

Path Planning of a Robotic Manipulator for 3D Scanning of Moving Object on a Conveyer

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DECLARATION

I declare that this is my own work and this dissertation does not incorporate without acknowledgement any material previously submitted for a Degree or Diploma in any other University or institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

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Abstract

Robot manipulator systems are used in an industrial automation system to minimize human effort or involvement and increase product or service quality. Generally, automated robot systems are used to perform material handling, assembly operations, and quality inspection of the manufacturing system to achieve better performance in the precision, accuracy, and production rate of the continuous operation. In the injection molding industry, the surface quality of the output product is critical for producing a high-quality product. The surface scanning method is a common method for inspecting product surface quality. Most of the existing scanning methods need to identify and place the object in a fixed and known position to do quality scanning. In this research, we proposed a method of using a 4 DoF robot manipulator to move the scanner to get a quality surface scanning output for injection-molded products which are moving on a conveyor. Robot manipulator path planning is one of the main objectives of the research. The movement of the robot's end-effector must change depending on the object's orientation. The object image feature extraction method is used to determine the orientation of the object. The angle value's maximum accuracy ranges from $+5^{\circ}$ or -5° . The robot's end effector angle is changed according to the measured orientation of the object. The robot end effector is required to follow the object without any relative speed on the conveyor and maintain the absolute maximum speed to achieve an effective scanning output. According to experimental results, the optimal conveyor speed is 10cms^{-1} . The speed control system is used to maintain the conveyor speed without any external disturbance and measure the speed, and it is fed to the robot system to maintain the relative speed of the conveyor. The distance between the scanner and the object is measured using an ultrasonic sensor. This sensor feeds the distance to the system, and the distance helps to maintain the path trajectory and takes into account the quality of the scanning output. A portable 3D scanner, the Quanser Kinova 4 DoF robot arm, and the MATLAB Simulink platform are being used to simulate the proposed system. According to the results, the conveyor speed was set at 10 cms^{-1} and the robot end effector moved on the trajectory based on the object orientation angle.

Keywords-Robot Manipulator, 3D Scanning, Path Planning, Image Feature Extraction.

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