ACOUSTIC ENERGY HARVESTING FOR BATTERY-LESS UNDERWATER IOT

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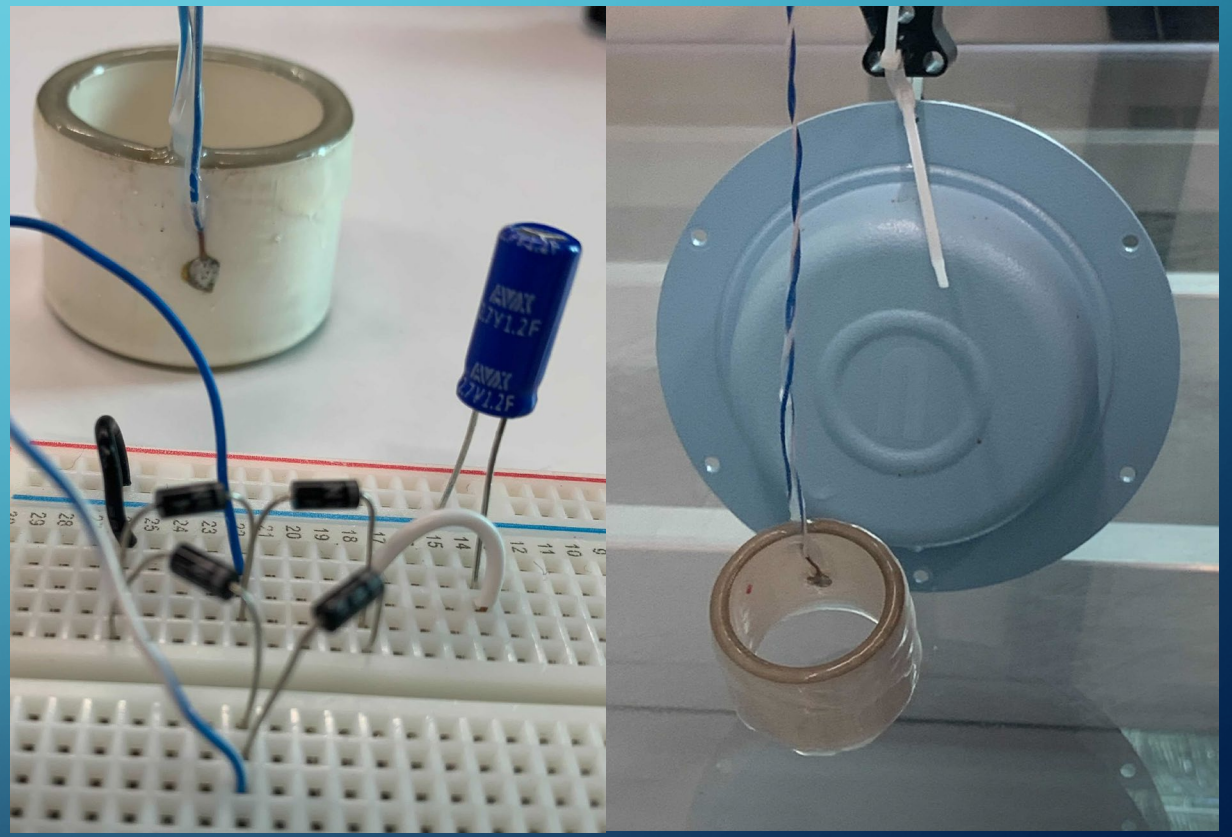

