2017 - 2018 FALL SEMESTER
MECE 407 INNOVATIVE ENGINEERING ANALYSIS AND DESIGN
PROJECT TOPICS

1- Design, Manufacture and Implementation of a Mini Size Tension Test Equipment:

-max force 500 kg,
-hydraulic or trapezoidal thread actuated,
-on-line force measurement with stain gages or load cells,
-on-line displacement measurement,
-all data should be transfered on-line to a computer,
-on-line plot of the engineering stress. vs. strain variation,
-necessary programmes (embedded or the ones to be run at the computer side) should be prepared to calculate stress, strain, deflection, area change of the specimen
-all the necessary sensors and the actuators will be selected and mounted by the project members
- thread actuted power system equiped with gear box(es) could be used for the sake of simplicity and economy,
-tension tests should be performed using small size/diameter samples made of steel, copper, polimer and composites.

2- Assemble of Small Mechanical Parts by n Industrial Robot Using An Image Processing Technique:

- the industrial robot available in the lab will be used (or the ones available -completed projects could also be used if we oblige to)
- the mechanical parts will be placed randomly (in a mixed order) in front of the robot
- a camera will be used to identify the mechanical parts (bolts, nuts, washers, pins, cores, etc)
- the suitable image processing strategy will be determined/selected by the group members after the literature survey,
- the mechanical parts will have a suitable size and geometry for easy gripping by the robot.
- mechanical parts will be mounted/assembled to a prepared steel block (the block will be machined in the workshop of the faculty),
- if the students will have a great progress at this project topic in a short while, the mechanical parts may be placed randomly on a slowly moving conveyor band.

3- Design, Manufacture and Implementation of a Rotating inverted pendulum:

Two metal sticks will be attached to each other from their tips. The first stick is connected to a motor and the motor rotates the first stick according to its rotation axis. Due to this movement the second stick is able to move freely in a perpendicular plane to the motor rotation axis. The aim is putting the second stick in a perpendicular position in upwards direction and making it stationary in this position for a sufficient duration.

4- Design, Manufacture and Implementation of a ManuLight tracking device:

The device will have to turn left and right and up and down tracking a light source depending on the light source's varying position. The tracking process will be a continuous process. If the source comes too close to the device (approximately 20 cm) the device will protect itself with a shield and whenever the distance between the device and the source exceeds (approximately 20 cm) the device will remove its shield.

5- Designing an optical instrument for detection of Eye diseases :

In this project our aim is implementing a portable, compact and cheap device by using an optic technology which can be used to identify the eye diseases such as cataract and astigmatism. Opt mechanical design will be coupled to a source which is illuminate the eyes, and reflected light will be captured with an imaging sensor. The post processing of recorded images will be executed with an android device such as self phone. Technical specifications of the Project outcome: Different type of LED's and/or laser diodes, lenses, mirrors, gratings and collimation units will be used in transmitter design. Optical detectors such as CMOS or CCD will be used to collect light via a telescopic system. A smart phone will be used to process data with java programming language.

6- Development of micro machining 3D laser printer :

In this project our aim is implementing a 3D laser printer for micro machining applications. This gadget will exhibit some attributes such as portability, compactness and re-configurability based on optical design. A programmable spatial Light Modulator (SLM) will be used to manipulate the collimated light. This structured light then will be directed onto a special mixture (Photo sensitive resin) by a relay optical system for molding operation. Technical specifications of the Project outcome: Transmitter and receiver units will include different types of LED's and/or laser diodes, lenses, mirrors and collimation units. SLM will be coupled to this designed optical system. Optical detectors such as CMOS or CCD will be used to collect information for real time molding operation. All operations (post processing, molding, drilling, etc.) will be controlled by a Labview Programming Language.

7- Automatic Vacuum Cleaner Robot Project

It is proposed an automated vaccum cleaner robotic system that allows for automatic cleaning of a particular area or room by covering the area using border analysis. The

robotic system follows a zigzag path to cover entire room. The system uses ultrasonic sensors for boundary sensing and operates accordingly in order to cover entire room. The system also has a vacuum suction cleaner attached to its back for dust suction. It also displays the time utilized for complete cleaning session and displays it on LCD display post the cleaning process. The system uses microcontroller based circuit system in order to monitor ultrasonic sensors as well as operate LCD display and control robot movement at the same time. The system detects one corner of room and starts from there, it then activates vacuum cleaner motor in order to start the suction system. The robot now operates in a zig zag manner by turning once a corner is reached. It cover the complete area automatically. There should be no obstacle in the entire room for this system to work properly. This can be resolved in future improvements in the system. Also the system now displays the time it required to finish the complete cleaning on LCD display.

8- Development of a Robotic Arm Replicating Human Arm Movements

In this project a robotic arm is aimed to be designed that will replicate human arm movements. Two different arms which has the same physical structure and dimensions will be produced. Both of them have the same motion sensors to measure its own arm position. One of the arm will be master and driven by an human subject who moves the robot arm through a glove attached at the end of arm. Different from the master arm, slave robotic arm will have actuators to replicate the motion produced by master arm. Technical specifications of the Project outcome: Master robot arm will have motion sensors such as potentiometers measuring its own position. As master arm is moved by an human subject, slave arm will receive the master arm's position data and relocate itself to replicate the motion of master arm by driving its own actuator. Data collection from master arm, measuring slave arm's motion data and controlling actuators of the arm will be handled in real time using a microcontroller.

9- Development of a Drone for Door-To-Door Delivery:

In this project a drone is aimed to be designed to deliver a package which may contain food, book, newspaper etc. to a consumer. Seller of the package will provide the drone location of delivery address. Drone will take the item to the defined coordinates, leave the package and turn back to its initial location. Drone will control a three finger robot hand to hold and release the package of the delivery. Technical specifications of the Project outcome: Drone will be designed from scratch. Frame, landing gear, propellers, electronic speed controllers and motors will be brought together to build a drone. A flight controller is required to enable a stable flight. GPS sensor is required to determine the location of drone. A three finger hand that can be opened and closed by the drone will be incorporated.

10 - Control of the personal transportation vehicle

The human transportation vehicle (HTV) is a vehicle that is increasing being used in many areas nowadays. The self-balancing HTV is actively controlled to allow safe and easy

transportation of a single person. A good control of HTV can provide safe and quick transportation of people from one to its desired place in a short time. In this Project, some effective controllers will be designed achieve good control of HTV systems.

11- Control of Wind Turbine for Clean Energy

Wind energy is currently the fastest-growing energy source in the world. It is a cost-effective, environmentally friendly solution to energy needs. Modern wind turbines are large, flexible structures operating in uncertain environments as wind direction and flow constantly changes. There are many controls challenges associated with efficient energy capture and delivery for wind turbines. In this project, we consider the so-called "above-rated" operational mode of the wind turbine. In this mode, the wind speeds are high enough that the pitch angle of the turbine blades needs to be prescribed properly to shed excess power so that the generated wind power is regulated at desired levels. This mode of operation readily permits the application of linear control theory. One or more controllers will be designed to control the wind turbine to provide more clean energy.