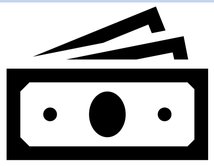
Custom Printable Robotic Boats for Early STEM Education

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Introduction

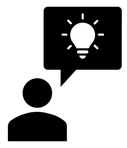
Problems with Existing Robotics Kits



Expensive



Middle- and high-school age group



Limited hands-on design

Our Solution

- Creating a design tool for low-cost foldable robotic boats

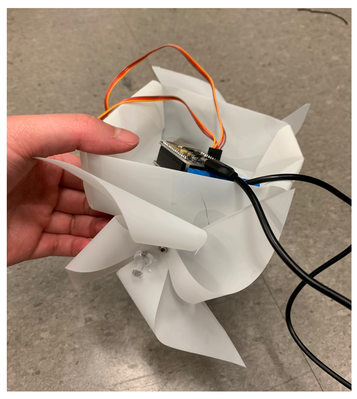
Educational Applications

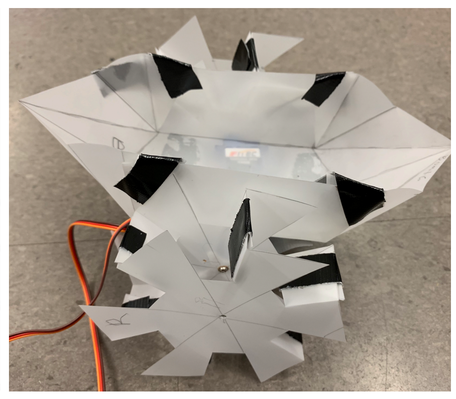
- Students design, build, and redesign robotic boats
- Hands-on experience with cycle of scientific experimentation

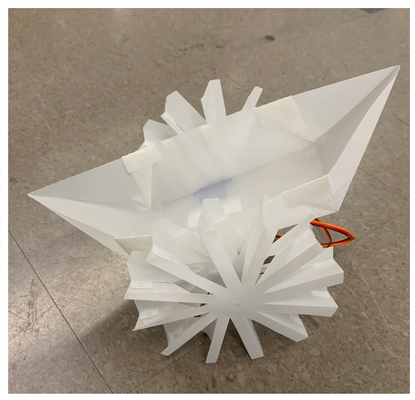


Developing the Design Tool

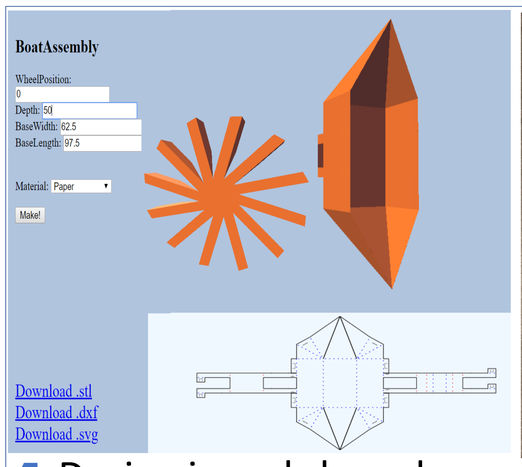
Built prototypes of mechanically powered paddleboat design → Motorized boat and integrated electronics into design → Finalized boat template → Model 2D template and 3D structure on RoCo