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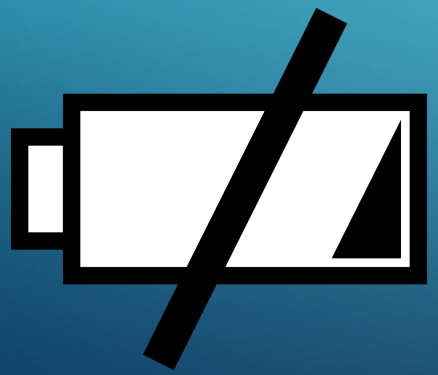
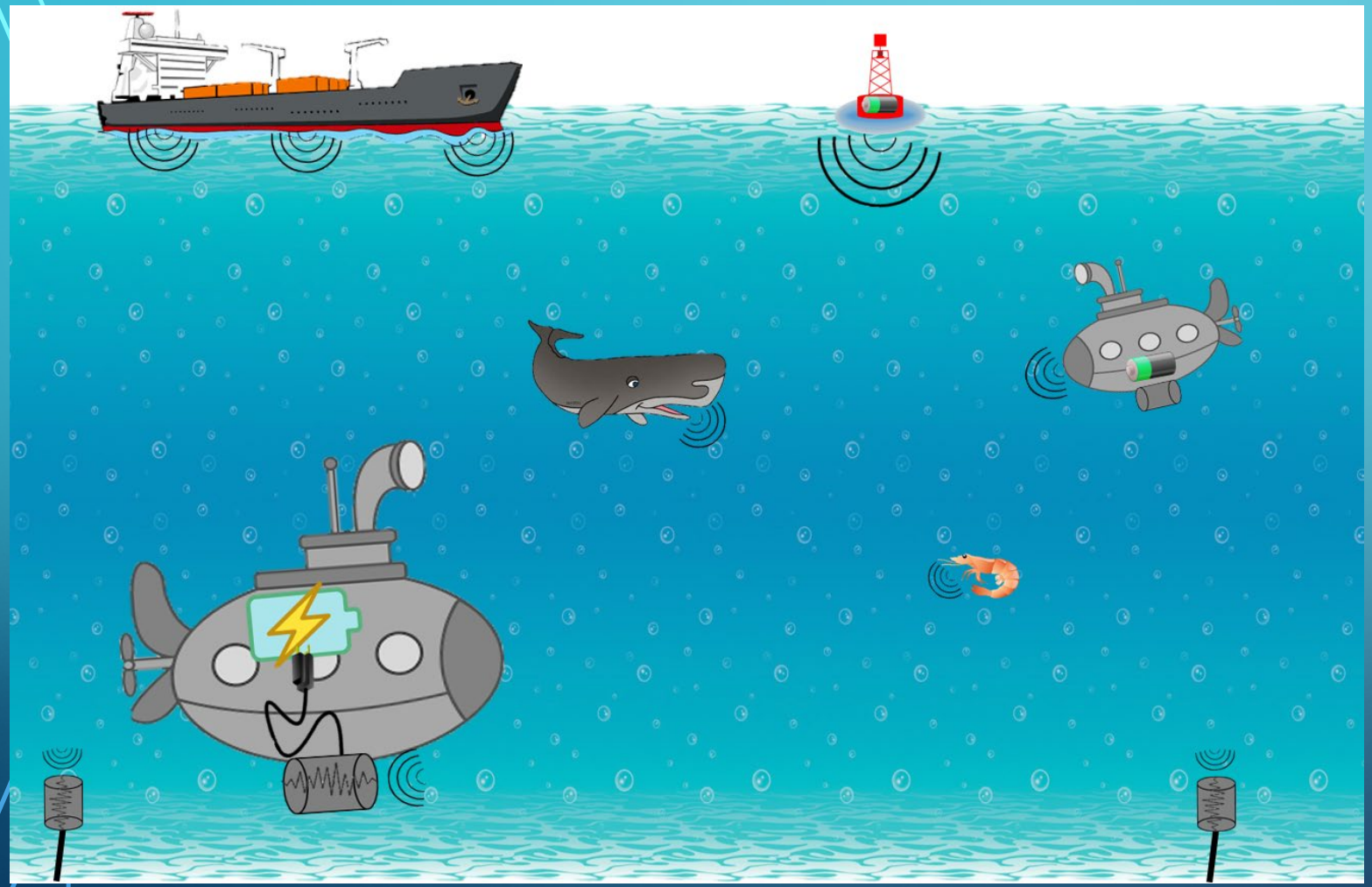
UNDERWATER WIRELESS CHALLENGES

- Sending data underwater requires more energy than on land
- No energy sources (e.g., wind, solar) for sustained underwater operations
- Batteries have a short lifespan



