4H3020

WEAR TEC

# BOOK 2 | SEWING & MICROCONTROLLERS

sparkfun ELECTRONICS

EXTENSION

# WHAT IS WEARTEC?

The Nebraska 4-H Wearable Technology (WearTec) is a National Science Foundation (NSF) funded project focused on activities related to wearable technologies. The goals of the project are to develop an intervention that focuses on solving real world problems and practicing the engineering design process while immersed in the innovative area of wearable technologies.

This curriculum was developed for youth in grades 4 to 6 to teach engineering design, computer programming, basic circuitry and sewing. The curriculum has been designed to encourage connections between in-school and out-of-school time instruction. Wearable technologies provide a powerful, personally expressive tool for use in both formal and informal learning environments.

These technologies bring together engineering and computing to make computers, which are "soft, colorful, approachable, and beautiful". Wearables offer a window into the world of technology enabling students to develop technology literacy in a more inclusive manner than game development or educational robotics. The electrical components of wearable technologies expose the connections and circuitry that is normally hidden from students. Students can literally see the connections between the electrical and technical components when creating circuits with conductive thread or copper tape. This provides a tangible artifact that brings relevant theories from physics, engineering, and computing to life. Crafting and aesthetics are key components of designing wearable technologies further increasing the attractiveness and accessibility to students.

Creating wearable technologies provides an outlet for personal expression as the end product can be worn. This has particular power in attracting female students who tend to be more interested in aesthetics, textile design and social connections than their male counterparts.

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# ENGINEERING DESIGN PROCESS

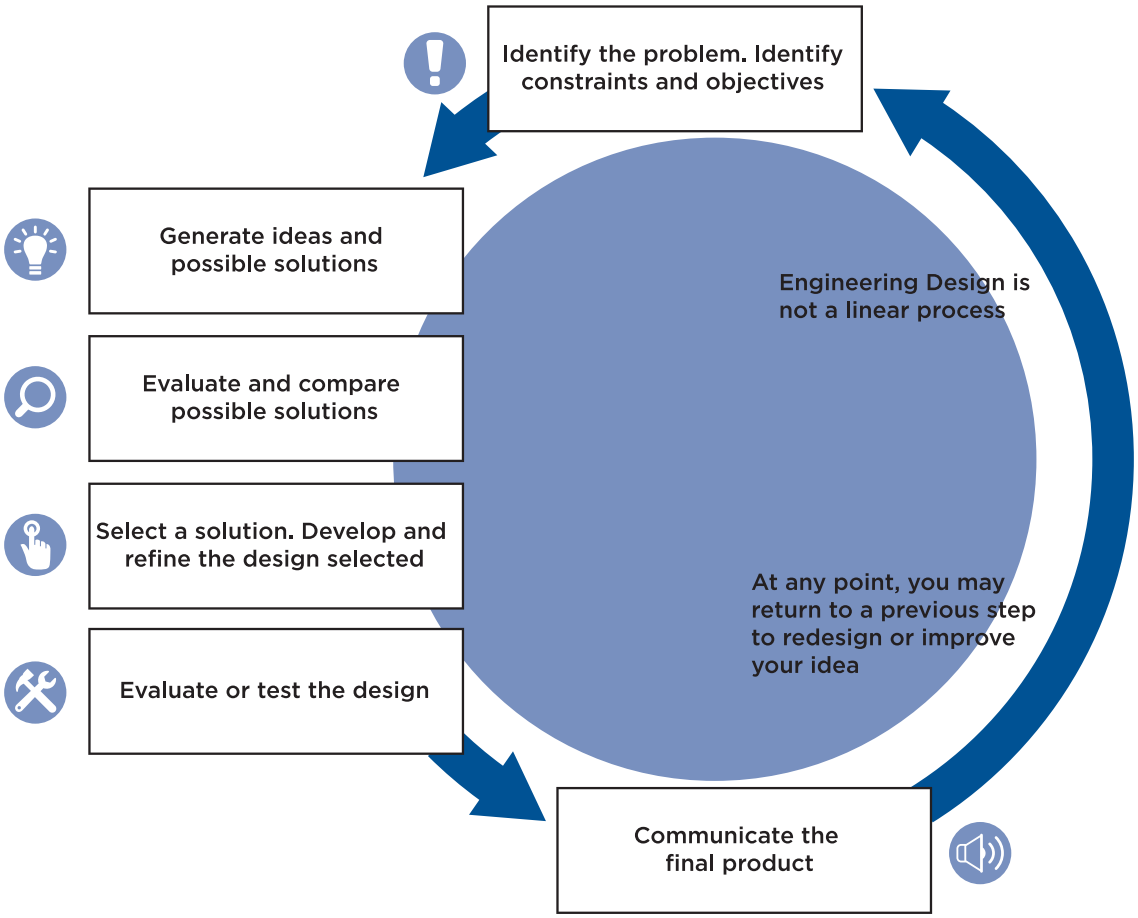
## Engineering Design Process (EDP) Overview

