GNG 2101
Introduction to product development and management

User Manual

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Abstract

Due to the pandemic, in-person classes have been cancelled. For this reason, the Centre for Entrepreneurship and Engineering Design (CEED) is looking for an interactive product that educates users such as teens as well as seniors on the basics of Arduino similarly to that of an in-person tutorial.

We, at Lincoln's Legends, made the Perfect Arduino tutorial, which contains videos lessons, quizzes and activities. This makes our tutorial interactive, accessible, and easy-to-use for everyone.

This user manual documents the functionalities and capabilities of our product, as well as its purpose. Detailed instruction of the product and its features are discussed, along with health and safety guidelines and troubleshooting instructions. This document will include a summary of our work, and future aspirations for our product.

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Introduction

COVID-19 has left millions of people bored in self-isolation, without any form of mental stimulation or activities to keep them occupied. This is unhealthy, as the brain, like every other muscle, is one that needs to be exercised. By engaging minds in STEM related activities people will be able to expand upon their current knowledge, develop their thought process, and improve upon their mental health. We at Lincoln's Legends have created the "Perfect Arduino Tutorial", a learning platform capable of teaching any audience the basics of Arduino.

Our tutorial brings easy and interactive e-learning to the everyday consumer. Users are able to access our tutorial over multiple different technologies, such as smartphones, tablets, and laptops. Our product is easy to use and is very accessible as it is available in both French and English, and includes built in voice overs and subtitles. Users are then able to engage in hands-on activities by completing our follow-along lessons through the choice of using a physical Arduino or an Arduino simulator. Our tutorial includes interactive step by step activities that allows the user to practice and gain experience in their newfound knowledge.

Our product being a tutorial is similar in form to other products produced by large companies such as Khan Academy, Code Academy and Tutorials Point. We take tutorial development to the next level. Where our competitors specialize in the quantity of tutorials produced, we focus on quality of material and developing an effective way to teach our information.

Through lots of testing we believe we have found the most effective way to convey the information we are teaching, allowing it to be fun while also being comprehensive.

Functions and capabilities of the product

Our product is an interactive tutorial that includes instructive videos, as well as activities and quizzes. The tutorial is fully available in English and French, meaning that everything from the content to the voice-overs and captions are available in both languages. (Figure 1)

Figure 1: Language selection

The user is given a welcome as well as a brief rundown of what they can expect to learn in this tutorial. (Figure 2)

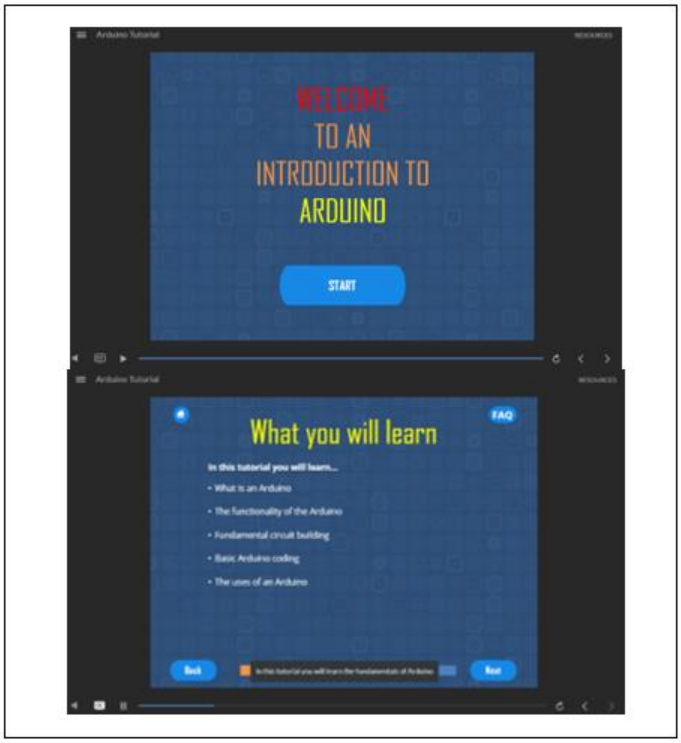

Figure 2: Introduction to the tutorial

Lessons are composed of a few different sections, and each section has a short video explaining a certain topic. (Figure 3) (Appendix 1- Lesson 2)

Figure 3: First lesson

Every lesson has a quiz. The short quizzes are meant to give the user a reference point for which parts the user understands well and which parts they are struggling with. The quizzes let the user know if they got the answer right or wrong, as well as their final score. (Figure 4) (Appendix 2-Quiz 2)

