MODEL OF FUZZY LOGIC BASED SHIPYARD CONTAINER CRANE

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ABSTRACT

From the structural aspect, the model of crane is divided into 3 different parts which are the gripper, trolley and rack.

Fuzzy logic controller is a control methodology which uses the logic of fuzziness in decision making. All inputs are fuzzified to certain degree of membership in each fuzzy set and output is generated according to the set of rules set for fuzzy reasoning.

Two different types of input are chosen for controlling the swing motion and delay time taken by the crane during load transferring process. They are the container's weight and position of trolley. To set the value of container's weight, few buttons has been used. A 2x16 character LCD is programmed to display the weight's value set.

Rotary encoder is a sensor consisted of slotted plate and a pair of light emitter and receiver. Numbers of pulse-train are generated as the slotted plate rotates in between light emitter and receiver. Therefore, it is attached to the trolley's wheel to determine distance traveled.

Two different rating of DC motors are separately used to lift up or lower down container and to drive the trolley. For bidirectional motor movement, an H-ridge motor driver has been applied in between motor and control system.

To control the gripper's movement, servo motor is chosen and mechanically connected to the gripper. Servo has an ability to rotate to certain position by adjusting the pulse-width modulation; two sets of pulse-width modulation are being used to adjust the gripper's movement.

This system is mainly controlled by PIC16F877A, a 40 pins microcontroller, which has large number of I/O lines and program memory capacity. Sensors and controlled devices are all interface to this microcontroller. In the programming part, information such as container's weight and trolley position are processed and pulse-width modulation is generated to control the speed of trolley. Sugeno's type fuzzy inference system is used for decision making.