B^3 Specifications

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Revision History

Revision	Description	Author	Date	Approval
1	Original	Chui Vanfleet	30 Jan, 2017	
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1 Scope

This Documents pertains to the design and verification requirements for a Ball Balancing Bot, or B^3 for short. The goals of the project are to:

- Learn concepts of classical control theory.
- Gain control system design experience.
- Gain experience with embedded microcomputer architectures.
- Graduate.

The B^3 project will, at it's conclusion result in a robot that is capable of balancing and moving on a common ball. B^3 will be controllable from a remote that the user may use to drive the robot around.

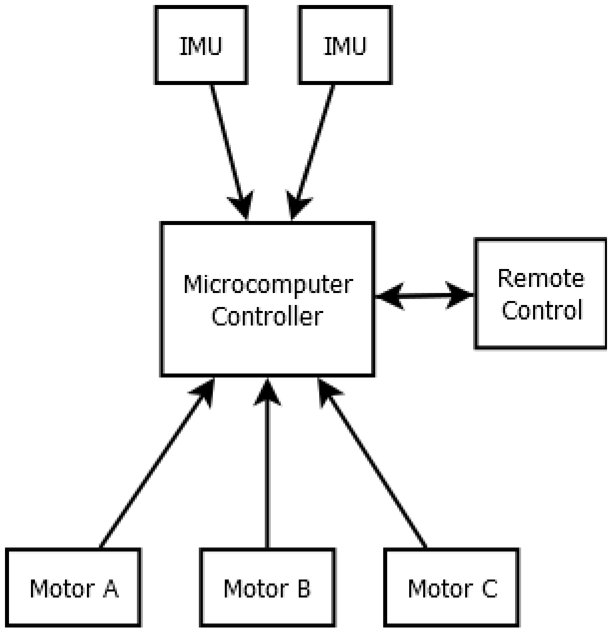

Figure 1: Block diagram showing the relationships between each component of B^3

1.1 General

This specification establishes the design, construction, performance, development, and test requirements for the B^3 system. These requirements represent an effort to meet the aforementioned goals.

1.2 Acronyms

- B^3 - Ball Balancing Bot.
- **IMU** - Inertial Measurement Unit.

1.3 Definitions

- **Remote Control** - An human interface to send input commands to the robot from a distance of 2-10 feet.

2 Stakeholder Requirements

The stakeholders for the complete B^3 system are:

1. Developers
2. Utah State university Electrical Engineering department
3. Dr. Don Cripps
4. Professor Taylor Peterson
5. Customers/Users

2.1 Stakeholder User Stories

The primary stakeholders needs are described below.

1. B^3 must use some type of feedback control system.

   User Story
   As a student in Dr. Cripp's Mechatronics class, I must use a feedback system to control motors, actuators, etc in this project.

2. B^3 must use some type of microcomputer for control of the system.

   User Story
   As a student in Taylor Peterson's Microcomputer Interfacing class, I must use some type of microcomputer or embedded system in the project.

3. B^3 must be remote controllable to navigate about a room.

   User Story
   As this project will be used to count towards two separate classes, some additional degree of difficulty must be added into the project. As a robot that balances atop a ball is cool, it'd be much better if you could drive it around.

4. B^3 must balance atop a standard sports ball.

   User Story
   As a user, I want to be able to put the robot on something like a basketball, soccer ball, or even a volleyball. That way I don't have to have a specialized ball just for B^3 .

3 Engineering Requirements

3.1 Interface Requirements

3.1.1

The robot shall fit atop a basketball, soccer ball, or volley ball.

3.1.2

The robot shall be controllable via remote input from the user.

3.2 Functional Requirements

3.2.1

The robot shall make use of a feedback control system.

3.2.2

The robot shall make use of a microcomputer or embedded system..

3.2.3

The robot shall balance on top of a ball.

3.2.4

The robot shall be drivable from remote control input.

3.3 Functional Support Requirements

3.3.1

The robot shall move in any horizontal direction.

3.3.2

The robot shall be able to withstand a one-foot drop on it's side.

4 Verification of Requirements

4.1 Interface Requirements Verification

4.1.1

Does the robot sit atop a basketball, soccer ball, or volley ball?

4.1.2

Can the robot be directed via remote control?

4.2 Functional Requirements Verification

4.2.1

Does the robot use a feedback control system?

4.2.2

Does the robot use a a microcomputer or an embedded system?

4.2.3

Does the robot balance on top of a ball?

4.2.4

Can the robot be driven from remote control?

4.3 Functional Support Requirements Verification

4.3.1

Can the robot move in any horizontal direction?

4.3.2

Can the robot be dropped from one foot onto it's side and not break?