The engineering design process is a series of steps that engineers follow to come up with a solution to a problem. Many times the solution involves designing a product that meets certain criteria and/or accomplishes a certain task. This process is different from the steps of the scientific method. While scientists study how nature works, engineers create new things, such as products, websites, environments, and experiences. Because engineers and scientists have different objectives, they follow different processes in their work. Scientists perform experiments using the scientific method; whereas, engineers follow the creativity-based engineering design process.

It's important to note that the EDP is flexible. There are as many variations of the model as there are engineers. With WearTec, students work through all six steps, but in real life, engineers often work on just one or two steps, then pass their work to another team.

Note that the EDP is non-linear. At any point, you may return to a previous step to redesign or improve your idea. The EDP is reliant on the iterative process. For example, after you improve your design once, you may want to begin all over again to refine your technology. You can use the EDP again and again!

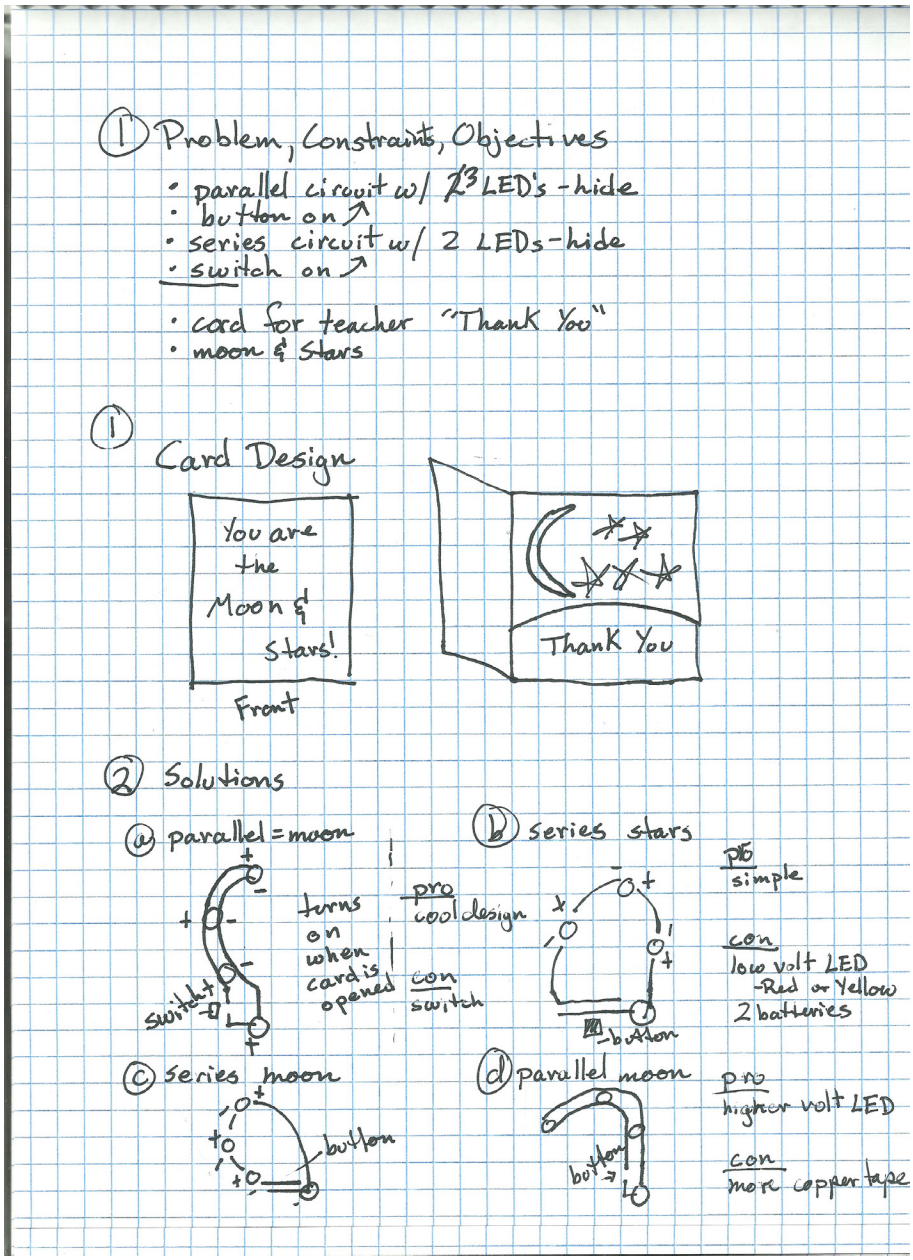
In the WearTec curriculum you will notice symbols to represent a step. These symbols are intended to help you identify the steps of the EDP and bring about the thinking associated with that step. The symbols can be used for short-hand inclusion in the engineering journal.



