ECE 100 Laboratory Manuals

Illinois Institute of Technology ECE Department

Last Modified: August 24, 2021

Contents

0.1 Preface

Welcome to the ECE 100 - Intro to Profession - Laboratory Section In this laboratory, students will utilize Arduinos, sensors, code, and other items to build an assortment of robots. Students will collaborate in groups and participate in a variety of competetions between groups from all lab sections

Academic Honesty All students must follow the IIT Code of Academic Honesty during this laboratory session. Full text for the Code of Academic Honesty can be found on IIT's website

Reference Material There are several good reference sites for coding with Arduino and Arduino Sensors. The Arduino IDE uses the C++ coding language, so any reference material for C or C++ is also applicable

- Arduino Official Language Reference
- Arduino Tutorial Sketch
- Tutorialspoint.com Arduino Tutorials

Reports Format Templates for Prelab and Postlab reports can be found on Blackboard. Reports may be written using LaTeX or a text processor such as Microsoft Word, Google Docs, etc.

Laboratory Session 1

1.1 Pre-Laboratory Report

Complete this report before coming to the Laboratory Session

Due Date Week of August 30th-September 3rd, 2021 in lab section. Submit report electronically before start of Lab via Blackboard (check assignments folder)

Subject Section #, FirstName LastName

Body "I have read and will comply with the ECE 100 Course policies"

Short Answer Questions

1. What is a microprocessor? What is a microcontroller?
2. What is the difference between a microprocessor and a microcontroller?
3. Is an Arduino a microprocessor or microcontroller?

Additional Task Please complete Google Form attached at link below. Attach a screenshot of the "Response Sent" screen to verify completion. Google Form Link

Additional Task Bring Robot Kit to your lab section

1.2 Post-Laboratory Report

Due Date Week of September 6th-September 10th, 2021 in lab section. Submit report electronically before start of Lab via Blackboard (check assignments folder)

Contents Please follow the template for Post-Laboratory Reports as given on Blackboard.

Laboratory Session 2

2.1 Pre-Laboratory Report

Due Date Week of September 6th-September 10th, 2021 in lab section. Submit report electronically before start of Lab via Blackboard (check assignments folder)

Format Follow the Pre-Laboratory Report Template found on Blackboard

Content Sections to be included in the Pre-Laboratory Report include

1. **Header**
2. **Problem Statement**
3. **Research & Investigation**
4. **Alternative Solutions**
5. **Optimum Solution (with flowcharts)**
6. **Sources/Works Cited**
7. **Code Attachments**

Additional Task Create Flowcharts for the code to be generated in Laboratory 2

a. Make 1 flowchart for the sample code that you have been provided in the Research & Investigation section
b. Make 1 flowchart for your Optimal Solution
c. You can use PowerPoint, or any other software, to create your flowcharts
d. Your flowcharts should use simple English, not IC syntax
e. Include the flowchart in the Optimum Solution section of your Pre-Lab report

Additional Task Begin implementing code for use in Laboratory 2

2.2 Post-Laboratory Report

Due Date Week of September 13th-September 17th, 2021 in lab section. Submit report electronically before start of Lab via Blackboard (check assignments folder)

Format Follow the Post-Laboratory Report Template found on Blackboard

Content Sections to be included in the Pre-Laboratory Report include

1. **Header**
2. **Problem Statement**
3. **Research & Investigation**
4. **Alternative Solutions**

5. **Optimum Solution**
6. **Analysis & Testing**
7. **Final Evaluation**
8. **Sources/Works Cited**
9. **Code Attachments (as needed)**

Laboratory Session 3

3.1 Pre-Laboratory Report

Complete this report before coming to the Laboratory Session

Due Date Week of September 13th-September 17th, 2021 in lab section. Submit report electronically before start of Lab via Blackboard (check assignments folder)

Format Follow the Pre-Laboratory Report Template found on Blackboard

Content Sections to be included in the Pre-Laboratory Report include

1. **Header**
2. **Problem Statement**
3. **Research & Investigation**
4. **Alternative Solutions**
5. **Optimum Solution (with flowcharts)**
6. **Sources/Works Cited**
7. **Code Attachments**

Additional Task Answer the following questions and include them in the Pre-Laboratory Report

a. What does the "digitalWrite()" function do in Arduino?

b. What does the "analogWrite()" function do in Arduino?

c. What does the "pinMode()" function do in Arduino?

