Project Title:	**An Automatic Visual Inspection of Industrial Products surfaces using Image Processing and AI**
Synopsis:	The finishing surface of industrial parts such as shafts, bearings, pistons, rings and pins should be smooth within the permissible limits before installation process, as the defects in these parts may damage or reduce the life of machine. The optical surface inspection of industrial products will be done through designing the setup of one camera and several multiple mirrors. After that, the video streaming processing will be applied to find the defects on the product surfaces. The noise will be always occurred during inspection. Thus, an artificial intelligence algorithm will be used to eliminate the noise and grade of the products.
Objectives:	1. To design optical defects mechanism for investigating the lateral surfaces of the rotationally symmetric products using camera and image processing. 2. To develop an image processing with AI algorithms for multi-grade classification of the inspected products. 3. To evaluate the performance of the proposed prototype through a comparison with other existed systems.
Equipment required:	Camera, mirrors and aluminum profile
Software required:	MATLAB
Supervisor(Deparbment):	Dr. Mohammed Abdo Hashem Ali (Mechanical Engineering)
Program:	Master of_Mechanical_ Engineering/Master of_Electrical_ Engineering
Duration:	Maximum 2 consecutive semesters

Project Title:	**Development of An Autonomous Robotic System for Road Marks Painting**
Synopsis:	The road marks painting are performed manually worldwide through two main tasks, namely, pre-marking and applying the paint by thermoplastic/cold painting systems. this project is aimed to replace the manual road painting with an autonomous small vehicle system that is equipped with components of a painting system mounted on its platform. This system involves two main systems, namely, the autonomous vehicle navigation system and automated road mark painting system. The autonomous navigation system will be used to detect the exact position of the road that will be painted such as in the middle, at right or left. The automated painting system will be used to perform the painting of the marks on the road while the autonomous system of AV vehicle is continuously navigating on the road. Based on the types of the road lane marks, the painting system should be able to control the time periods for spraying the paint on the road.
Objectives:	1. To develop an autonomous electric vehicle for road features detection and road marks painting. 2. To apply autonomous navigation system together with motion control for driving the vehicle autonomously in roads. 3. To develop a control painting system for applying many types of road marks while navigating on the road.
Equipment required:	Camera, odometry, LRF, battery, IFC cards, DC motors, wheels, airless pump and aluminum profile
Software required:	VC# and MATLAB
Supervisor(Deparbment):	Dr. Mohammed Abdo Hashem Ali (Mechanical Engineering)
Program:	Master of_Mechanical_ Engineering/Master of_Electrical_ Engineering
Duration:	Maximum 2 consecutive semesters

Project Title:	**Development of an Intelligent Spanner For Auto-Tightening and Loosening of Multi Diameter Bolts/Nuts using Vision System and AI**
Synopsis:	Currently, the adjusting of the spanner during opening/closing of bots/nuts are done manually world-wide by choosing the suitable spanner among of spanners kit. The project is aimed to develop an intelligent spanner that is capable to change automatically its jaws size according to the size of the bolt or nut. The intelligent spanner consists of a mini camera and multiple-jaws, DC motors, microcontroller and spanner housing. The mechanical and electrical parts are designed and fabricated with a specific size that can be loaded by human hand . The camera is used to scan the bolt or nut and then determine their size in order to change the spanner's head according to it. The artificial intelligence algorithm is applied on the extracted features from the images in order to do decision making on the bolt's size and grab it into the standards.
Objectives:	1. To develop an intelligent spanner capable to be used for tightening and loosening of different diameters of nuts and bolts 2. To investigate the upper surface of a nut or bolt and determine their diameters using image processing techniques. 3. To develop an AI based decision making algorithm for determining of the bolts/nuts standards
Equipment required:	mini camera and multiple-jaws, DC motors, microcontroller and spanner housing
Software required:	MATLAB
Supervisor(Deparbment):	Dr. Mohammed Abdo Hashem Ali (Mechanical Engineering)
Program:	Master of_Mechanical_ Engineering/Master of_Electrical_ Engineering
Duration:	Maximum 2 consecutive semesters

Project Title:	**Development of Gravitational Mechanism for Sustainable Electricity Generation**
Synopsis:	One of the main sustainable resources and costless sources of energy is the gravity-based engine. It can be used with mobility system by utilizing the gravity in a certain manner to produce the torque that can move either electrical motors or engines. There are two methods to produce energy from weights that are moving down under the effect of gravity.; namely; direct and indirect methods. Indirect methods, the weights are used directly to generate the shaft rotation according to the torque generated from some masses that are arranged in certain positions around the shafts which is resulted by continuous movement due to unbalancing situations in masses. In indirect methods, the weights are used to increases the pressure of hydraulic liquid which will be used indirectly to move the engine using hydraulic motors. Most of the existed is using gravity in direct way with one stage only to generate electricity through dynamos and then use it for lighting and operating electrical devices. Actually, the torque generated from one stage is small and can't be used to drive mobility vehicles, thus we are planning in this research to develop special direct gravity engines with multi-stages to increase the value of the torque generated from gravity engine.
Objectives:	1. To model and dynamic analysis of a gravitational mechanisms for gravitational mechanisms 2. To design several types of unbalancing gravitational mechanisms. 3. To develop a prototype of gravitational mechanism for electricity generation.
Equipment required:	Fabrication of Wheel with several holes, IMS and odometry sensors, Dynamo
Software required:	MATLAB
Supervisor(Department):	Dr. Mohammed Abdo Hashem Ali (Mechanical Engineering)
Program:	Master of_Mechanical_ Engineering
Duration:	Maximum 2 consecutive semesters

Project Title:	Development of Wheeled Mobile Robot Motion Control using Active Force Control and Laser Simulator Logic
Synopsis:	A new strategy to control the motion of wheeled mobile robot (WMR) using active force control (AFC) based on its capability to eliminate the presence of disturbances, will be developed in this project. A proportional derivative active force control (PDAFC) scheme will be particularly implemented in this project incorporating with one type of intelligent techniques, namely, laser simulator logic to effectively and robustly control the heading rotation of a wheeled mobile robot (WMR) and used to calculate the inertia matrix which is multiplied by acceleration to give the actual torque. The modelling of robot in kinematic and dynamic models should be derived first using Newton and Lagrange Equations. A simulation study using SIMULINK software will be conducted to test the control algorithm based on the derived equations. A fabrication of small prototype for mobile will be accomplished to test the proposed algorithm on the real mobile robot prototype. The robustness and effectiveness of the proposed control scheme in both simulation and experimental work will be investigated that its effective in comparison with traditional controller like PD controller and AFC.
Objectives:	1. To model wheeled mobile robot with three wheels IN KINEMATIC AND DYANAMIC MODELS. 2. To develop a control system based on active force control and laser simulator logic 3. To implement the proposed control system on simulation and real wheeled mobile robot
Equipment required:	Camera, odometry, LRF, battery, IFC cards, DC motors, wheels, airless pump and aluminum profile
Software required:	VC# and MATLAB
Supervisor(Department):	Dr. Mohammed Abdo Hashem Ali (Mechanical Engineering)
Program:	Master of_Mechanical_ Engineering/Master of_Electrical_ Engineering
Duration:	Maximum 2 consecutive semesters