

Backyard Splashpad Specifications Document

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November 7, 2018

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Revision History

Revision	Description	Author	Date	Approval
1	Initial Revision	James and Braydan	Oct. 24, 2018	
2	Incorporate Feedback	James and Braydan	Nov. 1, 2018	
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Specifications

1 SCOPE

- (a) **General:** This document describes the design and verification requirements of the Backyard Splash Pad. The Backyard Splash Pad is used to provide backyard entertainment for adults and children alike. This specification for the backyard splash pad does not include any information on installing the Backyard Splash Pad or creating a playable surface around the Backyard Splash Pad.

- (b) **Acronyms:**

BSP: Backyard Splash Pad

2 APPLICABLE DOCUMENTS

(a) Government Documents

(b) Industry Documents

3 STAKEHOLDER REQUIREMENTS

The stakeholders for the Backyard Splash Pad are:

1. Dr. Don Cripps
2. Jolynne Berrett
3. The Families of Braydan Allen and James Humble
4. The USU ECE Department

3.1 Stakeholders Requirements

The primary stakeholders needs are described below.

- **Dr. Don Cripps The device:**

1. Must be complicated enough to challenge the designers.

- **Jolynne Berrett. The device:**

1. Must have a useful, readable user manual.

- **The Families of Braydan Allen and James Humble will be the primary users of the device. The device:**

1. Must not present safety/shock hazards to any user.
2. Must have an easy user interface.
3. Must be able to run in a typical backyard.
4. Must have multi-colored lights.

- **The USU ECE Department is funding the project. The device:**

1. Must be low in initial cost (design and prototype).
2. Must meet the pedagogical requirements of the course (ECE 4820/4830/4840/4850) for which it is designed.

4 ENGINEERING REQUIREMENTS

4.1 System Overview

The Backyard Splash Pad is comprised of four main components: a device controller, a user interface, a mechanical system, and an object-tracking system. The device controller receives input from the user interface and uses it to control the mechanical system. The user interface presents information about the system to the user and accepts input from the user. The mechanical system controls the flow of water. The object-tracking system detects objects near the Splash Pad and reports information to the controller. See Figure 1.

4.1.1 Functional Diagram

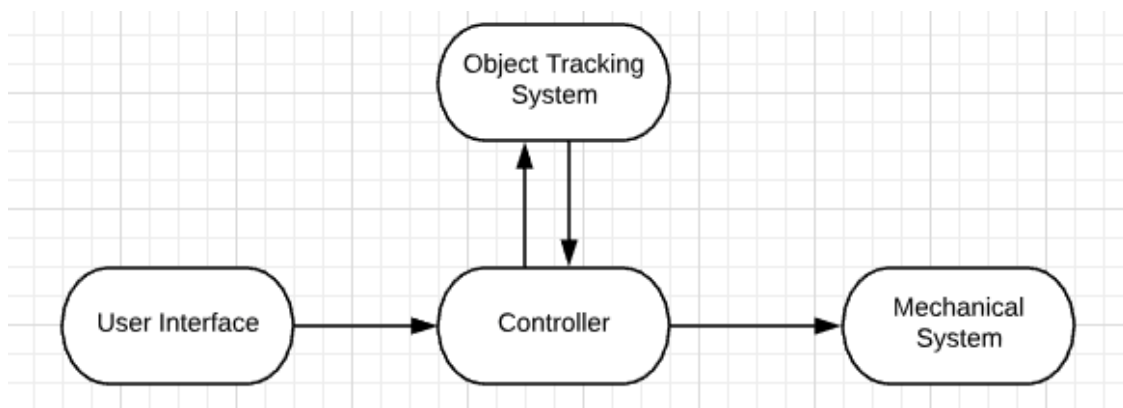


Figure 1: Functional Diagram.

4.2 Functional Requirements

4.2.1 Controller

4.2.1.1 Stream Control

The controller shall be able to turn on and off each water stream individually.

4.2.1.2 Light Control

The controller shall be able to turn on and off each light individually.

