

“Concept-to-Reality”

3DX Arduino Level 1 Project Guide:

1. Conceive an idea:

1. Write an introduction paragraph about the project by answering the following questions:
 - i. What is the idea?
 - ii. Why is the idea important or how does it improve existing ideas?
 - iii. Who will benefit from the idea?

2. Research the idea:

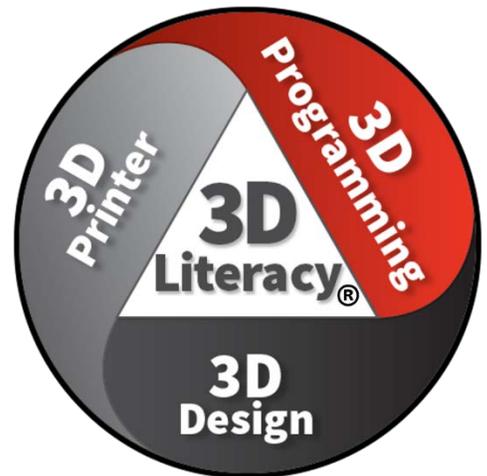
1. Gather existing information into a single place for reference:
 - i. Does the idea already exist?
 - ii. What examples of the idea are available?
 - iii. Are there open source projects relating to the idea?
 - iv. If so, how many and who has published the projects?
 - v. Consult with experts or people who have built and published existing ideas:
 1. Send email to project publishers, introduce yourself, describe your project, and ask questions that will help lead you to solutions:

Examples: Where did they get the idea?

 What resources did they use to develop the idea?

 What areas of the project were easy and what areas were difficult?

 Do they have any advice for improvements?
2. If blueprints, schematics, and/or programs of the idea are available, perform complete analysis of existing materials:
 - i. Identify how existing project functions
 - ii. Look for any gaps or weakness in functionality
 - iii. Write a Gap Analysis that identifies a plan to improve weaknesses or create solutions to the problem – Could be in paragraph or outline form



3. Develop the idea:

1. Develop a 3D CAD model of the idea:

- i. Reverse engineer existing projects – take notes of features added or removed
- ii. Design three variations of your project idea – practice creative thinking
- iii. Takes notes of changes made to the models and the reasoning behind the changes

2. 3D Programming development:

- i. Use online Arduino program simulator
- ii. If possible, start with existing program that has similar functionality
- iii. Start with one part of the program and get it working before proceeding
- iv. Important – make comments and notes in every line of program to reduce confusion and increase ability for feedback

3. Develop mechanical analysis:

- i. Create a sketch note that describes movement, attachment, or project functions

4. Develop electrical schematic:

- i. Utilize standard electrical symbols and draw necessary circuits
- ii. Perform circuit calculations to identify necessary component values

5. Create project schedule and budget:

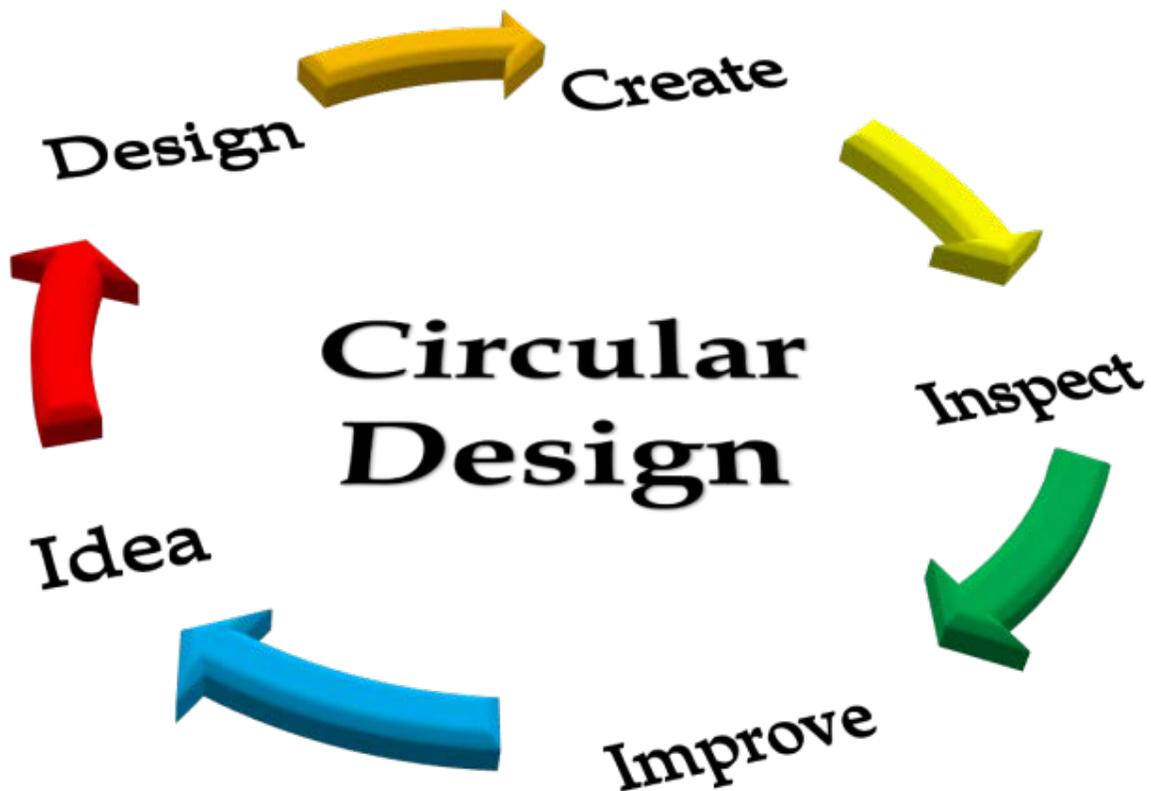
- i. Estimate project timeline and identify milestones
- ii. Make a parts list of necessary components (plastic, controller, motors, wire, connectors, components, etc.)
- iii. Try to find used materials for the project before purchasing new ones

6. Perform a cost/benefit analysis:

- i. Is the investment of time and money to fully develop this idea justified by the time and money savings this new idea offers?

4. Proof of Concept:

1. Create skeleton models with 3D printer (minimum material usage)
 - i. Check fitting tolerances and assembly features
 - ii. Adjust 3D CAD model as necessary, reprint parts
2. Test mechanical and electrical properties
 - i. Test mechanical functionality and force load limits
 - ii. Prototype circuits with breadboards
3. Anticipate changes in design or functionality
 - ii. Adjust 3D CAD model and/or Arduino program and circuit as necessary
- d. Apply “Circular Design Process” for improvements:



5. Create Final Project and Assembly Report:

1. Order necessary components (electrical, materials, etc.)
2. Final manufacturing of individual parts (3D printers and other machining if necessary)
3. Document assembly process with detailed instructions and photos or video
4. Write a conclusive paragraph that summarizes the work that was performed, what was learned in the process, and what possible improvements can be made

6. Publish the project online:

1. Utilize open source websites for project publications
 - i. Thingiverse.com
 - ii. Instructables.com
 - iii. LetsMakeRobots.com

7. Present the project to 3DX class: