Design			☑		
Analysis			☑		
Hand tools			☑		
Traditional Machining		☑			
CNC machining	☑				
3D printing		☑			
Welding	☑				
Wiring		☑			
Simple analog or digital electronics (e.g., resistors, capacitors, op-amps)			☑		
Microcontrollers (e.g., Arduino)			☑		
Bonding	☑				
Processing (e.g., vacuum bag, autoclave)	☑				

Software Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Matlab			☑		
Comsol		☑			
Python	☑				
Ansys		☑			
SolidWorks			☑		
Other CAD packages	☑				
Siemens NX	☑				
LabView			☑		
E-Calc	☑				
AVL	☑				
Xfoil	☑				
Machine vision program	☑				

ME PROJECT 16

Storage Rotating Disk Jet Impingement Deposition Equipment

Advisor: Prof. Yogesh Jaluria

Email: jaluria@soe.rutgers.edu

Project Abstract: Design, fabricate and test a deposition system consisting of a vertical air jet impinging on a rotating disk for processes, such as painting, coating, and spray deposition, which are used in manufacturing. High flow rate and uniform flow over the rotating surface are desirable. The rotational speed and inlet velocity should be variable for different processes.

Project Goals: Design, fabricate and test a rotating disk, jet impingement, system.

Project Envisioned Outcomes: Design the system, fabricate it and show that the rotation and inflow can be controlled to obtain uniform flow over the rotating plate.

Students Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Design			☑		
Analysis			☑		
Hand tools		☑	☑		
Traditional Machining	☑				
CNC machining	☑				
3D printing		☑			
Welding	☑				
Wiring		☑			
Simple analog or digital electronics (e.g., resistors, capacitors, op-amps)			☑		
Microcontrollers (e.g., Arduino)			☑		
Bonding		☑			
Processing (e.g., vacuum bag, autoclave)	☑				

Software Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Matlab			☑		
Comsol			☑		
Python		☑			
Ansys		☑			
SolidWorks			☑		
Other CAD packages		☑			
Siemens NX	☑				
LabView			☑		
E-Calc	☑				
AVL	☑				
Xfoil	☑				
Machine vision program	☑				

ME PROJECT 17

Design of Model Aircraft Electric Engine Thrust Stand

Advisor: Prof. Doyle Knight

Email: ddknight@rutgers.edu

Meeting Place: https://rutgers.webex.com/meet/ddknight

Project Abstract: Design of Model Aircraft Electric Engine Thrust Stand

Project Goals: Design and fabricate model aircraft electric engine thrust stand.

Project Envisioned Outcomes: Model aircraft electric engine thrust stand.

Students Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Design		☑			
Analysis			☑		
Hand tools			☑		
Traditional Machining			☑		
CNC machining	☑				
3D printing				☑	
Welding			☑		
Wiring			☑		
Simple analog or digital electronics (e.g., resistors, capacitors, op-amps)				☑	
Microcontrollers (e.g., Arduino)				☑	
Bonding			☑		
Processing (e.g., vacuum bag, autoclave)	☑				

Software Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Matlab			☑		
Comsol			☑		
Python		☑			
Ansys		☑			
SolidWorks				☑	
Other CAD packages			☑		
Siemens NX	☑				
LabView				☑	
E-Calc		☑			
AVL	☑				
Xfoil			☑		
Machine vision program	☑				

ME PROJECT 18

3D Printer Capable of Printing Elastomeric Composites

Advisor: Prof. Jennifer Lynch-Branzoi

Email: jklynch@soe.rutgers.edu

Meeting Place: https://rutgers.webex.com/meet/jklynch

Project Abstract: 3D printing is used to quickly fabricate prototypes. With the development of new materials, including polymeric nanocomposites, 3D printing is a good choice to easily fabricate parts from these novel feedstocks and perform materials characterization. However, high concentration of nanoparticles in a polymer matrix nanocomposite can cause difficulties when using a 3D printer. The aims of this project are to develop and build a 3D printer capable of printing elastomeric composites with a high concentration of nanoparticles and characterize printed novel elastomeric composites, as well as the elastomer alone as a control.

Project Goals: The project goals are to (1) develop and build a 3D printer capable of printing elastomeric composites with a high concentration of nanoparticles, (2) enable accessories to be used with the printer including a spot heater to aid curing and a thermal imager to monitor curing, and (3) characterize these printed novel elastomeric composites, as well as the elastomer alone as a control.