Figure 4: Quiz 1

The user is required to select whether they have a physical Arduino or not. If they do, they will be instructed how to set up the physical Arduino for the activities. If they do not, they will be using an Arduino simulator on Tinkercad, and will be instructed how to set up the simulator for the activities. (Figure 5)

Figure 5: Choice for the activities

Every lesson is accompanied with an activity. The activities are engaging ways for the user to fully demonstrate what they have learned in the lesson, as well as to challenge them a little bit. (Figure 6) (Appendix 3-Activity 2)

Figure 6: Activity 1

The tutorial has an FAQ page to answer any questions that users could potentially have. Users can access this page at any time, and they can easily return to the page that they were previously on as well. (Figure 7)

Figure 7: FAQ page

Detailed instructions of the prototype

The material needed to make this prototype is presented in table 1. The prototype was made using the software Articulate Storyline 360, and it was very easy to use to make the product. Creating and editing the slides was easy to do as it was very similar to other platforms we have used before, such as Google Slides or Microsoft PowerPoint. Adding the buttons and making them do what we wanted was a little more challenging, but with some more experience it became much easier. The software was also ideal to use because users are able to access the tutorial on multiple platforms, such as Windows, Mac, iPhone and Android. It is very easy to access the tutorial. All the user must do is click on a link and they are brought directly to the tutorial. The product itself is also very easy to use, since all the user has to do is click or tap the buttons to progress through the tutorial. Most pages have an FAQ button and a home button, that can be easily accessed if needed. The time completion can also be seen during the lessons

and activities with the process bar. You can find this prototype at the following link: https://makerepo.com/LincolnLaylor/arduino-uno-tutorial-z4?fbclid=IwAR08e6FGFkcHZDg0lHv2ylK54smvjMuUwHpjAcysXXJ1kwdY5-nvUTI24ps

Table 1: Bill of materials and parts (BOM)

Part Name	*Description (Identify prototype #)*	*Quantity*	*Unit Costs ($CAD)*	*Extended Cost (Qty x $)*
Computer	All Prototypes	5	N/A	N/A
Router	All Prototypes	5	N/A	N/A
Arduino	All Prototypes	1	N/A	N/A
Video-editing software	All Prototypes but 1	1	N/A	N/A
Breadboard	All Prototypes	1	N/A	N/A
Breadboard Components	All Prototypes	1	N/A	N/A
Video-sharing platform	All Prototypes but 1	1	N/A	N/A
Video-recording platform	All Prototypes but 1	1	N/A	N/A
Tutorial Construction Tool	All Prototypes but 1	1	Free Trial	N/A

Health and Safety guidelines

This tutorial is accessible over various technologies (smart phones, tablets, laptops) and is thus easily portable.

Please do not engage with this tutorial while operating any form of vehicle or machinery as it can act as a distraction, endangering your health and the well being of others.

Looking at a screen can cause dry eyes, or other forms of discomfort. If any of these occur, take a break from the tutorial until symptoms waver.

This tutorial does not provide you with any certification, nor does it permit you to operate any form of heavy or industrial machinery. If you have any questions about what you are doing, or if you have any safety concerns please contact us at lincolnslegendstutorial@gmail.com or contact a specialist.

Lincoln's Legends is not responsible for any injury occurred during or after the completion of this tutorial. Please be safe when working with any electrical components or sharp objects. If any injury occurs, contact your local doctor. If injuries are severe, call 911.

Troubleshooting

1. Arduino IDE issues
    a. The code will not run

        This is the most common case of Arduino issues. This means there is a syntax error in the code that prevents the IDE from allowing the code the run. To fix this, follow the instructions given in the Articulate platform. Otherwise, it would be important to find the error and correct it in order to make the program run.

    b. Missing library

        This issue means the IDE is missing a library. To resolve this issue, make sure to include the library in the IDE. For this, the library has to be installed on your computer.

    c. Wrong output

This error is linked to an error in the code. A wrong output is generally linked to a wrong command in the IDE. To fix this issue, it is important to follow the instructions given in the platform. Someone with more experience in the programming languages C and C++ could potentially use his knowledge to fix the issue.

d. No output

If the IDE can run without an output, it can possibly be linked to an error in the instructions of the IDE. However, a lack of output can also be linked to a problem in the electrical circuit. To fix this, check the code in the IDE to see if the commands are all in proper order and are written correctly. If the issue is still not fixed, check the wired connections from the Arduino to the breadboard and make sure everything is in place.

2. Arduino and breadboard issues

a. The Arduino is not responding to the IDE

This issue is most likely due to a bad connection between the IDE (Connection with the computer) and the Arduino. To fix this, make sure the Arduino is well connected to your computer in order to have a proper upload of the IDE to the Arduino.

b. My Arduino is broken

Unfortunately, the only way to repair a broken Arduino is to replace it by a new working Arduino.

c. The connections to the breadboard are loose

One way to fix this issue is to make the connections permanent by soldering. Another way is to simply adjust the connections and tighten them.