## EDP Journal Explanation and Use Guidelines

An engineering design process (EDP) journal is a working document. It is where ideas, sketches, and student reflections are recorded. It is a journal your students will use to document their learning and discovery through drawings, data, and record keeping. The journals should show thought behind strategy, designs, innovations, and organization. The journals are evidence of how students have grown and overcomes obstacles in their designs.  Each step of the engineering design process should have a corresponding journal entry.

Professional engineers use design notebooks to record their thoughts and learn from their experiences. By using a design journal students are engaging with real-life tools and experiences important for skill and interest development.




- Use dates
- Indicate step of engineering design process
- Notes on inclusion or exclusion of ideas
- Pros and cons of solutions
- Reasoning for iterations

# WHAT YOU'LL NEED

## Electronic Components

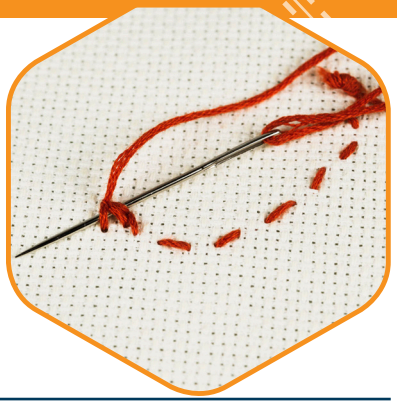
* Components needed for each student/participant

| *Sparkfun supplies** | *Sewing 101* | *Monster* | *LilyTiny* | *Color Match* | *Blink* | *Total* |
|---|---|---|---|---|---|---|
| LilyPad non-switch battery holder | 1 (use for monster) | | 1 (use for color match) | | | 2 |
| Lilypad LEDs | 1 | 2 | | | | 3 |
| Alligator clips (10 pack) | 1 (use for all activities) | 1 | 1 | 1 | 1 | 1 |
| Conductive thread | | 1 (use for all activities) | 1 | 1 | 1 | 1 |
| CR 2032 battery | 1 | 1 | 1 | 2 | 2 | 7 |
| Tricolored LED | | | | 1 | | 1 |
| LilyTiny | | | 1 | | | 1 |