Project Envisioned Outcomes: The primary outcome of this project will be a functioning 3D printer enabling printing of novel polymeric nanocomposites with in situ monitoring of the curing process, which will aid in materials optimization for a specific application and prototyping.

Students Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Design			☑		
Analysis		☑			
Hand tools		☑			
Traditional Machining		☑			
CNC machining	☑				
3D printing		☑			
Welding	☑				
Wiring			☑		
Simple analog or digital electronics (e.g., resistors, capacitors, op-amps)		☑			
Microcontrollers (e.g., Arduino)		☑			
Bonding	☑				
Processing (e.g., vacuum bag, autoclave)	☑				

Software Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Matlab		☑			
Comsol	☑				
Python	☑				
Ansys	☑				
SolidWorks		☑			
Other CAD packages		☑			
Siemens NX	☑				
LabView		☑			
E-Calc	☑				
AVL	☑				
Xfoil	☑				
Machine vision program	☑				

Additional Requirements and Information:

Use Excel or Origin for data analysis

A similar project can be found at http://3dprintingfromscratch.com/common/how-to-build-a-3d-printer-from-scratch/

ME PROJECT 19

3D Printer for Thermoplastics, Thermosets, Conductive and Metallic Materials

Advisor: Prof. Rajiv Malhotra

Email: rajiv.malhotra@rutgers.edu

Meeting Place: https://rutgers.webex.com/meet/rm1306

Project Abstract: The project involves the integration of lasers and other light sources with an in-development 3D printer for printing thermoplastics, thermosets, conductive and metallic materials within the same process. A setup has been developed in past projects for this process. This particular project will involve integration of a fiber-laser with this setup to enable laser processing of these materials as well.

Project Goals: The project involves the integration of lasers and other light sources with an in-development 3D printer for printing thermoplastics, thermosets, conductive and metallic materials within the same process.

Project Envisioned Outcomes: Integration of lasers and other light sources with an in-development 3D printer for printing thermoplastics, thermosets, conductive and metallic materials within the same process.

Students Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Design		☑			
Analysis	☑				
Hand tools			☑		
Traditional Machining			☑		
CNC machining			☑		
3D printing			☑		
Welding	☑				
Wiring			☑		
Simple analog or digital electronics (e.g., resistors, capacitors, op-amps)			☑		
Microcontrollers (e.g., Arduino)			☑		
Bonding		☑			
Processing (e.g., vacuum bag, autoclave)	☑				

Software Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Matlab					
Comsol					
Python					
Ansys					
SolidWorks					
Other CAD packages					
Siemens NX					
LabView					
E-Calc					
AVL					
Xfoil					
Machine vision program					

ME PROJECT 20

Detachable Propulsion Unit for Surfboards of Varying Size I

Advisor: Prof. Aaron Mazzeo

Email: aaron.mazzeo@rutgers.edu

Project Abstract: Surfing requires a high level of fitness to paddle with sufficient speed and power to catch green waves as they break. For beginning and intermediate surfers, paddling with sufficient speed can be challenging and lead to difficulty in popping up to catch waves and develop skills. This project will focus on the design and manufacture of a detachable propulsion unit that can fit on the underside of surfboards of varying size. The goal is not to create a fast-traveling vehicle but provide enough power in a portable, lightweight attachment to allow surfers to catch waves automatically based on the measured paddling rate of the surfer's arms. Future applications may include systems that assist lifeguards in rescue of drowning surfers.

Project Goals: Create a safe and lightweight system for hydraulic propulsion. Create a control system that uses wireless accelerometers mounted on the upper arm to determine when to power the propulsion system. Collect information from the surfer to then aid in customized instruction.

Project Envisioned Outcomes: Detachable propulsion system. Control system with wireless accelerometers; Data science to aid beginning surfers and help them learn to surf more quickly; Low-cost prototype that we can think about marketing.

Students Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Design	☑				
Analysis	☑				
Hand tools	☑				
Traditional Machining	☑				
CNC machining	☑				
3D printing	☑				
Welding	☑				
Wiring	☑				
Simple analog or digital electronics (e.g., resistors, capacitors, op-amps)	☑				
Microcontrollers (e.g., Arduino)	☑				
Bonding	☑				
Processing (e.g., vacuum bag, autoclave)	☑				

Software Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Matlab	☑				
Comsol	☑				
Python	☑				
Ansys	☑				
SolidWorks	☑				
Other CAD packages	☑				
Siemens NX	☑				
LabView	☑				
E-Calc	☑				
AVL	☑				
Xfoil	☑				
Machine vision program	☑				

Additional Requirements and Information:

Two teams -- one focusing on propulsion; one focusing on the accelerometers.