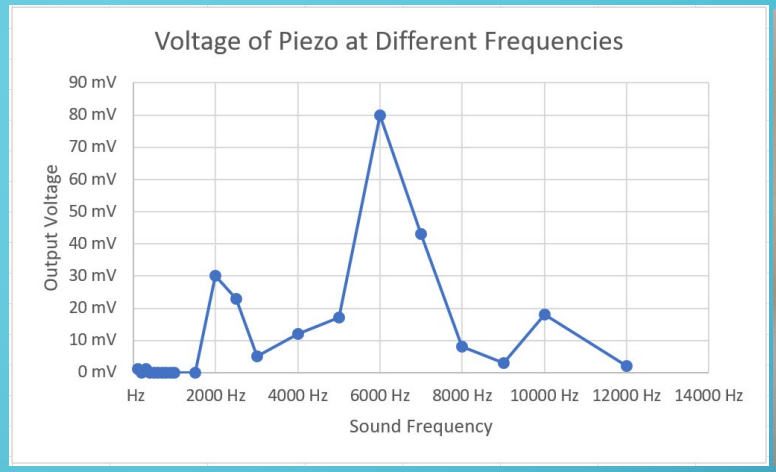
OUR SOLUTION: BATTERY-FREE UNDERWATER IOT

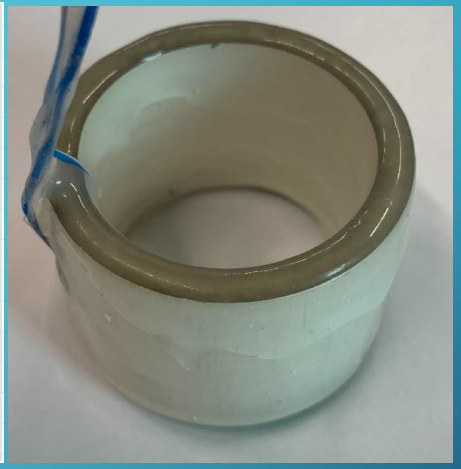


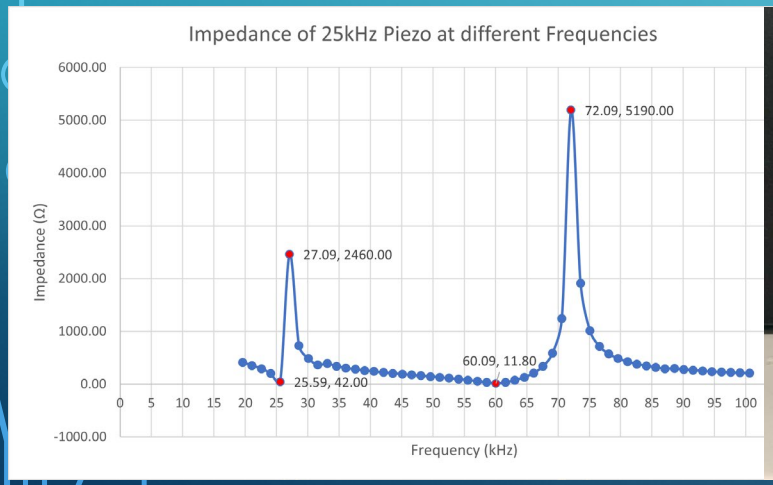
- Leverage the piezoelectric effect → harvest electric energy from sound waves
- Use supercapacitors instead of batteries
- Exploit existing and/or dedicated acoustic underwater sources to
  - Send sound energy
  - Communicate
  - Localize