Additional Task Create flowcharts for the code you plan to generate in Laboratory 3

a. Create 1 flowchart for your Optimum Solution

b. You can use PowerPoint, or any other software, to create your flowcharts

c. Your flowcharts should use simple English, not IC syntax

d. Include the flowchart in the Optimum Solution section of your Pre-Lab report

3.2 Post-Laboratory Report

Due Date Week of September 6th-September 10th, 2021 in lab section. Submit report electronically before start of Lab via Blackboard (check assignments folder)

Format Follow the Post-Laboratory Report Template found on Blackboard

Content Sections to be included in the Pre-Laboratory Report include

1. **Header**
2. **Problem Statement**
3. **Research & Investigation**
4. **Alternative Solutions**
5. **Optimum Solution**
6. **Analysis & Testing**
7. **Final Evaluation**
8. **Sources/Works Cited**
9. **Code Attachments (as needed)**

Laboratory Session 4

4.1 Pre-Laboratory Report

Complete this report before coming to the Laboratory Session

Due Date Week of September 20th-September 24th, 2021 in lab section. Submit report electronically before start of Lab via Blackboard (check assignments folder)

Format Follow the Pre-Laboratory Report Template found on Blackboard

Content Sections to be included in the Pre-Laboratory Report include

1. **Header**
2. **Problem Statement**
3. **Research & Investigation**
4. **Alternative Solutions**
5. **Optimum Solution (with flowcharts)**
6. **Sources/Works Cited**
7. **Code Attachments**

Additional Task Answer the following questions and include them in the Pre-Laboratory Report

a. What was your role on your team (i.e. main responsibilities)?

b. How would you describe your team's collaboration and communication throughout the previous lab sessions?

Additional Task Create flowcharts for the code you plan to generate in Laboratory 4

a. Create 1 flowchart for your Optimum Solution

b. You can use PowerPoint, or any other software, to create your flowcharts

c. Your flowcharts should use simple English, not IC syntax

d. Include the flowchart in the Optimum Solution section of your Pre-Lab report

4.2 Post-Laboratory Report

Due Date Week of September 6th-September 10th, 2021 in lab section. Submit report electronically before start of Lab via Blackboard (check assignments folder)

Format Follow the Post-Laboratory Report Template found on Blackboard

Content Sections to be included in the Pre-Laboratory Report include

1. **Header**
2. **Problem Statement**
3. **Research & Investigation**
4. **Alternative Solutions**
5. **Optimum Solution**
6. **Analysis & Testing**
7. **Final Evaluation**
8. **Sources/Works Cited**
9. **Code Attachments (as needed)**

Laboratory Session 5

5.1 Pre-Laboratory Report

Complete this report before coming to the Laboratory Session

Due Date Week of September 27th-October 1st, 2021 in lab section. Submit report electronically before start of Lab via Blackboard (check assignments folder)

Format Follow the Pre-Laboratory Report Template found on Blackboard

Content Sections to be included in the Pre-Laboratory Report include

1. **Header**
2. **Problem Statement**
3. **Research & Investigation**
4. **Alternative Solutions**
5. **Optimum Solution (with flowcharts)**
6. **Sources/Works Cited**
7. **Code Attachments**

Additional Task Answer the following questions and include them in the Pre-Laboratory Report

a. How does an ultrasonic sensor work?

b. In what applications are ultrasonic sensors commonly used?

c. What function is used in Arduino to process the reading of an ultrasonic sensor?

Additional Task Create flowcharts for the code you plan to generate in Laboratory 4

a. Make 1 flowchart for the sample code that you have been provided in the Research & Investigation section

b. Make 1 flowchart for your Optimal Solution

c. You can use PowerPoint, or any other software, to create your flowcharts

d. Your flowcharts should use simple English, not IC syntax

e. Include the flowchart in the Optimum Solution section of your Pre-Lab report

5.2 Post-Laboratory Report

Due Date Week of September 6th-September 10th, 2021 in lab section. Submit report electronically before start of Lab via Blackboard (check assignments folder)

Format Follow the Post-Laboratory Report Template found on Blackboard

Content Sections to be included in the Pre-Laboratory Report include

1. **Header**
2. **Problem Statement**
3. **Research & Investigation**
4. **Alternative Solutions**
5. **Optimum Solution**
6. **Analysis & Testing**
7. **Final Evaluation**
8. **Sources/Works Cited**
9. **Code Attachments (as needed)**

Laboratory Session 6

6.1 Pre-Laboratory Report

Complete this report before coming to the Laboratory Session

Due Date Week of October 4th-October 9th, 2021 in lab section. Submit report electronically before start of Lab via Blackboard (check assignments folder)

Format Follow the Pre-Laboratory Report Template found on Blackboard

Content Sections to be included in the Pre-Laboratory Report include

1. **Header**
2. **Problem Statement**
3. **Research & Investigation**
4. **Alternative Solutions**
5. **Optimum Solution (with flowcharts)**
6. **Sources/Works Cited**
7. **Code Attachments**

Additional Task Answer the following questions and include them in the Pre-Laboratory Report

a. What is the function of the buzzer sensor module?

b. Describe the purpose of the 3 pins of the buzzer sensor module (VCC, I/O, GND)

Additional Task Create flowcharts for the code you plan to generate in Laboratory 4

a. Make 1 flowchart for the sample code that you have been provided in the Research & Investigation section

b. Make 1 flowchart for your Optimal Solution

c. You can use PowerPoint, or any other software, to create your flowcharts

d. Your flowcharts should use simple English, not IC syntax

e. Include the flowchart in the Optimum Solution section of your Pre-Lab report

6.2 Post-Laboratory Report

Due Date Week of September 6th-September 10th, 2021 in lab section. Submit report electronically before start of Lab via Blackboard (check assignments folder)