4.2.1.3 Color Control

The controller shall be able to change the color of each light individually.

4.2.1.4 Responsive to Object Tracking System

The controller shall be able to turn on a specified nozzle as directed by the Object Tracking System.

4.2.1.5 Programmed Display

The controller shall have at least one pre-programmed fountain routine containing light changes and water streams turning on and off.

4.2.2 User Interface

4.2.2.1 User Nozzle Control

The user interface shall allow the user to select what nozzle(s) are turned on.

4.2.2.2 User Color Control

The user interface shall allow the user to select what color the LEDs are.

4.2.2.3 User Object Tracking Control

The user interface shall allow the user to enable or disable the object tracking system.

4.2.3 Mechanical System

4.2.3.1 Water Flow

The mechanical system shall be able to create seven water streams that rise at least 6.0 ft vertically above the nozzle.

4.2.3.2 Water and Dust Resistance

The mechanical system shall be sprayproof. The mechanical system shall be dust-tight.

4.2.3.3 Operation Time

The mechanical system shall be able to operate for 10,000 hours.

4.2.3.4 Safety

The mechanical system shall not provide electrical shock to users.

4.2.4 Object Tracking System

The Object Tracking System is the part of the system that senses objects in the area surrounding the splash pad, and sends commands to the controller based on the position of objects detected.

4.2.4.1 Minimum Object Size

The object tracking system shall be able to detect any object larger than a sphere with a 9.4 in. diameter that is within 2.0 ft of any nozzle.

4.2.4.2 Lighting Levels

The object tracking system shall be able to function when the brightness level around the splash pad is at least 2000 lux.

4.2.4.3 Automatic Calibration

The Object Tracking System may be able to automatically adjust to differences if its position relative to the splash pad is changes.

4.3 Support Requirements

4.3.1 Device Controller

4.3.2 User Interface

4.3.2.1 Interface Platform

The User Interface shall require an android phone for more advanced features.

4.3.3 Mechanical System

4.3.3.1 Power Consumption

The system shall operate on 1000.0 Watts or less.

4.3.3.2 Power Supply

The system shall be powered by a standard 120 V electrical outlet.

4.3.3.3 Size

The system shall fit within a cube that is 10 ft on an edge.

4.3.4 Object Tracking System

4.3.4.1 Size

The object tracking system shall fit within a cube that is 6 inches on a side.

4.3.4.2 Container

The object tracking system shall have a case.

4.3.4.3 Mounting

The object tracking system case shall have a mounting interface.

5 VERIFICATION OF REQUIREMENTS

5.1 System Overview

The Backyard Splash Pad is comprised of four main components: a device controller, a user interface, a mechanical system, and an object-tracking system. The device controller receives input from the user interface and uses it to control the mechanical system. The user interface presents information about the system to the user and accepts input from the user. The mechanical system controls the flow of water. The object-tracking system detects objects near the Splash Pad and reports information to the controller. See Figure 2.

5.1.1 Functional Diagram

Test by confirming that each element of the functional diagram is present in the final design.

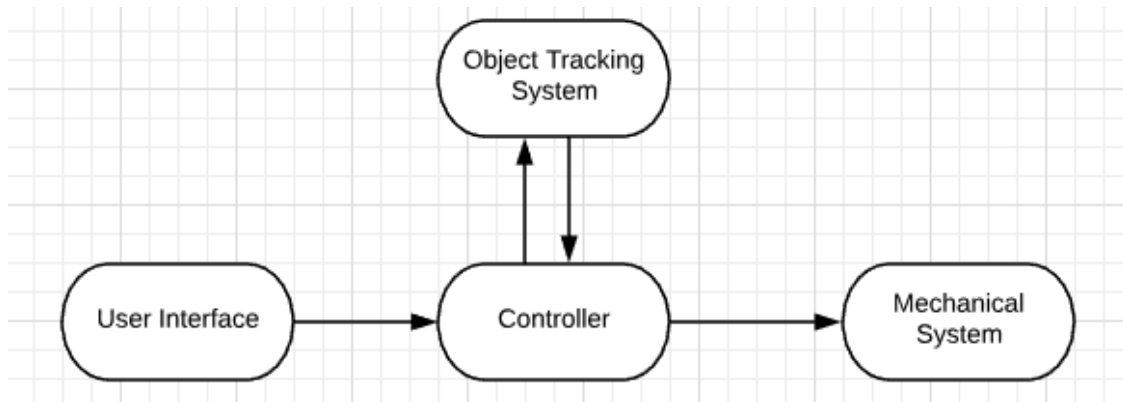


Figure 2: Functional Diagram.