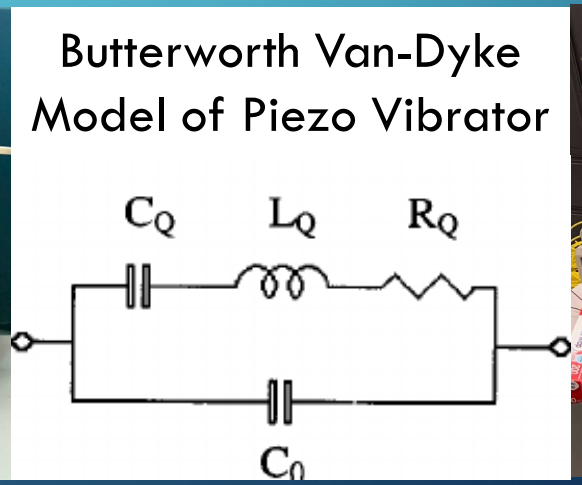
PIEZOCERAMICS & ENERGY HARVESTER CIRCUIT

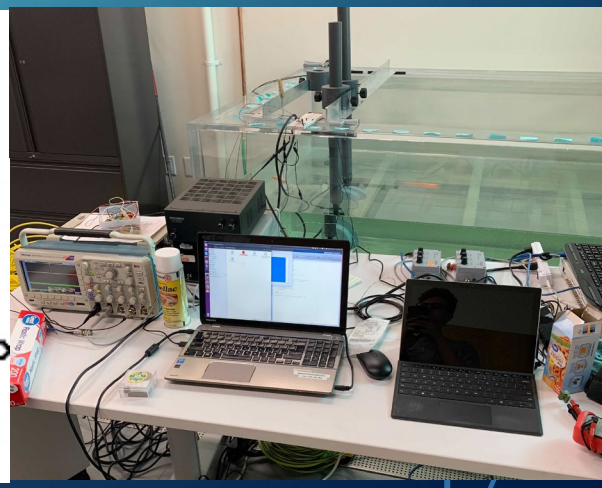
- Piezocylinders→ omnidirectional energy collection
- Compared rubber vs. silicon potting
- Took impedance measurements to create an electrical equivalent model
- Prototyped a regulation and sleep circuitry to monitor harvested energy











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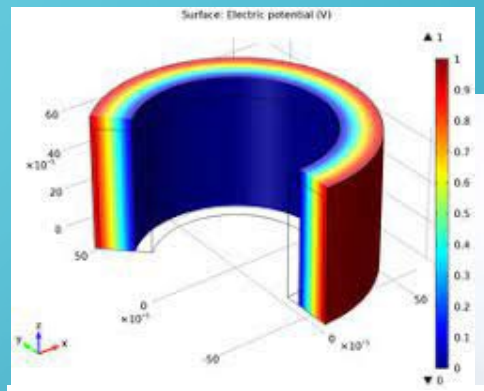
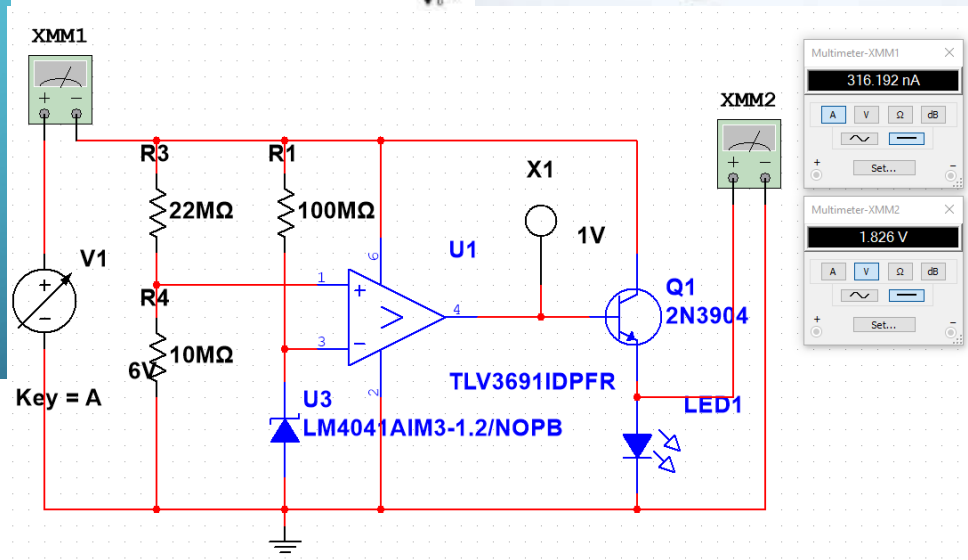
FUTURE WORK

- Build and simulate an impedance matching circuit to minimize energy losses
- Characterize the amount of energy that we can harvest for
  - Piezoceramics with different resonant frequencies
  - Different input power and range of the acoustic source
- Dynamically change the impedance load of the piezo and reflect the carrier sound signal at different frequencies → emulate an underwater FM communication protocol





Multisim

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