Lunds Tekniska Högskola

Digital and Analogue Projects

EITF40

Automatic Cocktail Mixer

Spring semester 2018

Authors:
David Åkerman
Guillaume Marcelin

Academic advisor:
Bertil Lindvall
Christoffer Cederberg

March 6, 2018

Abstract

In this project we tried to create a automatic cocktail mixer with alcohol control. To create this we used a Atmega32 microcontroller together with some magnetic valves and mechanical flowmeters for controlling the flow of the liquid. We also used a LCD screen and a keypad as an interface for the user. In the end we got a working prototype which can control the alcohol consumption and gets you the correct amount of alcohol if you are not to picky with the precision.

Contents

1 Introduction

The aim of the course in Digital and analog projects is to do a prototype of a analog or digital system(or both). Our first wish was to work with a flow meter because of a personal project of plastic pollution analysis in the Atlantic Ocean with the organization Oceasciences. A more concrete project had to be chosen with concrete goals and results. With no precise idea, the team chose to have a playful aim: An automatic cocktail mixer.
To add some difficulty to the project, it has been decided that an interface with keypad and screen would be added. Moreover, as everyone know the famous awareness phrase: "Drink responsibly", a limitation of drinks had to be added. There should be an unique user log in, and a time limitation before taking another glass of alcohol.

2 Basic design choice

Once the principle, and the specification had been defined, the basic design and the main material had to be chosen. Many different options were possible and a selection had to be made. The main aspects taken in account to take the final decision were both the precision of the amount of liquid pored and the price to have as many bottles as possible in the prototype. The main ideas were to use flow meters, mass sensors or depth level sensors to measure the amount of alcohol pored, to use a timer to assess the amount of alcohol served, or to have a gap between two valves of a given volume to poor the exact amount of alcohol (see Appendix 1). The selected design was first the use of two valves with a gap, being an easy and cheap solution, and the most precise one. After the first tests, the valves used were discarded because the pressure needed to open them was really important (more than 20 meters of liquid). To get valves which could open with almost no pressure, the price was greatly increased, and the ideas of the flow meters came back, to be the final design: one flow meter above each valve to measure the quantity of liquid poured into each glass, with a prototype with two bottles.

3 Software

In our system there is two types of users, admin and ordinary user. An ordinary user can only order drinks and admin can only add and delete users. There is only one admin on the system with a username and password already inserted into the system. The usernames is 6 character long and the passwords 4 characters long and possible characters are '1'-'9', '*', '0', '#'. To type a username or password you type your input then you press confirm for the input to be handled. If you confirm before typing 6 or 4 characters the input will be padded with the value 0 for each missing character e.g ['3', '4', 0, 0]. Other useful buttons are the clear button which clear a inputted character, a back button to go back to a previous menu(going back directly after login or logout is not possible for security reasons) and a button to logout. In menus each alternative is shown to the user next to the button to press e.g "1: Add User". When using the functionalities of the admin you will get message if your addition or removal of a user was successful, if not successful you will get a cause(limit of number of users reached, username taken or user not found). The functionalities for the user is to either get a alcoholic beverage or a soda(non-alcoholic). When choosing alcohol the system will automatically pour a fixed amount of liquid measured by the flowmeter and start a counter. The user will not be able to get any alcohol

from the machine until this counter has counted down to 0. This counter value will be saved to a EEPROM once a minute to prevent the user from reseting the counter by cutting the power. When choosing soda the user will manually have to open a valve by pressing a button to pour the liquid.

4 Electronic Hardware

We were given a AVR AtMega 32 for the project, which was a good enough micro controller for what we wanted to do. The electronic design was first done for the option with two valves and a gap (see appendix 3).The 32pins were used this way: eleven outputs for the LCD screen, 8 outputs for the valves, connected to LED to simulated the opening of the valves, 4 inputs and 4 outputs for the keyboard, 1 for a potential mass sensor to check that the bottles are not empty (finally not used) and the 4 pins for the JTAG connection. As the design has changed, and two flow meters has been added, two inputs with interrupt were needed, and 6 outputs for the valves and one for the weight sensor were finally not used. Some transistors and capacitors had also to be added for the valves to open correctly, as they are magnetic coils, needing a more important power supply. The flowmeter we ended up works by sending a interrupt when a mechanical component get pushed by the liquid. A basic LCD with 4 rows with 20 character on each and a keypad with 16 buttons was used. The final inputs/outputs are given in appendix 4.

5 Mechanical Hardware

The prototype was build on a homemade wood shelf: At the top are some open bottles connected to the flow meter, itself connected to the valve, which is screwed on the shelf. All the connections between the components were 3D printed in plastic, with the CAD software SolidWork. We tried to have some flow meters 3D printed as well, but did not have enough time to finish those.

