Arduino Control System

Hans-Petter Halvorsen

2019-03-07
1 Introduction

In the introduction chapter you should have a short introduction to your work, background, goal, constraints, etc. If relevant, you can also mention what kind of software and hardware that has been used. In this system we will use an Air Heater system as shown in Figure 1-1.

![Air Heater System](image)

Figure 1-1: Air Heater System.

The aim is to control the temperature on the outlet. Pretend that you write this documentation for a customer that have asked you to make this system and document it.

2 Problem Description

You need to explain the problem with your own words, figures and sketches. For small projects, you may include this as a sub chapter under the Introduction chapter.

Figure 2-1 shows the system overview. We see that the system consists of a network.

![System Overview](image)

Figure 2-1: System Overview
3 Material and Methods

The main purpose of the 'Materials and Methods' section is to provide enough detail for a competent worker to repeat your study and reproduce the results. The scientific method requires that your results be reproducible, and you must provide a basis for repetition of the study by others. You may call the chapter 'Implementation' in a typical software project. Equipment and materials available off the shelf should be described.

In Figure 3-1 we see the control system developed in this project.

![Figure 3-1: Control System](image)

From eq. (3.1) we see that ....

$$y = ax + b$$  \hspace{1cm} (3.1)

Make sure to enter equations properly. See how it is done in different text books, etc.

Hundreds of code lines in the report makes no sense. You may include small code snippets in your main report or screen-shots of the most important parts of your program. The rest of the code could be in an appendix if it’s not too much. 50-100 pages with code listing makes no sense in the report or in appendix.

A better way is to attach it in electronic form in some way, e.g. a link to a web site where you can download it.

You should also plan and document your code using flow charts (see example in Figure 3-2), etc.

![Figure 3-2: Flow Chart](image)
You may also include other kind of sketches if you think that is relevant in order to explain your work. Use a proper tool like e.g., MS Visio or similar.

In Figure 3-3 we see an example of a Use Case diagram.

![Use Case Diagram](image)

Below we see the C# code for the PI controller:

```csharp
bool myTest;
myTest = false;
if (myTest == false)
{
    MessageBox.Show("Hello1");
    MessageBox.Show("Hello2");
}
```

From the code, we see that ...

4 Results

In the results section, you present your findings: display items (figures and tables) are central in this section.

In Table 4.1 the results are summarized. We see that the data match the real system based on the logged data. Note that Table numbering should be above the table!

<table>
<thead>
<tr>
<th>M</th>
<th>T</th>
<th>W</th>
<th>T</th>
<th>F</th>
<th>S</th>
<th>S</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>8</td>
<td>9</td>
<td>10</td>
<td>11</td>
<td>12</td>
<td>13</td>
<td>14</td>
</tr>
<tr>
<td>15</td>
<td>16</td>
<td>17</td>
<td>18</td>
<td>19</td>
<td>20</td>
<td>21</td>
</tr>
<tr>
<td>66</td>
<td>56</td>
<td>12</td>
<td>34</td>
<td>12</td>
<td>23</td>
<td>18</td>
</tr>
<tr>
<td>12</td>
<td>21</td>
<td>34</td>
<td>54</td>
<td>12</td>
<td>33</td>
<td>43</td>
</tr>
</tbody>
</table>
5 Discussions
One of the most important things in your report is to analyze and discuss your results in detail. For larger reports, each chapter should be on a separate page.

6 Conclusion
A Conclusion is always needed in a technical report or article. Here you shall summarize your results and draw conclusions, not write how much you have learned, etc.

Bad examples:
- “I have learned much doing this assignment”
- “This was very useful, and I will need this when I get a job”
- “From this Lab, we understand the Kalman Filter much more and how to implement it in LabVIEW which also make us much better to use LabVIEW. We also learned how to design a feedforward controller to combine with a traditional PID controller and by comparison, we have better understanding that the usage of Kalman Filter and feedforward controller.”

You should focus on your results, not just list up what you have done or how much you have learned by doing this, etc. It is nice that you have learned a lot, but this is not relevant!! Does the program work as expected? Why/Why Not? Any improvements that needs to be made with your program, etc.

7 References

Example of Book with one author:

Example of Book with three or more authors:

Web Site Example:

Master or PhD thesis Example:

E-book Example:

Remember to refer to all your references in the reference list in your text, and in the same order as they appear in the list.

Appendices
Appendices contain information in greater detail than can be presented in the main body of the paper.