ME PROJECT 21

Detachable Propulsion Unit for Surfboards of Varying Size II

Advisor: Prof. Aaron Mazzeo

Email: aaron.mazzeo@rutgers.edu

Project Abstract: Surfing requires a high level of fitness to paddle with sufficient speed and power to catch green waves as they break. For beginning and intermediate surfers, paddling with sufficient speed can be challenging and lead to difficulty in popping up to catch waves and develop skills. This project will focus on the design and manufacture of a detachable propulsion unit that can fit on the underside of surfboards of varying size. The goal is not to create a fast-traveling vehicle but provide enough power in a portable, lightweight attachment to allow surfers to catch waves automatically based on the measured paddling rate of the surfer's arms. Future applications may include systems that assist lifeguards in rescue of drowning surfers.

Project Goals: Create a safe and lightweight system for hydraulic propulsion. Create a control system that uses wireless accelerometers mounted on the upper arm to determine when to power the propulsion system. Collect information from the surfer to then aid in customized instruction.

Project Envisioned Outcomes: Detachable propulsion system. Control system with wireless accelerometers; Data science to aid beginning surfers and help them learn to surf more quickly; Low-cost prototype that we can think about marketing.

Students Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Design	☑				
Analysis	☑				
Hand tools	☑				
Traditional Machining	☑				
CNC machining	☑				
3D printing	☑				
Welding	☑				
Wiring	☑				
Simple analog or digital electronics (e.g., resistors, capacitors, op-amps)	☑				
Microcontrollers (e.g., Arduino)	☑				
Bonding	☑				
Processing (e.g., vacuum bag, autoclave)	☑				

Software Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Matlab	☑				
Comsol	☑				
Python	☑				
Ansys	☑				
SolidWorks	☑				
Other CAD packages	☑				
Siemens NX	☑				
LabView	☑				
E-Calc	☑				
AVL	☑				
Xfoil	☑				
Machine vision program	☑				

Additional Requirements and Information:

Two teams -- one focusing on propulsion; one focusing on the accelerometers.

ME PROJECT 22

Transportable Wheelchair Ramp

Advisor: Prof. Andrew Norris

Email: norris@rutgers.edu

Project Abstract: A common problem that people in wheelchairs have is negotiating a simple step. Just one 9 inch step at a door can block entrance or exit. While permanent ramps are available, the wheelchair user often encounters steps with no ramps, especially at private residences. This project will focus on developing a transportable and transferable device that will adjust to various step heights up to one foot high. The device can be plugged into electric outlets, allowing different mechanisms to be considered, e.g. electric motors to adjust the height of one end, pneumatic or hydraulic assists to raise or lower a flat or inclined surface.

Project Goals: Students will research existing resources to identify a niche for a novel device of use to wheelchair users. This will include interviews with potential users. The mechanical engineering features will focus on how to make an adaptable device that can cater to different step heights. Students will consider a variety of designs, brainstorming on the best approach. The team will focus on a final design that fits within the budget. The goal is a working model that will be demonstrated.

Project Envisioned Outcomes: A working design, experience of design constraints, working within a budget and time limitations. Some exposure to how to cater to the final user.

Students Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Design			☑		
Analysis			☑		
Hand tools			☑		
Traditional Machining			☑		
CNC machining			☑		
3D printing	☑				
Welding	☑				
Wiring			☑		
Simple analog or digital electronics (e.g., resistors, capacitors, op-amps)			☑		
Microcontrollers (e.g., Arduino)		☑			
Bonding	☑				
Processing (e.g., vacuum bag, autoclave)	☑				

Software Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Matlab		☑			
Comsol			☑		
Python		☑			
Ansys			☑		
SolidWorks			☑		
Other CAD packages		☑			
Siemens NX	☑				
LabView	☑				
E-Calc	☑				
AVL	☑				
Xfoil	☑				
Machine vision program	☑				

Additional Requirements and Information:

Some understanding of vibration, experience with electric motors.
Links to similar projects:
https://www.youtube.com/watch?v=2_TjQoyV5RE
https://www.youtube.com/watch?v=x5BMlPe_mQY
https://www.youtube.com/watch?v=KxEJ0xkLO7g

ME PROJECT 23

RFR Powertrain Dynamometer

Advisor: Prof. Assimina Pelegri

Email: pelegri@rutgers.edu

Project Abstract: Dynamometer's are data acquisition tools to measure the torque and speed for a motor. We want to build a dynamometer that can mechanically load through viscous damping our Emrax motor and custom made battery pack. This dyno will record power output of the motor and electrical loading response behavior of the battery pack.