6 Result and Discussion

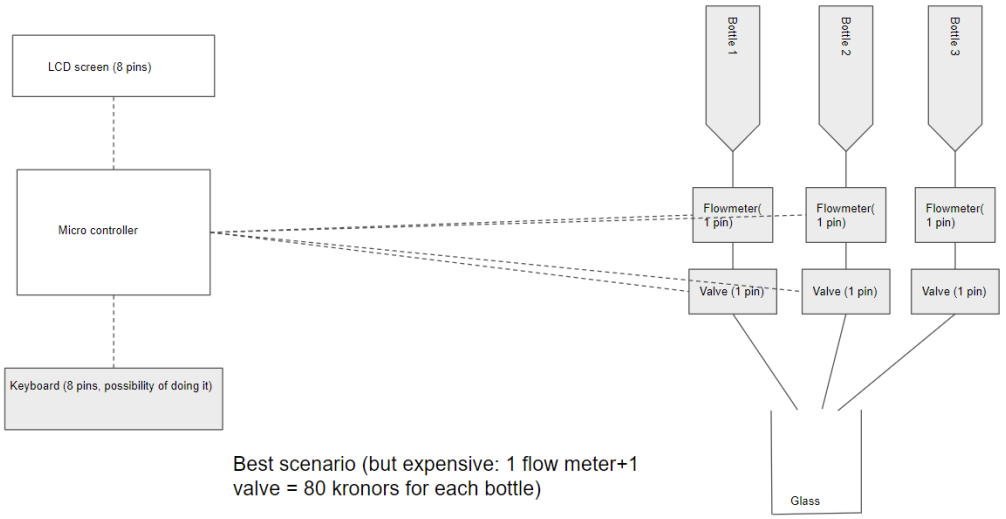
After many test of different materials, and reorganizations of the work, a working solution has been found. It can serve about 3 cl of alcohol with some ml to much or less, control how much alcohol the user gets from the machine, add soda manually to do a cocktail, or just to serve the soft drink neat.
Overall the system works good but many improvements could be done to the drink dispenser on both software and hardware level. A problem you see at first glance is that the system is very big and wires are sticking out and even disconnect sometimes, few people would want this in there home. If the components where packed in a chassis in a neat way the overall system could be become smaller. The valve used is also quite big so a smaller valve could make the system smaller overall. Another problem is that system is quite expensive even if it only has 2 bottles. The big offender is the valve, but even the flowmeter is to expensive if you use to many in the system. By 3D printing the flowmeter instead, the system could be a bit cheaper. It may also be a bit more precise with smaller components. Both the flowmeter and the valve seems a bit oversized for this particular use case.
On the software part you could add a option to change the admin password to hopefully increase the security a bit. A timer could be used to check if the bottles need to be refilled, if no signal is detected from the flowmeter for some time the bottle is probably empty. If more bottles with corresponding valve and flowmeters was added you could serve different drinks and cocktails with different recipes and sizes.
This project has been a good opportunity for us to see many aspects of a digital project: The electronic part, the implementation of the program, the construction of the support and the 3D printing with the difficulty to be really precise to be waterproof. Last but not least, one of the most enjoyable part of this course is that the choice of the project is totally free: there is no condition, no restriction and the teachers are supporting, trying to find alternatives if the project seems to be too simple or too difficult, but never trying to choose what we have to do or should do.

7 Acknowledgements

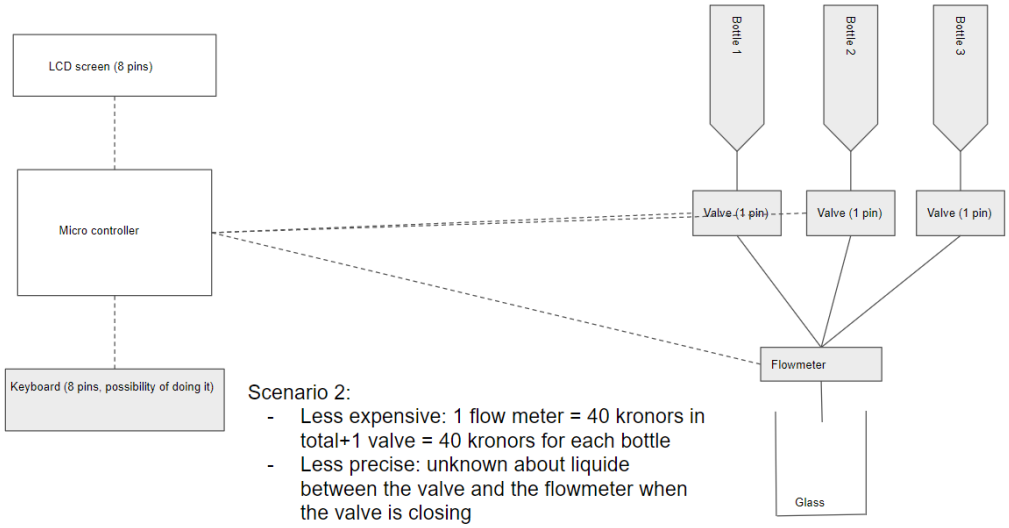
We would like to thank Christoffer for all the support he has given us, all along the project, at any time in the day or the night.

