University of Amsterdam

Multi-touch screen hierarchical virtual "PIDAC" simulation

Project outline

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Contents

1 Background information

PIDAC (Plug-In Digital Analog Computer) is a learning tool for sequential and combinational logic. It is a system that has been in use for the past 30 years.

A succinct summary of the PIDAC system is given by the following excerpt from bachelor thesis "Distributed simulation of digital circuits" by van Schaik [1]:

> PIDAC consists of a base board acting as a power grid for a collection of modules that can be plugged onto it, where a module is electronic circuit, most often an IC (integrated circuit), wrapped up in a user-friendly box, exposing its pins as jacks that allow them to be easily wired together with pluggable cables. Both digital and analog modules exist allowing people to quite simply learn about analog and digital electronics without having to solder and without having to know about the more in-depth details of electronics. Among these digital modules, one can find modules such as ALUs (arithmetic logic units), microcontrollers, registers, and NAND-gates.

2 Project outline

2.1 Problem outline

As mentioned in the background information section, PIDAC is a system that has been in use for several decades. While it is still very usable, PIDAC has some limitations:

- Physical components are required for creating and expanding circuits
- Connections are not checked for correctness
- Wiring can become a tangled mess

The solution proposed here is to create a virtual PIDAC simulator for a multi-touch screen platform.

2.2 Project goal

The desired outcome of this project is to have a fully functional and documented virtual PIDAC simulator for a multi-touch screen platform before the end of the project. The virtual PIDAC simulator should encompass at least the following features:

- Multi-touch interface
- Symbolic visualisation of component logic
- Rubber band connections between components
- Hierarchical component wrapping
- A number of basic components
- Being able to store and load wrapped components and circuits
- Displaying of timing diagram for probe location
- Visual feedback
- Error messages/hints
- Ability to add delay

3 Project organisation

3.1 Research questions

To achieve the desired outcome for this project, the following research questions must be answered:

- **Research question 1:** What kind of simulation would be best suited for this project?
- **Research question 2:** To what extent is it possible to encompass all features and feel of PIDAC on a multi-touch screen simulation?
- **Research question 3:** To what extent is it possible to give useful warnings and error messages about component connections to the user?

3.2 Estimated time table

Week 1 (30-03 to 06-04):
Literature study
Setting up development environment

Week 2 (07-04 to 13-04):
Basic components logic
Simple GUI for basic components

Week 3 (14-04 to 20-04):
Component wrapping and storing/loading
Visualisation of timing diagram

Week 4 (21-04 to 27-04):
Error checking and displaying of hints

Week 5 (28-04 to 04-05):
Error checking and displaying of hints

Week 6 (05-05 to 11-05):
Error checking and displaying of hints
Adding multi-touch interface

Week 7 (12-05 to 18-05):
Adding multi-touch interface
Writing thesis

Week 8 (19-05 to 25-05):
Adding multi-touch interface
Writing thesis

Week 9 (26-05 to 01-06):
Writing thesis

Week 10 (02-06 to 08-06):
Writing thesis

4 Project scope

The focus of the practical part of this project will be on creating a windows based solution, considering the multi-touch platform that has been made available is windows based.

5 Related work

A project somewhat similar has been undertaken at the University of Amsterdam by student S.J.R. van Schaik. Schaik has written the bachelor thesis "Distributed simulation of digital circuits" [1], which is a great source of inspiration for this project.

The main similarity between the two projects is that they both simulate a PIDAC environment. The difference is in the platform that is used.

In Schaik's implementation, multiple touch screen devices are used to simulate a PIDAC module each and are linked together via a network interface. Seeing as this is a very niche solution, a desire has arised for something more broadly applicable. This is where the Multi-touch screen virtual PIDAC simulation comes in.

References

[1] S.J.R. van Schaik. Distributed simulation of digital circuits. Bachelor thesis, University of Amsterdam, 2015.