Requirements Document

Gateway

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Change History

Significant drafts, major edits, or structural changes will be listed here along with the initials of the editor and the date.

- PMC 02/17/12 - First major draft completed for Pueblo tournament.
- PMC 02/24/12 - Design changes from Pueblo tournament added.
- PMC 02/29/12 - Edits completed per feedback from R. Andrews.
- PMC 03/02/12 - Second major draft completed for Colorado State Championships.
- SEM 04/17/12- Final draft completed for VEX Robotics World Championships- High School

Table of Contents

1.0 Introduction

The Kent Denver Robotics Club participates in VEX competitions regularly as a challenge to improve our skills and as an external measure of progress. We do this in accordance with our mission statement, “to learn about science, technology, engineering, and math through fun, innovative, and fulfilling team-oriented projects in robotics.” This year’s VEX Robotics competition, Gateway, is a game in which pairs of robots compete to place barrel and ball-shaped game objects into cylindrical goals of various heights.

In this document, we outline, in generic terms, the basic requirements for our robot as specified in the game rules and determined by the team. These requirements, as stated, are absolute, and any design failing to meet all specified requirements is considered to be unsuitable. Accordingly, only the most basic requirements are included here - further refinement will continue throughout the design and build process. This is a working document and will continue to be improved and revised throughout the design process.

2.0 Applicable Documents

The following documents are important to the design process. They are used for background information, design research, and reference throughout the process. Numeric references refer to the corresponding document as defined in this section (i.e. “Document 2.1.2”).

2.1 VEX Gateway Official Documents

2.1.1 VEX Gateway Game Description and Scoring
2.1.2 VEX Gateway Manual
2.1.3 VEX Gateway - Appendix A Field Drawings, Specifications & BOM
2.1.4 VEX Gateway - Appendix B Robot Skills Challenge
2.1.5 VEX Gateway - Appendix C Programming Skills Challenge
2.1.6 VEX Gateway - Appendix D Inspection Guidelines
2.1.7 VEX Gateway - Appendix E Awards
2.1.8 VEX Gateway - Inspection Checklist
2.1.9 VEX Gateway - Referee's Scoresheet

3.0 Requirements

The basic requirements for the robot are presented in this section. Requirements stated as “shall” are absolute and believed to be fundamental to the success of a design, while those stated as “should” are optional but strongly encouraged. Requirements stated as “should” are so written most often because it is possible a design choice could obviate the concern the requirement addresses. A design which fails to meet a “should” requirement is not immediately disqualified from consideration but is subject to additional scrutiny.

3.1 Chassis and Drivetrain

3.1.1 The robot shall use no more than ten motor or servo modules, per VEX rule R11 (document 2.1.2).
3.1.2 The robot shall be capable of controlled motion forward and backwards.
3.1.3 The robot shall be capable of turning (yawing) in either direction without limit.

3.1.4 The robot's minimum turning radius shall not exceed one foot.
3.1.5 The drivetrain shall incorporate three to five wheels.
3.1.6 The chassis shall mount the motor and servo modules.
3.1.7 The chassis shall mount the drivetrain.
3.1.8 The chassis shall mount the game object manipulating system.
3.1.9 The chassis shall mount the sensor equipment.
3.1.10 The chassis shall mount exactly one VEX EDR microcontroller.
3.1.11 The chassis shall mount the antenna and receiver.
3.1.12 The chassis shall mount the batteries.
3.1.13 The chassis should mount any decorative elements.
3.1.14 The chassis shall be built to minimize deflection, in reasonable compromise with 3.1.15.
3.1.15 The chassis shall be built to minimize weight, in reasonable compromise with 3.1.14.
3.1.16 The robot shall not use more than four 2-wire 393 motor modules, per VEX rule R11 (document 2.1.2).

3.2 Game Object Manipulation

3.2.1 The robot shall be able to score on the floor goals.
3.2.2 The robot shall be able to score on the 11.5" goals.
3.2.3 The robot shall be able to score on the 20" goals.
3.2.4 The robot shall be able to score on the 30" goals.
3.2.5 The robot shall be able to manipulate both balls and barrels type game objects.
3.2.6 The robot shall be able to carry and score at least three objects at a time.
3.2.7 The robot shall be capable of manipulating up a barrel which is standing upright or is on its side.

3.3 Sensors and Code

3.3.1 The robot shall operate during the autonomous period.
3.3.2 The robot shall compete in the Programming Skills Challenge (see 2.1.5).
3.3.3 The robot shall be controlled only via VEXNet, per VEX rule R10 (document 2.1.2).
3.3.4 The robot shall operate exactly one Cortex microcontroller.
3.3.5 Logic shall limit the maximum slew rate of the motor outputs to a reasonable amount.
3.3.6 Logic shall limit the concurrent load placed on each circuit.
3.3.7 Logic shall limit the maximum level at which motor outputs are driven to 120.
3.3.8 The robot shall operate no microcontroller other than that specified in 3.3.4, per VEX rule R9 (document 2.1.2).

3.4 Construction and Rules

3.4.1 The robot shall fit within a volume of 18" x 18" x 18" at the start of the match, per VEX rule G2 (document 2.1.2).
3.4.2 Nuts and screws should use washers and be appropriately tightened.
3.4.3 It shall be easy to remove scoring objects from the robot while the robot does not have power, per VEX rule G12 (document 2.1.2).
3.4.4 The robot shall not be constructed in a modular fashion intended to allow the quick replacement of an entire subsystem, per VEX rule R1 (document 2.1.2).
3.4.5 The robot shall not include parts which could damage the field or scoring objects,

per VEX rule R3a (document 2.1.2).

3.4.6 The robot shall not include parts which could damage other robots, per VEX rule R3b (document 2.1.2).

3.4.7 The robot shall not include parts which could entangle other robots, the field objects, or scoring objects, per VEX rule R3c (document 2.1.2).

3.4.8 The robot shall include only official VEX EDR parts, per VEX rule R5 (document 2.1.2), with the following exceptions, per VEX rule R7 (document 2.1.2):

a) Parts used solely as color filters for light sensor(s).

b) Parts which are identical to legal parts (without regard for color).

c) 6-32, 8-32, M3, or M4 screws not exceeding 2” in length.

d) Any commercially available nut to fit screws described in c, above.

e) Non-functional decoration.

f) Non-aerosol grease on parts not contacting the field or scoring objects.

g) “Polycarbonate as cut from a single 12" x 24" sheet up to 0.0625" thick,” which has not been, “chemically treated, melted or molded,” (document 2.1.2, rule R7f).

h) Tape.

i) One USB extension cable used to mount the VEXNet key.

3.4.9 The robot power switch shall be accessible without moving any part of the robot, per VEX rule R16 (document 2.1.2).