5.2 Functional Requirements

5.2.1 Controller

5.2.1.1 Stream Control

Test by observing that each stream turns on and turns off.

5.2.1.2 Light Control

Test by observing that each light turns on and turns off.

5.2.1.3 Color Control

Test by observing that each light changes color.

5.2.1.4 Responsive to Object Tracking System

Enable the object tracking system. Observe that a water stream turns on due to input from the Object Tracking System.

5.2.1.5 Programmed Display

Use the user interface to run the fountain routine. Observe that lights change and water streams turn on and off.

5.2.2 User Interface

5.2.2.1 User Nozzle Control

Use the user interface to turn on a water stream. Observe that the water stream turns on.

5.2.2.2 User Color Control

Use the user interface to change the color of a light. Observe that the color of the light changes.

5.2.2.3 User Object Tracking Control

Use the user interface to disable the Object Tracking System. Place a basketball-sized object (or larger) near a nozzle. Observe the the splash pad does not react to the presence of the object.

5.2.3 Mechanical System

5.2.3.1 Water Flow

Turn on seven water streams. Observe that there are seven. Measure height of each water stream with a tape measure. Ensure that each stream rises at least 6.0 ft high.

5.2.3.2 Water and Dust Resistance

Throw dust or sand at enclosures on the mechanical system. Open enclosures and check for sand. If none is found, the device passes this test.

Use a garden hose with no nozzle to spray enclosures on the mechanical system. Dry off exterior of enclosures. Open enclosures and check for water. If no water is found, the device passes this test.

5.2.3.3 Operation Time

Turn on the splash pad. Start a stopwatch. When the stopwatch reaches 10 minutes, ensure that the mechanical system is still operating.

5.2.3.4 Safety

Turn on the splash pad. Touch each surface on the mechanical system. If a shock is felt, the system fails this test.

5.2.4 Object Tracking System

5.2.4.1 Minimum Object Size

Enable the Object Tracking System. Roll a NBA regulation sized basketball (9.4 inch diameter) towards a nozzle. If one of the fountains changes due to the presence of the basketball, then the system passes this test.

5.2.4.2 Lighting Levels

Perform test [5.2.4.1](#) when the sun is 20 degrees above the horizon.

5.2.4.3 Automatic Calibration

Move the Object tracking system so that it is in a new location relative to the splash pad. Perform any steps required by the design to account for location adjustment. Perform test [5.2.4.1](#).

5.3 Support Requirements

5.3.1 Device Controller

5.3.2 User Interface

5.3.2.1 Interface Platform

5.3.3 Mechanical System

5.3.3.1 Power Consumption

Total the maximum power used by all of the components as stated in product specifications. Ensure that it is less than or equal to 1000.0 Watts.

5.3.3.2 Power Supply

Ensure that the power source for the system is a 120 V electrical outlet.

5.3.3.3 Size

Measure the dimensions of the system with a tape measure. Make sure the system is no longer than 10 feet on a side.

5.3.4 Object Tracking System

5.3.4.1 Size

Measure the dimensions of the Object Tracking System with a ruler. Ensure that the Object Tracking System is no longer than 6 inches on a side.

5.3.4.2 Container

Visually inspect the object tracking system to ensure that there is a case.

5.3.4.3 Mounting

Attempt to mount the object tracking system. If the object tracking system can be mounted without damaging the object tracking system or its case, it passes this test.

Paragraph Number	Test Type	Tester's Name	Pass/Fail	Date