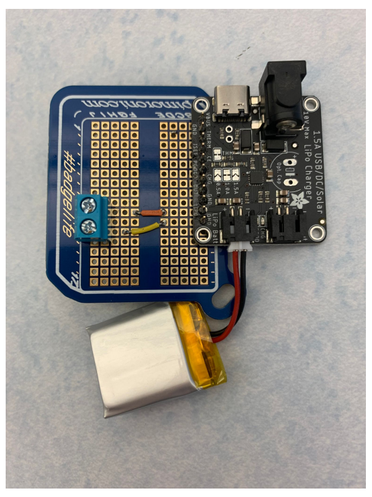
P21389: "Bug Torch"

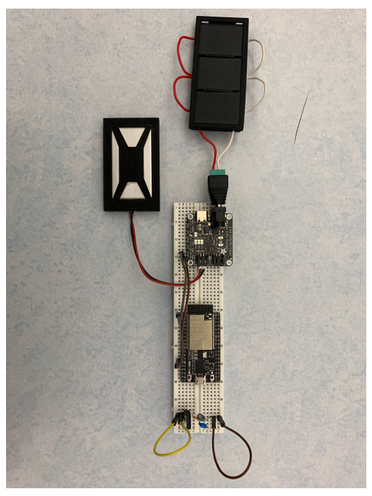
Background

The Bug Torch system attempts to solve the problem of messy maintenance of existing pest-deterring citronella torches and produce a system that will not need to be replaced every season. Using an automatic refilling process torch maintenance will be cleaner and more convenient.

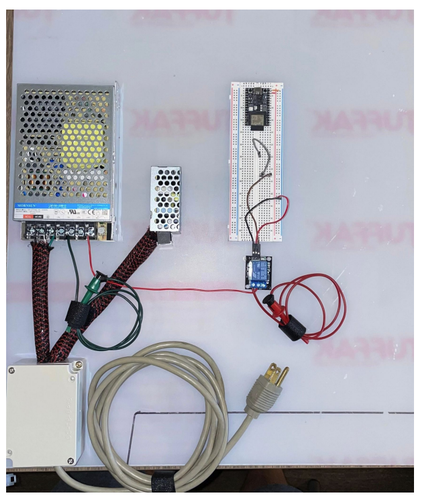
Subsystems



LiPo Charger with LiPo Battery



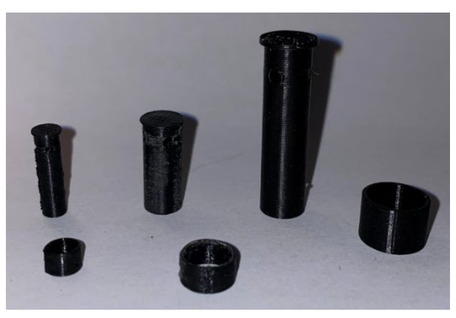
Solar Power with ESP32



Base Station

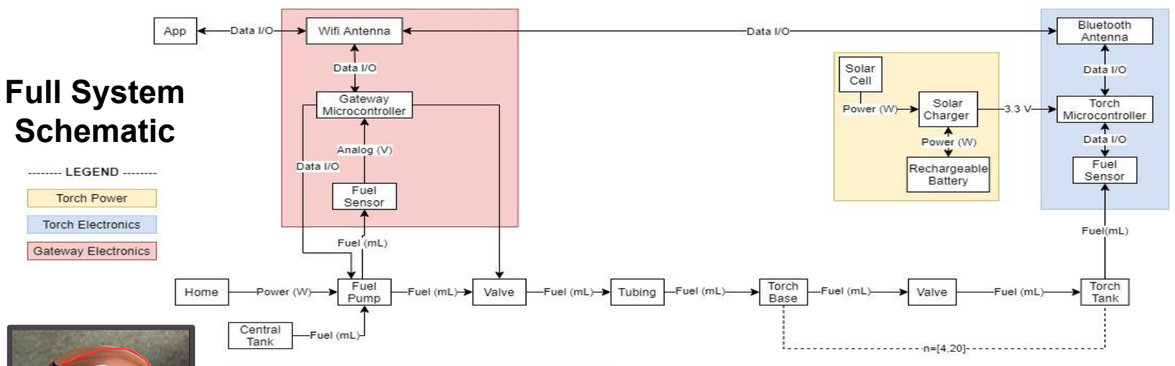
Pump Hooked with Fuel Tank

Capacitive Sensor

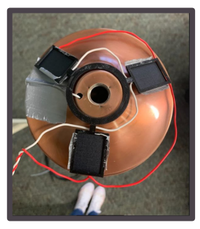


CAD Model of Valve

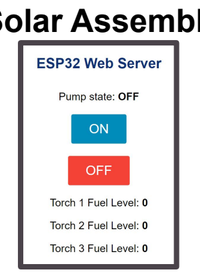
Final Design



Full System Schematic



Solar Assembly



App

Full System Assembly

The final design included a single torch assembly which can pump water from a central tank to the torch. A preliminary app design was also delivered to the client.

Requirements

Customer: Integrated smartphone app, does not use ground wires, capable of autonomous/wireless operation.

Engineering: Microcontrollers must communicate over at least 100 feet and with a central server, torches refill automatically based on sensor data, torches do not overfill.

Requirements	Performance Metric	Satisfied?
Integrated app/monitor torches	Communication distance	Yes
No underground wires	Minimize maintainence	Yes
Scales to 20 torches	4 torches operational	???
Autonomous operation	8 hours operation with no interaction	Yes

Testing

Test 1a: Customer Provided Valve

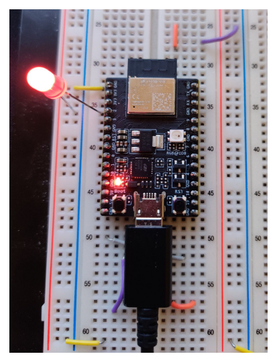
Test 1b: Modified Customer Valve

Test 1c: Team 3D Printed Valve

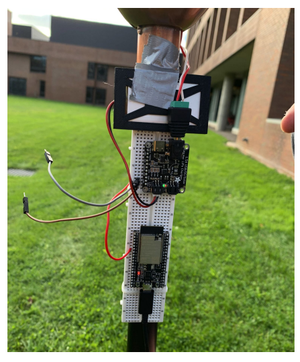
Comparing the custom designed flow control valve to the model provided by the client.

Thread testing for new torch body

ESP32 web app to turn on and off the LED which will correlate to torch pump



ESP32 test with manual control to turn on and off LED through web app



Testing solar system outside to power on the ESP32

Performance

- The team was able to achieve wireless transmission of torch data.
- The microcontroller received viable power from a solar energy source.
- No ground wires were used in the design.
- Torch fuel level could be read as a binary value.

Challenges

- Fuel Valve sealing.
- Capacitive sensor debug.
- Microcontroller selection.
- Citronella Burning Approval through EHS
- LiPO Battery charging/discharging.
- Threaded connections in torch body.
- Bent/warped base parts.
- Modifying the design to use citronella oil.

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- Elizabeth DeBartolo, MSD Program Coordinator
- Carlos Barrios & Tim Landschoot, RIT Professors
- Gary Hodenius, MSD Machine Shop Specialist

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For more information, visit the team's Confluence page using this QR code: