**Final Project Technical Review: Automated Robotic Targeting System**

**Complete list of project components:**

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| ***Actuator Specification:*** *List any electrical actuators you plan to use in your device* **(4 pts)** | | | | | |
| *Component Name* | *Description*  *(Cost)* | *Performance Requirements* | *Performance*  *Specifications* | *Power*  *Source* | *Control Method* |
| 1528-1366-ND | 5V unipolar stepper motor for robot arm end effector ($4) | Torque: 0.5 Nm | Pull-In Torque  0.3 Nm | 5V | Full stepping using motor driver board |
| 1738-1157-ND | Brushless motor with integrated driver ($20.50) | Torque: 60 mNm  RPM > 30 | Torque rated:  235.4 nNm  Speed rated:  159 RPM | 12V | PWM using integrated motor driver and encoder |
| 1738-1157-ND | Brushless motor with integrated driver ($20.50) | Torque: 940 mNm  RPM > 30 | Torque rated:  235.4 nNm  Speed rated:  159 RPM  add 4:1 gear reduction | 12V | PWM using integrated motor driver and encoder |
| 1738-1157-ND | Brushless motor with integrated driver ($20.50) | Torque: 2.9 Nm  RPM > 10 | Torque rated:  235.4 nNm  Speed rated:  159 RPM  add (13-16):1 gear reduction | 12V | PWM using integrated motor driver and encoder |
| 1528-1366-ND | 5V unipolar stepper motor for robot turn plate (base) ($4) | Torque: 0.5 Nm | Pull-In Torque  0.3 Nm | 5V | Full stepping using motor driver board |

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| ***Sensor Specifications:*** *List any sensors that you plan to use in your devices* **(4 pts)** | | | | | |
| *Component Name* | *Description* | *Performance Requirements* | *Performance*  *Specifications* | *Power Source* | *Conditioning and MSP432 Integration* |
| [1191-1005-2-ND](https://www.digikey.com/product-detail/en/kionix-inc/KXTC9-2050-FR/1191-1005-2-ND/3137317) | *Accelerometer*  *(3 axis)* | >+-1g | +-2g | MSP | 3 Analog Input using P5.5, P5.4, P5.3 |
| 497-17586-1-ND | *Gyroscope* | > 180 °/s | 200 °/s | MSP | SPI communication using P1.5, P1.6, P1.7 |
|  | *2 Contact Strips (to indicate to start cutting action)* | - | - | MSP | Current Limiting Resistor to Digital Input using P3.0 |
| Z5652-ND | *Optical Distance Sensor* | (0-2) cm min detection, >5cm detection range | (22.8-70) mm detection range | 5.5V | Analog Input using P5.1 |
| ***Integrated Circuit and Peripheral Device Specifications:*** *List any non-sensor ICs (i.e. transistors, motor driver boards) and peripherals devices (i.e. cameras, additional MCUS) used in your project)* **(4 pts)** | | | | | |
| *Component Name* | *Description* | *Performance Requirements* | *Performance*  *Specifications* | *Power Source* | *Purpose/Rationale for Use* |
| PN-2222A | MOSFET (x8) | Vebo: 5V | Vebo:5V | - | Serve as a switch for the motor |
| 1N4007 | Rectifier (x8) | >5V | DC blocking voltage: 1000V | - | Protects motor |

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| ***MSP432 Interfacing:*** *List any MSP432 functions (i.e. I/O, serial communication, and timers) used* **(4 pts)** | | |
| *MCU Function* | *MSP432 Pins* | *Description, Rationale/Purpose for Use, and Computing Considerations* |
| I2C | P6.4, P6.5 | Input 3 axis acceleration analog data to determine hand motion |
| I2C | P1.6, P1.7 | Input using SPI communication of gyroscope data to determine end effector orientation |
| Digital Input | P3.0 | Trigger for interrupt to start cutting action |
| ADC | P5.1 | Input distance from sensor at end effector for automated precise cutting action |
| PWM | P2.7, P2.6, P2.5 | PWM digital output to brushless motor integrated driver |
| Digital Input | P3.2, P3.3, P3.4 | Digital encoder input for motor position feedback |
| Digital Output | P3.5, P3.6, P3.7 | Digital output to integrated motor driver to set motor direction |
| Digital Output | P4.4, P4.5, P4.6, P4.7 | Stepper motor control for end effector |
| Digital Output | P4.0, P4.1, P4.2, P4.3 | Stepper motor control for base plate rotation |

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| ***Software and Control Algorithms:*** *List any signal conditioning, motor driver, and control algorithms* **(4 pts)** | |
| *Algorithm* | *Description of Algorithms, Rationale/Purpose for Use, and Modeling and Computing Considerations* |
| PID | Feedback from each of 3 brushless motors is used in PID control to correct joint angle error. Desired joint angle is determined by reverse kinematics of robot end effector. |
| PID | In precision mode, distance sensor determines new end effector desired position for PID of joint angles. |
| Stepper Motor Driver Sequence | Cycle through sequence of motor coils by converting desired degree of rotation to required number of steps. |

