 # Electric Water Blaster

Team Members:
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- jaejin2
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 # Problem

Common problems with traditional water guns are that they rely on manual pumping and squeezing, leading to inconsistent water pressure, limited range, and user fatigue. They also provide no feedback on the water level or have any interface for the users. Our project is to build a fully electric, high-pressure water blaster that aims to fix those issues and add additional features. It will deliver consistent, controlled bursts of water while providing real-time feedback along with improved ergonomics and enhanced water resistance. We will integrate intelligent electronics with a robust mechanical system to provide a more engaging and reliable experience for users.

 # Solution

For our project, we will develop an electric water blaster. At a high level, it will have a 12V DC electric pump. The pump will fill the tank and pressurize the water up to 60 PSI. A solenoid valve will control the release of water to allow it to fire powerful bursts. Our project will make use of an array of sensors to detect internal leaks and the current water level of the tank. The water blaster will also feature an OLED display which will display the current state (filling, firing, idle, etc) of the water blaster to the user so they can understand what is happening at all times. The OLED display will also display the fill level of the water blaster so the user knows how many bursts of water remain in the tank. There will also be buttons below the OLED to allow the user to navigate through the menus and make adjustments to the firing logic of the water blaster. We plan to power the water blaster through an off-the-shelf battery, likely from electric tools due to its more durable and high output characteristics.

 # Solution Components

##Subsystem 1: Control Board
The control board will ultimately receive all the sensor data and move through our state machine acting accordingly given the inputs from the sensors and the IO subsystems. It will interface directly with the 12V fast actuation solenoid valves, the 12V DC electric pump, the SPI display, and the IO board.

Components Used:
STM Microcontroller - STM32G070KBT6

##Subsystem 2: Input & Output

This subsystem provides user interaction through a display, buttons, and possibly analog controls. The SPI display will show real-time information like fill level, pressure status, and firing mode, and the buttons and knobs will allow for the firing to be altered to be more powerful or less powerful using a menu. If we find additional ways to tweak the firing characteristics in testing we will add those options for the user in the final menu. This will also control the basic trigger functionality with a push button and some creatively engineered 3D-printed parts.

Sensors & Components Used:

OLED SPI Display – NHD-0420CW-AB3 – Displays system status, fill level, and settings.
Physical Buttons & Potentiometer – TS02-66-43-BK-160-LCR-D, PTV09A-4020U-B103-ND – Allow user control over burst length, power level, and menu navigation.
Push button – TS02-66-43-BK-160-LCR-D – Trigger for water blaster

##Subsystem 3: Battery
The battery subsystem will provide the power for the entire water blaster. We currently would like to use some sort of tool battery due to its characteristics like high current ratings and a relatively low voltage. This battery subsystem would likely be around 18V and would then be stepped down to the 12V we need for the electric pump, solenoid valve, and power input on the control board.

Components:
Battery - Milwaukee® M18™ RedLithium™ Battery XC5.0
12V DCDC – COM-18732 – Converts our 18V battery output to 12V

##Subsystem 4: Frame & Shell
The frame and shell house and protect all components from water leakage. We will 3D-print our shell for precision, and use TPU-sealed buttons and NPT fittings to prevent any water leakage.

Features:

TPU-Sealed Buttons & Covers – Prevent water ingress.
3D-Printed or Composite Shell – Ensures lightweight durability, potentially carbon fiber or fiberglass
Conformal Coating – MG Chemicals - 419D-55ML 419D Premium Acrylic Conformal Coating – Protects electronics from potential moisture exposure.

##Subsystem 5: Sensor Array
The sensor array will monitor various signals throughout the water blaster. Currently we would like to track for water leaks inside so we can safely shut off the device. To do this we will use water sensors. A larger part of the sensor array is the water level tracking. We currently have a few ideas but will need to investigate further before we decide on a final implementation. The current ideas are for an array of ultrasonic sensors to approximate the fill level, an LED and a

photoresistor to determine the presence of water based on the measured resistance, and a pressure sensor at the bottom of the tank to estimate the weight of the water and therefore the volume of the water.

Sensors Used:

Water Leak Sensor – 101020018 water sensor – Detect leaks inside the frame of the water blaster
Ultrasonic Sensor (Optional) – – Estimate how much water is in the tank
Pressure Sensor (Optional) – MHR01305PBMNNEAA01 – Measures tank pressure for optimal pump operation.
Flow Sensor (Optional) – 114991172 – Measures water input and output to track fill level

##Subsystem 6: Pump, Solenoid Valve & Tank
This subsystem handles water pressurization and delivery. A 12V self-priming diaphragm pump will pressurize water up to 60 PSI, and a fast-actuating solenoid valve will control short, high-powered bursts. The tank will store pressurized water and be monitored for safe operation.

This subsystem is responsible for filling the reservoir, pressurizing the water, and ultimately firing it from the water blaster. It will make use of a 12V self-priming diaphragm pump rated for up to 60 PSI.

Sensors Used:

12V DC Electric Pump - HIGH FLO 12 DC Electric Electric 12 Volt Sprayer Pumps - fills the tank and pressurizes the water
12V Fast actuation solenoid valve – 1528-1280-ND – Opens and closes to release a burst of water
Flow Sensor (Optional) – 114991172 – Measures water output for performance tuning.

Criterion For Success

The goals we would like to meet for our project to be considered complete are as follows:

- Consistent water bursts
- Distance coverage of over 20ft
- Complete frame of water blaster that houses all the components and is leak resistant
- A screen that displays the current state of the blaster based on sensor data and timing as well as buttons to navigate the configuration menus
- Accurately detects leaks and shuts down accordingly
- Tracks water level and remaining shots

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