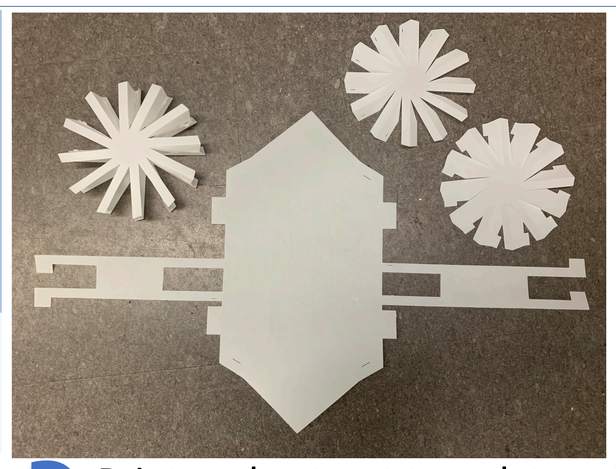




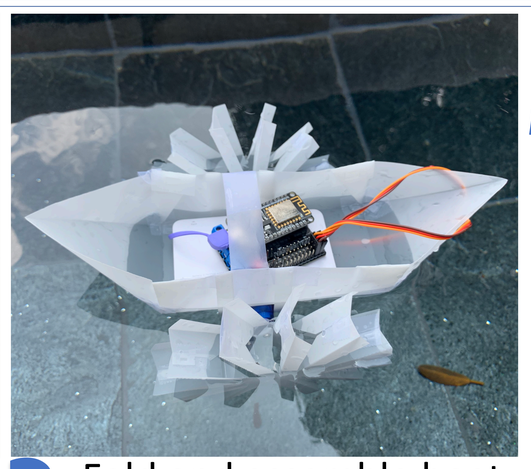
Student Design Process



1 Design in web-based app by inputting parameters



2 Print and cut out template



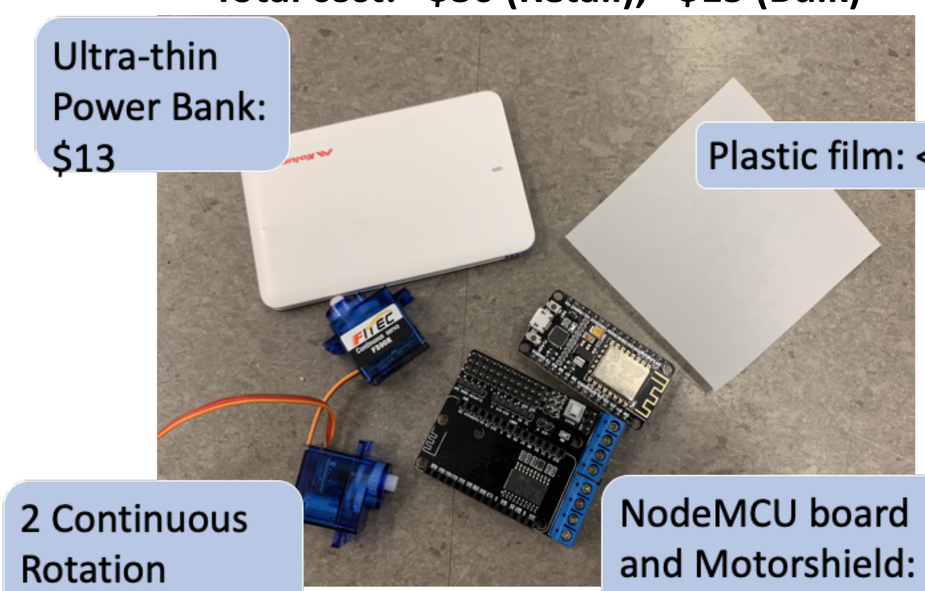
3 Fold and assemble boat, Test effects of chosen parameters

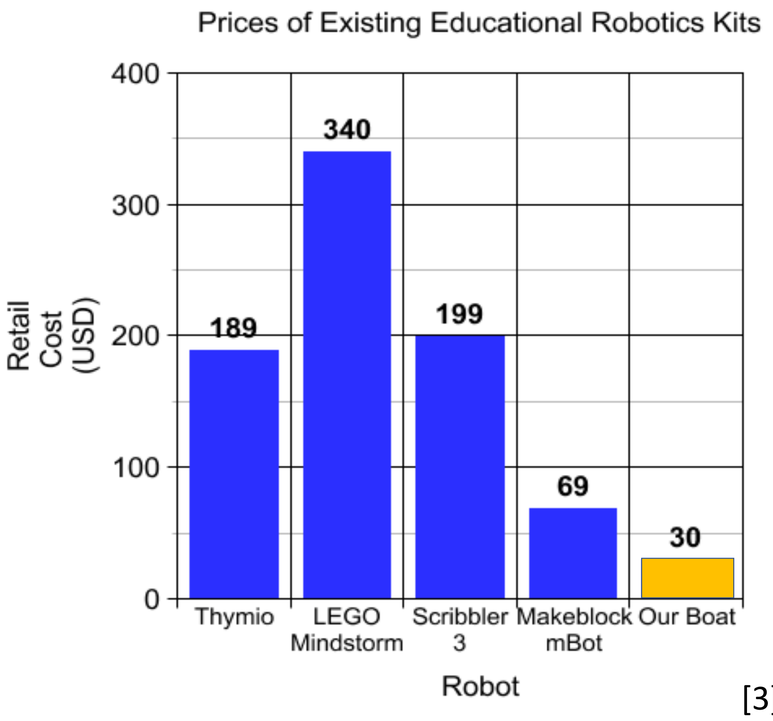


Results

- Iterative design process and customization allows for personalized products
- Encourages experimentation and hands-on learning approach
- Teaches gateway STEM skills and engineering/design process

Total cost: ~$30 (Retail), ~$15 (Bulk)





[3]

Acknowledgements

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References

[1] McLurkin, James, et al. "Using multi-robot systems for engineering education: Teaching and outreach with large numbers of an advanced, low-cost robot." IEEE transactions on education 56.1 (2012): 24-33.

[2] Blumenfeld, Phyllis C., et al. "Motivating project-based learning: Sustaining the doing, supporting the learning." Educational psychologist 26.3-4 (1991): 369-398.

[3] Rubenstein, Michael, et al. "AERobot: An affordable one-robot-per-student system for early robotics education." 2015 IEEE International Conference on Robotics and Automation (ICRA). IEEE, 2015.

[4] Mondada, Francesco, et al. "The e-puck, a robot designed for education in engineering." Proceedings of the 9th conference on autonomous robot systems and competitions. Vol. 1. No. CONF. IPCB: Instituto Politecnico de Castelo Branco, 2009.

[5] A.M. Mehta, J. DelPreto, B. Shaya, and D. Rus. "Cogeneration of Mechanical, Electrical, and Software Designs for Printable Robots from Structural Specifications". In: Intelligent Robots and Systems (IROS 2014), Chicago, IL, Sep 2014, pp. 2892-2897.

[6] Mehta, Ankur M., and Daniela Rus. "An end-to-end system for designing mechanical structures for print-and-fold robots." 2014 IEEE International Conference on Robotics and Automation (ICRA). IEEE, 2014.