## General Supplies

| *General Supplies* | *Sewing 101* | *Monster* | *LilyTiny* | *Color Match* | *Blink* |
|---|---|---|---|---|---|
| Large Sewing Needle | x | x | x | x | x |
| Embroidery Floss | x | x | x | x | x |
| 6x6 or Larger Aida Fabric | x | | | | |
| Scissors | x | | x | x | x |
| Fabric Marking Pencils | x | x | x | x | x |
| Fabric Glue | | x | | x | x |
| Other art supplies | | | | x | x |
| Batting or polyester fiberfill | | x | | | |
| Felt | | x | | x | x |
| Silk Flower | | | | x | |
| Conductive materials for making switches | | x | | x | x |

# LEARNING TO SEW



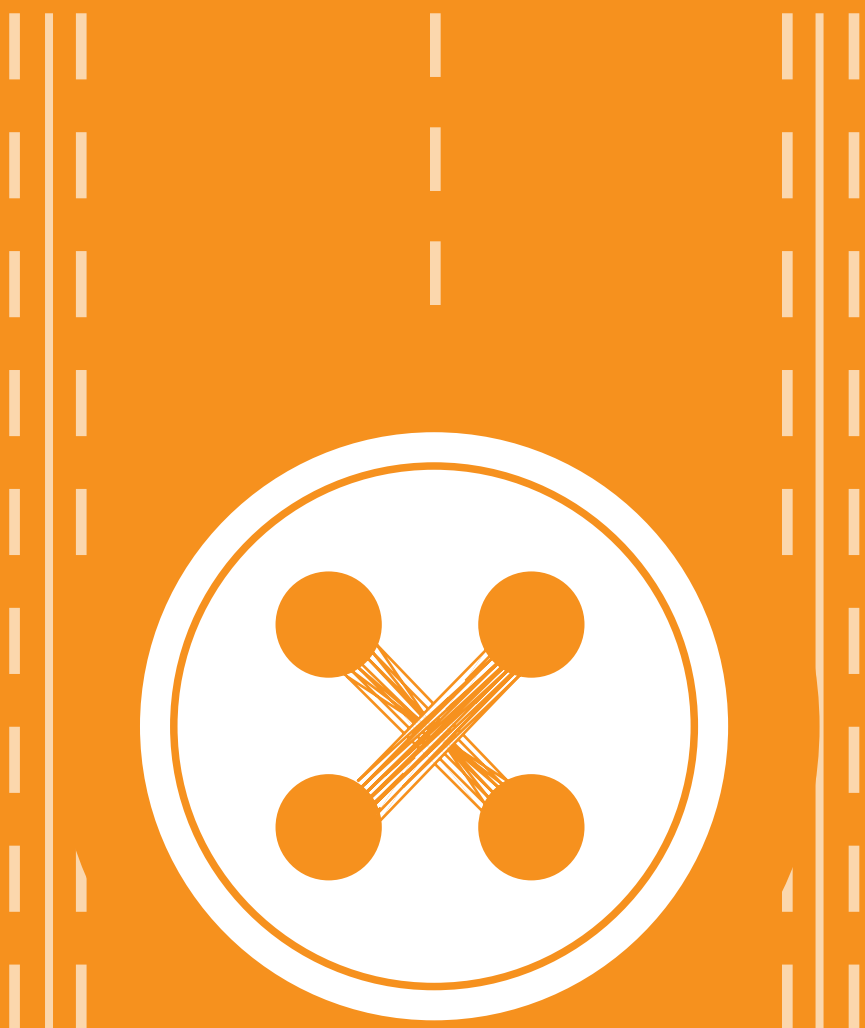
## ACTIVITY OVERVIEW

The purpose of this activity is to teach students how to sew without having to sew any components yet. Students will learn how to thread a needle, tie a knot, and sew a running stitch in even stitches. If possible use two colors of floss one to represent the positive polarity usually represented by a + and another color (usually black) to represent the negative polarity.

## Established Standards

**Nebraska State Science Standards:**

- SC8.1.3.a Identify problems for technical design.
- SC8.1.3.b Design a solution or product.



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