Backyard Splash Pad

Description

- **Motivation**
  - We wanted to obtain experience using OpenCV to do image processing
  - Splash Pads at parks are crowded
  - With kids it is not always easy to get out the door
  - Having a Splash Pad in your backyard allows you to customize it

- **Features**
  - Routine that will randomly turn on and off the nozzles
  - Phone app that can control the nozzles and light color
  - Reaction to objects when they are over a nozzle

Methods

- Connect a phone using Bluetooth Low Energy to control the nozzles and lights. Implemented using a TI CC2640R2 Microcontroller.

- Use a camera to track an object and shoot it with water when it is over a nozzle. Implemented using a RaspberryPi Model 3B+ and camera.

- Data is sent to a Teensy3.2, an Arduino based microcontroller, to control the nozzles and lights.

- A Pressure transducer controls a pressure relief valve to help regulate the height of the water.

System

- **Data Flow Diagram**

  - **User Input to App**
  - **UI Interaction**
  - **Mobile App**
  - **BLE write**
  - **Bluetooth Profile**
  - **Function Callbacks**
  - **Object Tracking Data**
  - **Microcontroller Hosting Bluetooth Low Energy Server**
  - **UART**
  - **Output Microcontroller**
  - **Power Signals**
  - **Signals to Valves**
  - **Video Feed from Camera**
  - **UART message with control data**
  - **12 bit color values**
  - **LED Driver**
  - **PWM Signals**
  - **LEDs**

Discussion

- **Lessons Learned**
  - During testing, we discovered that a better method for attaching the PVC pipe to the nozzles is needed.
  - During software development, we discovered that the memory available on the CC2640R2 was slightly smaller than our needs. This led to us using the Teensy3.2 to handle the control tasks.
  - During testing, we observed that the water flow wasn’t as laminar as desired.
  - During testing, we observed that the LEDs were difficult to see in sunlight.

- **Safety**
  - Electrical Shock Hazard
  - There is at least 1MΩ resistance between power and ground
  - Connected to a Ground Fault Circuit Interrupter (GFCI) outlet
  - Use Chlorine to make sure water is clean

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