Project Goals: The goal is to create a powertrain dyno for Emrax 208, a motor that is being used in the Rutgers Formula Racing 2022 car. The powertrain dyno for electrical motors with power output up to 90kW. Additionally, we want to gather temperature data from our batteries to ensure proper cooling.

Project Envisioned Outcomes: A working powertrain dynamometer that will provide accurate, usable numbers.

Note: This project is closed.

Students Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Design			☑		
Analysis			☑		
Hand tools				☑	
Traditional Machining				☑	
CNC machining			☑		
3D printing		☑			
Welding	☑				
Wiring			☑		
Simple analog or digital electronics (e.g., resistors, capacitors, op-amps)			☑		
Microcontrollers (e.g., Arduino)			☑		
Bonding		☑			
Processing (e.g., vacuum bag, autoclave)	☑				

Software Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Matlab			☑		
Comsol			☑		
Python	☑				
Ansys			☑		
SolidWorks			☑		
Other CAD packages	☑				
Siemens NX		☑			
LabView			☑		
E-Calc	☑				
AVL	☑				
Xfoil	☑				
Machine vision program	☑				

ME PROJECT 24

Dispensing Pump (Sponsored by Colgate-Palmolive)

Advisor: Profs. Alberto Cuitiño, Assimina Pelegri

Industry Advisor: Barbara Porter

Email: cuitino@rutgers.edu, pelegri@rutgers.edu

Project Abstract: The goal is to design a superior dispensing experience for consumer products within oral care, personal care and home care product categories. The student will need to build an understanding how the formula rheology and the dispensing mechanisms combine to create the proper dispensing experience. A wide range of formulas will be explored.

Project Goals: Measure various performance characteristics such as flow rate and activation force for a variety of products and pumping mechanisms. Create and test hypotheses regarding the functioning of each of the pumps.

Project Envisioned Outcomes: Recommendations for modifying packaging componentry (a new pump design) for various formula types for optimal dispensing.

Students Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Design			☑		
Analysis					☑
Hand tools		☑			
Traditional Machining		☑			
CNC machining		☑			
3D printing			☑		
Welding		☑			
Wiring		☑			
Simple analog or digital electronics (e.g., resistors, capacitors, op-amps)		☑			
Microcontrollers (e.g., Arduino)		☑			
Bonding	☑				
Processing (e.g., vacuum bag, autoclave)	☑				

Software Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Matlab	☑				
Comsol	☑				
Python	☑				
Ansys	☑				
SolidWorks	☑				
Other CAD packages	☑				
Siemens NX	☑				
LabView	☑				
E-Calc	☑				
AVL	☑				
Xfoil	☑				
Machine vision program	☑				

ME PROJECT 25

Vacuum Tube Solar Steam Generator

Advisor: Profs. Todd Rossi, Michael Muller

Email: todd.m.rossi@rutgers.edu,

Project Abstract: Solar thermal energy collectors are more appropriate than PV for industrial heat driven processes (e.g., water desalination). In this project, we will enhance, build, and operate a vacuum tube solar steam generator at 15 psi.

Project Goals: 1) Update design and build 15 psi solar steam generator prototype, 2) Operate, test, and measure performance, 3) Refine design as needed, 4) Setup continuously operating outdoor prototype with instrumentation, automated controls, and remote monitoring.

