Automotive Exhaust gas detection using fuzzy control of mobile manipulator with neural network-based position correction

Eng. Amr Nasr

Mechatronics department

Robotics has been acknowledged as a mainstay in the industrial automation domain for decades. It is gradually making its headway into the domains of vehicle applications domain but robot control is still the focus of recent research. This study show Robustness of FOPID Control and Fuzzy controller Due to the uncertainties in the nominal values of mobile manipulator The uncertainties in the nominal values of the system parameters such as links length and hand load cause error in the end effector position so Artificial Intelligence is used to detect the error.

Exhaust gas mobile manipulator is used to trace the exhaust system using temperature sensor and Ultrasonic Sensor while detect the crack using carbon dioxide (C02) sensor, image processing is used to determine crack coordination (X,Y and Z) two 2D camera. Crack coordination (X,Y and Z) depend on Mobile Manipulator Position by Dc wheel motor, Artificial neural network (ANN) is used to correct the robot position Based on workspace of manipulator.

Autodesk inventor was used for the design and dynamic simulation of the 6DOF Mobile Manipulator.

Denavit-Hartenberg technique was applied to analyze the forward and inverse kinematics of the arm. An interface between the Mat lab Sim Mechanic and Autodesk Inventor is developed to animate the motion of the robot arm. The interface is able to communicate with the robotic controller to send and retrieve information to/from the controller.

Three control actions are investigated to track desired trajectory of the gripper to the crack coordination; a PID control that depends on the inverse kinematics of the arm, single stage fuzzy control (SSFC) and three stages fuzzy control (TSFC). The fuzzy control serves as an inverse kinematic model to the arm. The inputs to the controller are the errors in the end effector position $\Delta x, \Delta y, \Delta z$ and the outputs of controller c:ire the controlled changes in the angular displacements of the joints.