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OPTIMIZING THE ROBOT ARM MOVEMENT TIME USING VIRTUAL REALITY ROBOTIC TEACHING SYSTEM

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Abstract
Robots play an important role in performing operations such as welding, drilling and screwing parts in manufacturing. Optimizing the robot arm movement time between different points is an important task which will minimize the make-span and maximize the production rate. But robot programming is a complex task whereby the user needs to teach and control the robot in order to perform a desired action. In order to address the above problem, an integrated 3-dimensional (3D) simulation software and virtual reality (VR) system is developed to simplify and speed up tasks and therefore enhance the quality of manufacturing processes. This system has the capability to communicate, transfer, optimize and test the data obtained from the VR and 3D environment to the real robot in a fast and efficient manner. In addition, this system eliminates the need for robot programming, and thus it is easily implemented by users with limited engineering knowledge. The optimization model is tested on a test case, in which the data are extracted from the VR system. The results show an increase in production rate and a decrease in cycle time when the make-span is minimized. The virtual reality robotic teaching system (VRRTS) offers several benefits to users, and will therefore surpass complex and time-intensive conventional robot programming methods.
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Key Words: Robot Traveling Time, Virtual Reality, Robotics, Teaching System, Optimization, Flexible Manufacturing System

1. INTRODUCTION

Nowadays, with the upsurge in market competition, automated or robotic form of operations such as welding, suction, drilling and screwing parts are increasingly required [1]. However, the programming of the robots is an intricate and time consuming task. VR is one of the promising technologies which can significantly simplify tasks and even eliminate robot programming.

1.1 Robots in flexible manufacturing systems

Industrial robots are widely used in numerous flexible manufacturing systems in order to improve efficiency and quality [2]. Robots with vastly different capabilities and specifications are available for a wide range of applications [3]. The most typical anthropomorphic or human like characteristic of a robot is its arm. The arm, together with the robot’s capacity to be programmed, makes it ideally suited for a variety of production tasks, including machine loading, spot welding, spray painting, as well as assembly of parts such as screwing and drilling [4-6]. Flexibility and automation in assembly lines can be achieved by the use of robots [7]. The robot can be programmed to perform a sequence of mechanical motions, and it can perform the motion sequence repeatedly until it is reprogrammed to perform other sequences [8, 9]. The robotic assembly line problem arises when there are different assembly tasks to be assigned [10]. This problem involves assigning tasks based on the assembly

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