Project Envisioned Outcomes: Continuously operate a 15 psi solar steam generator with automated controls and remote performance monitoring and reporting

Students Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Design		☑			
Analysis		☑			
Hand tools		☑			
Traditional Machining		☑			
CNC machining	☑				
3D printing	☑				
Welding	☑				
Wiring		☑			
Simple analog or digital electronics (e.g., resistors, capacitors, op-amps)		☑			
Microcontrollers (e.g., Arduino)		☑			
Bonding	☑				
Processing (e.g., vacuum bag, autoclave)	☑				

Software Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Matlab	☑				
Comsol	☑				
Python		☑			
Ansys	☑				
SolidWorks		☑			
Other CAD packages	☑				
Siemens NX	☑				
LabView	☑				
E-Calc	☑				
AVL	☑				
Xfoil	☑				
Machine vision program	☑				

Additional Requirements and Information:

https://drive.google.com/drive/folders/18ZTBnLddnsjitu4uhlxUGKu2hgHAAfg8?usp=sharing

ME PROJECT 26

Intermittent Vacuum/Pressure Cuff

Advisor: Prof. Jerry Shan

Email: jshan@soe.rutgers.edu

Project Goals: Design, build, and test a cuff which can alternately provide pressure and vacuum to spots on the leg or arm. The device has two purposes: 1) Speed up recovery, relieve pain and improve athletic performance, and 2) Enhance transdermal delivery of large molecules, including DNA vaccines, into cells.

Project Envisioned Outcomes: Working device with programmable cycles of pressure and/or vacuum delivered to either arm or leg of a person.

Students Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Design				☑	
Analysis				☑	
Hand tools				☑	
Traditional Machining				☑	
CNC machining				☑	
3D printing				☑	
Welding		☑			
Wiring				☑	
Simple analog or digital electronics (e.g., resistors, capacitors, op-amps)				☑	
Microcontrollers (e.g., Arduino)				☑	
Bonding		☑			
Processing (e.g., vacuum bag, autoclave)		☑			

Software Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Matlab		☑			
Comsol		☑			
Python			☑		
Ansys		☑			
SolidWorks				☑	
Other CAD packages	☑				
Siemens NX	☑				
LabView				☑	
E-Calc	☑				
AVL	☑				
Xfoil	☑				
Machine vision program		☑			

ME PROJECT 27

Paint Scratch Repair Device

Advisor: Prof. Jonathan Singer

Email: jonathan.singer@rutgers.edu

Project Abstract: The purpose of this project is to design a stand alone device for the repair of paint scratches in cars through the use of self-limiting electrospray deposition. This method will only target exposed metal, while not adding extra material to the painted regions.

Project Goals: This new team will build on the device started by the 2020 senior design team and test its ability to patch model scratches in painted metal panels.

Project Envisioned Outcomes: A new method for repairing scratches in automotive paint without costly repainting.

Students Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Design			☑		
Analysis			☑		
Hand tools			☑		
Traditional Machining			☑		
CNC machining		☑			
3D printing			☑		
Welding	☑				
Wiring			☑		
Simple analog or digital electronics (e.g., resistors, capacitors, op-amps)		☑			
Microcontrollers (e.g., Arduino)			☑		
Bonding	☑				
Processing (e.g., vacuum bag, autoclave)		☑			

Software Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Matlab			☑		
Comsol		☑			
Python		☑			
Ansys		☑			
SolidWorks			☑		
Other CAD packages	☑				
Siemens NX	☑				
LabView		☑			
E-Calc	☑				
AVL	☑				
Xfoil	☑				
Machine vision program	☑				

ME PROJECT 28

Topic TBA

Advisor: Prof. Stephen Tse

Email: sdytse@rutgers.edu

Please contact Prof. Tse directly regarding this project.

Students Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Design					
Analysis					
Hand tools					
Traditional Machining					
CNC machining					
3D printing					
Welding					
Wiring					
Simple analog or digital electronics (e.g., resistors, capacitors, op-amps)					
Microcontrollers (e.g., Arduino)					
Bonding					
Processing (e.g., vacuum bag, autoclave)					

Software Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Matlab					
Comsol					
Python					
Ansys					
SolidWorks					
Other CAD packages					
Siemens NX					
LabView					
E-Calc					
AVL					
Xfoil					
Machine vision program					

ME PROJECT 29

High Strength, Light Weight Cylindrical Pressure Vessel with Fiber-Reinforced Composites

Advisor: Prof. George Weng

Email: gjweng@rutgers.edu

Project Abstract: Use carbon fibers and epoxy resin to make polymer composites, and use the composites to build a cylindrical pressure vessel

Project Goals: To build a light-weight composite cylindrical pressure vessel that can sustain high pressure without failure.

Project Envisioned Outcomes: A hardware composite cylindrical pressure vessel.