Format Follow the Post-Laboratory Report Template found on Blackboard

Content Sections to be included in the Pre-Laboratory Report include

1. **Header**
2. **Problem Statement**
3. **Research & Investigation**
4. **Alternative Solutions**
5. **Optimum Solution**
6. **Analysis & Testing**
7. **Final Evaluation**
8. **Sources/Works Cited**
9. **Code Attachments (as needed)**

Laboratory Session 7

7.1 Pre-Laboratory Report

Complete this report before coming to the Laboratory Session

Due Date Week of September 6th-September 10th, 2021 in lab section. Submit report electronically before start of Lab via Blackboard (check assignments folder)

Format Follow the Pre-Laboratory Report Template found on Blackboard

Content Sections to be included in the Pre-Laboratory Report include

1. **Header**
2. **Problem Statement**
3. **Research & Investigation**
4. **Alternative Solutions**
5. **Optimum Solution (with flowcharts)**
6. **Sources/Works Cited**
7. **Code Attachments**

Additional Task Answer the following questions and include them in the Pre-Laboratory Report

a. What are servos and how do they work?

b. What Arduino functions are utilized to control the servo?

Additional Task Create flowcharts for the code you plan to generate in Laboratory 4

a. Make 1 flowchart for the sample code that you have been provided in the Research & Investigation section

b. Make 1 flowchart for your Optimal Solution

c. You can use PowerPoint, or any other software, to create your flowcharts

d. Your flowcharts should use simple English, not IC syntax

e. Include the flowchart in the Optimum Solution section of your Pre-Lab report

7.2 Post-Laboratory Report

Due Date Week of September 6th-September 10th, 2021 in lab section. Submit report electronically before start of Lab via Blackboard (check assignments folder)

Format Follow the Post-Laboratory Report Template found on Blackboard

Content Sections to be included in the Pre-Laboratory Report include

1. **Header**
2. **Problem Statement**
3. **Research & Investigation**
4. **Alternative Solutions**
5. **Optimum Solution**
6. **Analysis & Testing**
7. **Final Evaluation**
8. **Sources/Works Cited**
9. **Code Attachments (as needed)**

Laboratory Session 8

8.1 Pre-Laboratory Report

Complete this report before coming to the Laboratory Session

Due Date Week of September 6th-September 10th, 2021 in lab section. Submit report electronically before start of Lab via Blackboard (check assignments folder)

Format Follow the Pre-Laboratory Report Template found on Blackboard

Content Sections to be included in the Pre-Laboratory Report include

1. **Header**
2. **Problem Statement**
3. **Research & Investigation**
4. **Alternative Solutions**
5. **Optimum Solution (with flowcharts)**
6. **Sources/Works Cited**
7. **Code Attachments**

Additional Task Answer the following questions and include them in the Pre-Laboratory Report

a. What was your role on your team (i.e. main responsibilities)?

b. How would you describe your team's collaboration and communication throughout the previous lab sessions?

Additional Task Create flowcharts for the code you plan to generate in Laboratory 4

a. Make 1 flowchart for the sample code that you have been provided in the Research & Investigation section

b. Make 1 flowchart for your Optimal Solution

c. You can use PowerPoint, or any other software, to create your flowcharts

d. Your flowcharts should use simple English, not IC syntax

e. Include the flowchart in the Optimum Solution section of your Pre-Lab report

8.2 Post-Laboratory Report

Due Date Week of September 6th-September 10th, 2021 in lab section. Submit report electronically before start of Lab via Blackboard (check assignments folder)

Format Follow the Post-Laboratory Report Template found on Blackboard

Content Sections to be included in the Pre-Laboratory Report include

1. **Header**
2. **Problem Statement**
3. **Research & Investigation**
4. **Alternative Solutions**
5. **Optimum Solution**
6. **Analysis & Testing**
7. **Final Evaluation**
8. **Sources/Works Cited**
9. **Code Attachments (as needed)**

Laboratory Session 9

9.1 Pre-Laboratory Report

Complete this report before coming to the Laboratory Session

Due Date Week of September 6th-September 10th, 2021 in lab section. Submit report electronically before start of Lab via Blackboard (check assignments folder)

Format Follow the Pre-Laboratory Report Template found on Blackboard

Content Sections to be included in the Pre-Laboratory Report include

1. **Header**
2. **Problem Statement**
3. **Research & Investigation**
4. **Alternative Solutions**
5. **Optimum Solution (with flowcharts)**
6. **Sources/Works Cited**
7. **Code Attachments**

Additional Task Bring Robot Kit to your lab section

9.2 Post-Laboratory Report

Due Date Week of September 6th-September 10th, 2021 in lab section. Submit report electronically before start of Lab via Blackboard (check assignments folder)

Format Follow the Post-Laboratory Report Template found on Blackboard

Content Sections to be included in the Pre-Laboratory Report include

1. **Header**
2. **Problem Statement**
3. **Research & Investigation**
4. **Alternative Solutions**
5. **Optimum Solution**
6. **Analysis & Testing**
7. **Final Evaluation**
8. **Sources/Works Cited**
9. **Code Attachments (as needed)**