3. Articulate 360 and Tinkercad issues

a. My link for Articulate and/or Tinkercad is not working

This issue is probably linked to poor internet connection. If this happens to you, check your internet connection on your browser and see if you can

browse in order to identify the problem. If you cannot browse freely, fix your device's connection to the internet.

Conclusions & Recommendations

One of the most important lessons we learned from this project was to separate tasks based on different skills. This is important since having people work on the tasks they are best at, guarantees a better end product. Another lesson we learned was time management. Time management can mean the difference between a very good product and a poor one despite the competence of the members on the team. If a team is late on schedule, it can tamper with the quality of work as the stress of time takes a toll on the work.

In the future, we can work on different aspects of our final product to improve it. One of the best fronts to work on is the expansion of the product. Currently, we have 2 activities and expanding it to teach the user about more modules can be a very good thing to do for our project. It would set the project to be one of the best possible educational tools for Arduino. Another good aspect would be to increase accessibility with people internationally by making the product in new languages. Finally, working on the interactivity of the product would be good considering online-teaching can be a huge part of the future. Ideas such as possible added games to the platform and short interactive activities can be game-changing while being very informative about the topic.

In conclusion, we have learned many lessons throughout this project and are very proud of the work we were able to accomplish despite the constraints that COVID-19 brought. Lessons such as time management and working as a team are now engraved in our members' heads for the future. In this deliverable, we were able to tell the user about the health and safety risks of our product, on how to use the product, and on how to troubleshoot issues that they may encounter during the use of our product.

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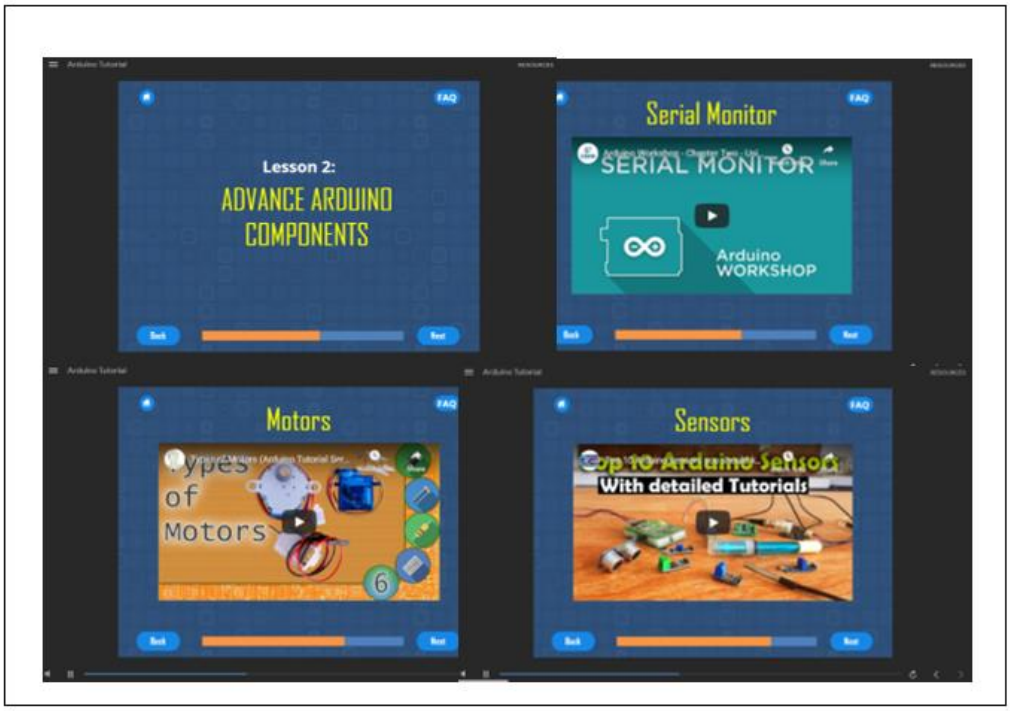
Appendices

1- Lesson 2



This is the lesson 2 in our product. It demonstrates to our users how to build the motors and sensors on Arduino.

2- Quiz 2

This is Quiz 2 in our product. The users can verify their understanding of the lessons by doing this Quiz. In this quiz there are six questions, four multiple choice questions and two true false questions. Each has 10points, total is 60 points. The passing grade is 30 points.

3- Activity 2

In activity 2, it shows how to use a sensor with an Arduino.