Project 3.1.7 Machine Control Design (VEX)

Introduction

Every machine that is controlled by a computer bases every operation on data and instructions that were designed by an engineer, technician, or end user. Designers must think through every contingency and all that can go wrong. In addition safeguards must be in place so that people and equipment are not damaged.

Equipment

- PC with ROBOTC software
- POE VEX Kit

Procedure

Your instructor will assign specific problems as described below for you to solve. You will work in teams of two or three. The procedure detailed below must be repeated for each problem solved.

1. As a team read the problem and record the requirements, constraints, components, or programming that must be used in your engineering journal.

2. With your team, discuss and brainstorm possible solutions in your engineering journal.

3. Sketch two potential physical solutions and two potential program solutions. Be sure to include labels, descriptions, signatures, and dates on all sketches.

4. Create a final physical solution as a detailed sketch. Be sure to include labels, descriptions, signatures, and dates.

5. Create and test your design, making necessary modifications. Include descriptions throughout the program for clarification of the process.

6. Prepare the following for documentation:

   - Title, date, class, and team names
   - Image of the final solution
   - Two potential physical sketches
   - Two potential program sketches
   - Final physical sketch
   - Final program sketch
   - Final program with descriptions
   - Answers to the conclusion questions

Problem 1: Start / Finish Line *(Hardware Level 1 Software Level 4)*
The Olympic committee would like your team to invent a control system for use with track and field running events. They want this device to automatically record the time and flash an LED when the first runner crosses the start / finish line.

Problem 2: Soccer Goal Light *(Hardware Level 2 Software Level 3)*
Your team has been asked to design a control system for the local soccer field that can detect when the ball has entered the goal. A light must blink for 10 seconds after a goal is scored. Remember, the goalie and others will also be crossing the goal frequently. You may need to modify the ball so that your device can differentiate between the soccer ball and other objects.

Problem 3: Automated Guided Vehicle *(Hardware Level 2 Software Level 4)*
An assembly plant would like for your team to design an Automated Guided Vehicle, AGV, to drive in a straight line back and forth to deliver batches of parts. The vehicle must travel back and forth based on closed loop control. The AGV will not start until a button on the robot is pressed. When the same button is held at the end of a cycle, the robot will stop after completing a trip back and forth.

Problem 4: Cable Winding Mechanism *(Hardware Level 3 Software Level 3)*
A telecommunications contractor needs your team to design a device that can accurately wind up a specific length of cable. The device must be able to wind a specific length consistently. The device must also be able to be started and stopped (emergency) by using a switch.

Problem 5: Elevator *(Hardware Level 4 Software Level 4)*
A company would like to begin producing residential elevators. Your team must design the control system and a prototype of an elevator that can go between three floors in any combination. The prototype must include a set of three switches to represent each floor of the elevator. Each floor the elevator stops at must have a call button and a set of three lights to indicate where the elevator is currently located. A built-in safety mechanism requires that the elevator normally rest on the ground floor and return to the ground floor after a user-determined period of nonuse.

Problem 6: Surgical Robot Arm *(Hardware Level 2 Software Level 4)*
A surgical supplier needs a robotic arm to move equipment within a sterile environment. Your team must design a remotely operated arm with 3 degrees of freedom: Base that pivots, arm that raises and lowers, and pinch mechanism.

Problem 7: Chocolate Cookie Topper *(Hardware Level 4 Software Level 2)*
A cookie factory needs your team to design a device that will put a chocolate drop on top of their peanut butter cookies. The machine must position a cookie on a separate device that will then move it into position for a dropper to descend and dispense the chocolate drop. The cookie with the chocolate drop should then move to another position where it will be placed with other finished cookies to await inspection and packaging.

Conclusion Questions

1. What was the most difficult part of the problem?

2. List and describe two features that were not part of the design problem that could be added to improve your design.