Students Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Design		☑			
Analysis		☑			
Hand tools		☑			
Traditional Machining		☑			
CNC machining		☑			
3D printing		☑			
Welding		☑			
Wiring		☑			
Simple analog or digital electronics (e.g., resistors, capacitors, op-amps)		☑			
Microcontrollers (e.g., Arduino)		☑			
Bonding			☑		
Processing (e.g., vacuum bag, autoclave)			☑		

Software Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Matlab			☑		
Comsol	☑				
Python	☑				
Ansys	☑				
SolidWorks	☑				
Other CAD packages	☑				
Siemens NX	☑				
LabView	☑				
E-Calc	☑				
AVL	☑				
Xfoil	☑				
Machine vision program	☑				

ME PROJECT 30

Autonomously Navigating Robotic Service Delivery System

Advisor: Prof. Jingang Yi

Email: jgyi@rutgers.edu

WebEx Meeting Place: https://rutgers.webex.com/meet/jgyi

Project Abstract: Autonomously Navigating Robotic Service Delivery System

Project Goals: The goal of this project is to design and develop a fully functional robot that self-navigates through restaurants or hospitals. The robot will be equipped with necessary sensors and navigational components to ensure that the food or medicine reaches its destination safely. This fast and organized delivery system would minimize the hassle for the customer and the employee.

Project Envisioned Outcomes: Design, prototyping and extensive functionality testing and demonstration

Students Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Design				☑	
Analysis				☑	
Hand tools				☑	
Traditional Machining				☑	
CNC machining				☑	
3D printing			☑		
Welding				☑	
Wiring				☑	
Simple analog or digital electronics (e.g., resistors, capacitors, op-amps)					☑
Microcontrollers (e.g., Arduino)					☑
Bonding				☑	
Processing (e.g., vaccum bag, autoclave)				☑	

Software Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Matlab			☑		
Comsol			☑		
Python					☑
Ansys			☑		
SolidWorks				☑	
Other CAD packages			☑		
Siemens NX	☑				
LabView				☑	
E-Calc	☑				
AVL	☑				
Xfoil	☑				
Machine vision program					☑

Additional Requirements and Information:

Require Programming in C/C++

ME PROJECT 31

A Smart Fertilizer Machine for Urban Organic Waste Recycling

Advisor: Prof. Qingze Zou

Email: qzzou@rutgers.edu

Project Abstract: In this project, we are creating one-of-its-kind smart machine that turns urban organic waste (e.g., vegetable and fruit left-out) into biogas and fertilizer. Urban agriculture has becoming an indispensable component of the food supply in big cities around the world, whereas in the contrast, organic waste has also becoming an increasingly critical environmental concern in these big cities as well. Thus, turning organic waste into biogas and fertilizer that can be directly used as energy resource and applied in urban agriculture, respectively, is not only very environmentally, but also economically beneficial. In this project, you are asked to build upon the outcome of the previous year's group, to improve their design and construction, and then build, and test a prototype machine that can automatically sort the organic waste, break them into small pieces, and convert them into biogas and fertilizer through fermentation process. The system you will make is a truly mechatronics system, and you will utilize the state-of-the-art sensing, actuation, computer vision, and onboard computation technologies to make the whole system completely autonomous, robust, and highly efficient that can be easily deported and installed in communities and/or urban farm factory in the future.

Project Goals: Create one-of-its-kind smart machine that turns urban organic waste (e.g., vegetable and fruit left-out) into biogas and fertilizer.

Project Envisioned Outcomes: A prototype machine that can automatically sort the organic waste, break them into small pieces, and convert them into biogas and fertilizer through fermentation process.

Students Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Design		☑			
Analysis	☑				
Hand tools			☑		
Traditional Machining		☑			
CNC machining	☑				
3D printing		☑			
Welding	☑				
Wiring			☑		
Simple analog or digital electronics (e.g., resistors, capacitors, op-amps)			☑		
Microcontrollers (e.g., Arduino)			☑		
Bonding			☑		
Processing (e.g., vacuum bag, autoclave)		☑			

Software Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Matlab			☑		
Comsol		☑			
Python	☑				
Ansys	☑				
SolidWorks		☑			
Other CAD packages	☑				
Siemens NX	☑				
LabView			☑		
E-Calc	☑				
AVL	☑				
Xfoil	☑				
Machine vision program	☑				

Additional Requirements and Information:

Arduino programming experience is required.