



CHILLAR MACHINE

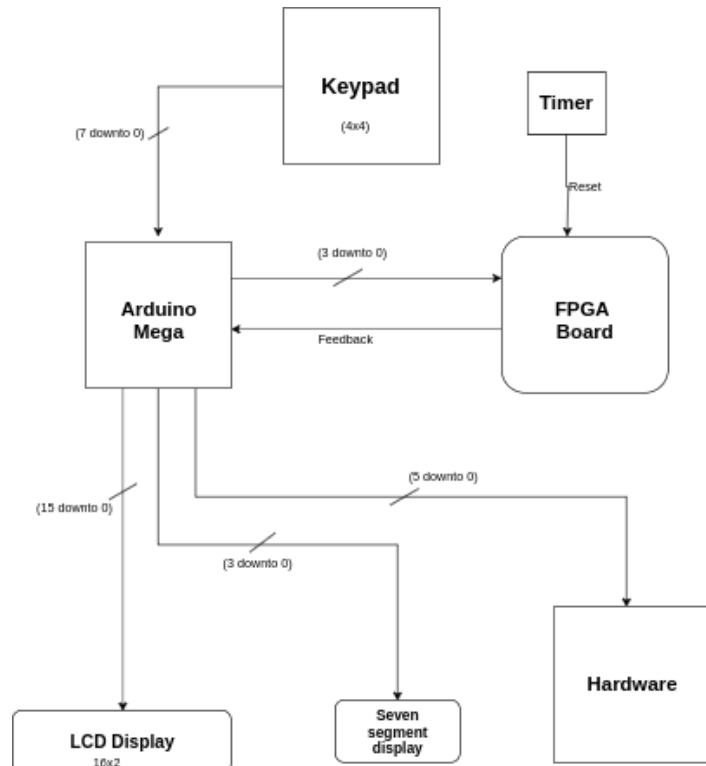
Dewansh Chhatri (180010011, dewansh.chhatri.18001@iitgoa.ac.in), Siddharth Shah (180010027, siddharth.shah.18001@iitgoa.ac.in), Nidhish Sawant (180030017, nidhish.sawant.18003@iitgoa.ac.in), and Manoj Anuragi (180020013, manoj.anuragi.18002@iitgoa.ac.in)

Introduction

The Chillar Machine caters to the needs of people facing trouble in finding a change for higher denomination currency notes. It dispenses change in return to the money inserted in it. The user can choose any combination of smaller denomination notes in the form of which he/she wants the change.

System Overview

The interface (front part) of the machine consists of an LCD panel which displays instructions (one at a time) to use the machine, a numeric keypad (in which the user feeds inputs), a timer and some indicator LEDs. In the machine, we've made use of the Intel Cyclone 2 (as our primary board) and the Arduino Mega (as our secondary board). All the logical parts and calculations involved in the project's software are performed on the FPGA board (Cyclone 2), whereas the LCD display, the Stepper motors and some of the LEDs are controlled by the Arduino board.



CHILLAR MACHINE

Fig. 1: Block Diagram

Implementation Details

The inputs that the user gives through the keypad are passed on to the FPGA through the Arduino Mega board. We didn't pass these inputs directly to the FPGA board, as we were facing some issues in converting the standard 8 bit outputs of the keypad into nibbles (which our VHDL code expects as inputs). The VHDL code on the FPGA board takes care of the keypad inputs and calculations required to be done behind the scenes. We have modelled the system as a Finite State Machine (FSM) in the code. The states have been made such that the user can input whatever linear combination of smaller denomination notes he/she wants as change. The machine dispenses change if the total change asked for is less than or equal to the money inserted, but does NOT dispense anything otherwise. That is, even if the user asks for a combination whose sum is less than the money inserted, the machine will auto-generate the change to be dispensed. The VHDL code's outputs are binary vectors (each one of them corresponding to a denomination) which are fed to the Arduino board as inputs. Each of these binary vectors represents the number of notes of the corresponding denomination, which the user asked for, as change. This indicates the Arduino on how to operate the Stepper motors.

Coming to the Arduino, it's used to display the instructions (to the user) at each step in the process through the LCD panel. It also highlights the denomination which is currently active (while the user is giving inputs) in any form, and whenever necessary (through LEDs). Finally, it activates the Stepper motors the required number of times (and appropriate durations) to dispense the various notes.

Modifications suggested : Although not implemented in this machine, but there can also be a timer, which can be coded in VHDL to run for 100 seconds. If the user is not able to feed all the inputs within this duration, then his/her session will time out, the Chillar Machine will go to its reset state, and he/she will have to start the process all over again.

Result

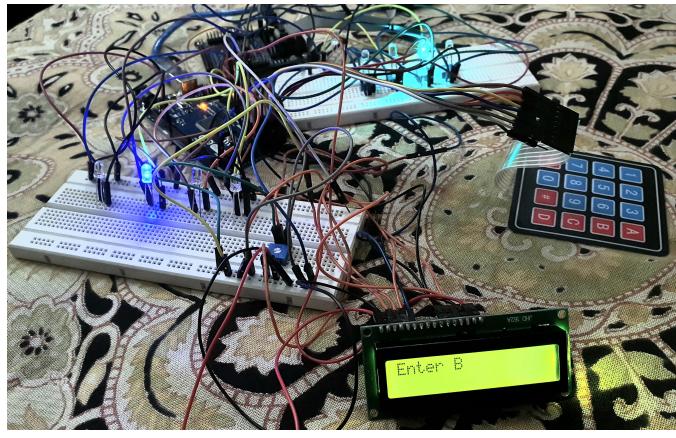


Fig. : Images

The Chiller Machine is working as expected, and doing its job of dispensing out the change that the user asks for.

The machine is also quite user-friendly, as instructions for operating it are clearly displayed at each step of the process. Furthermore, the user doesn't have to make sure that the change asked for (i.e. the linear combination of smaller denominations) is equal to the money inserted. That is, the machine will auto-generate the change in case the user asks for a combination whose sum is less than the money inserted. The indicator LEDs are also giving proper feedback of the inputs to the user, which is necessary for providing reassurance to the user that the machine is working properly. The machine's code is also quite robust and handles all possible invalid inputs by the user at each step quite well.

As for the hardware, we have made 2 money dispensing machines using cardboard to demonstrate the functionality of the Chiller Machine.

Conclusion

We can conclude that only after working on a serious project like this, we can actually learn the real life implementation of the knowledge that we gain through theory lectures and lab sessions.

References

- [1] Course lecture notes
- [2] <https://www.arduino.cc/>
- [3] <https://www.intel.com/>
- [4] <https://youtube.be/ZySGP4AwGCy>