Project: Tic-Tac-Tobot

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EECS 249 A Project Charter, Fall 2016

Project Goal
In this project, we want to build a robot that will challenge you to play a game of tic-tac-toe.

Approach
The robot will control the movement of a whiteboard marker using two servos. First, it draws the playing field. A camera will be used for monitoring the player's move (placing a circle or a cross). Autonomously, the robot will react and make its own move.
We will use the iterative and incremental development approach. It is important for us to establish a base functionality of the robot playing tic-tac-toe. Since the assembled hardware would be feasible also of other things that playing tic tac toe, more features can be added later on.

Objectives
The robot will control the movement of a whiteboard marker using two servos. The pen will be set up in a construction which has a shoulder and an elbow joint, so it can be moved to a defined x-y-position. The whiteboard is mounted in a fixed position next to the manipulator. First, the robot draws the playing field consisting of nine tiles. A camera will be used for monitoring the player's move (placing a circle or a cross). Autonomously, the robot will react and make its own move. In order to make space for the human player's moves, the whole construction should be able to move away from the field.

Constraints
Since the project involves robotic vision and pattern recognition, our plan is to use a Raspberry Pi 3 since it has a reasonable computational power and is capable of running OpenCV. However, the drawback of the Raspberry Pi is the lack of outputs that are capable of an accurate pulse width modulation. A possible solution is using the Adafruit PWM/Servo Hat or an Arduino (whichever works better).

Major Deliverables
There are three key components of the project, each of which is a major deliverable of the project:
1. The assembled hardware that is physically able to move a whiteboard marker.
2. The software being able to control the whiteboard marker and play tic-tac-toe.
3. The robotic vision that recognizes player's moves.

Risk and Feasibility
The most critical component is the hardware itself. Another problem might be that controlling the servos as accurate as we want might not be possible.

Schedule

- October 21: Project charter and ordering the hardware
- October 22: Training at the supernode maker space to get access to the 3D printers
- October 26: The reverse kinematics map & sizing of the manipulator components
- October 29: The mechanical components are completed
- November 5: Having the actuation working
- November 12: Having the vision working
- November 19: The robot plays tic-tac-toe
- November 22: *Project milestone report:* Get feedback on the performance
- November 28: System tested
- December 5: System improved, bugs fixed
- December 9: Presentation, project video and report finished
- December 15: Project presentation