A Appendix

A.1 Possible basic designs

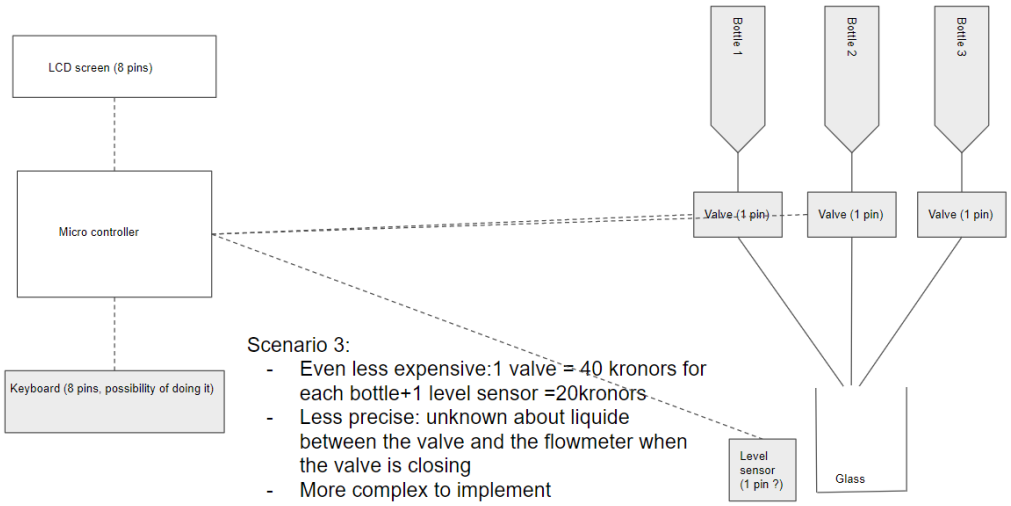


Best scenario (but expensive: 1 flow meter+1 valve = 80 kronors for each bottle)



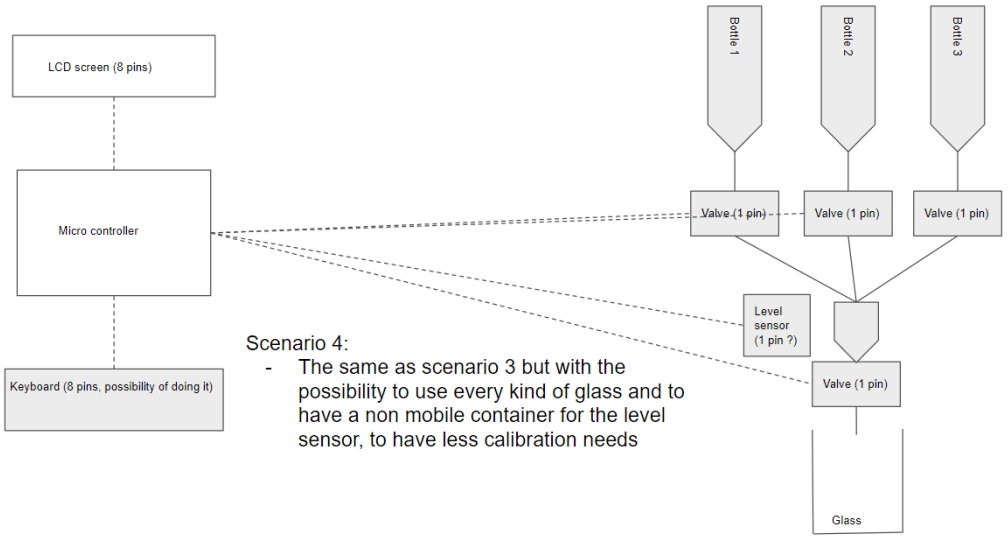
Scenario 2:

- Less expensive: 1 flow meter = 40 kronors in total+1 valve = 40 kronors for each bottle
- Less precise: unknown about liquide between the valve and the flowmeter when the valve is closing



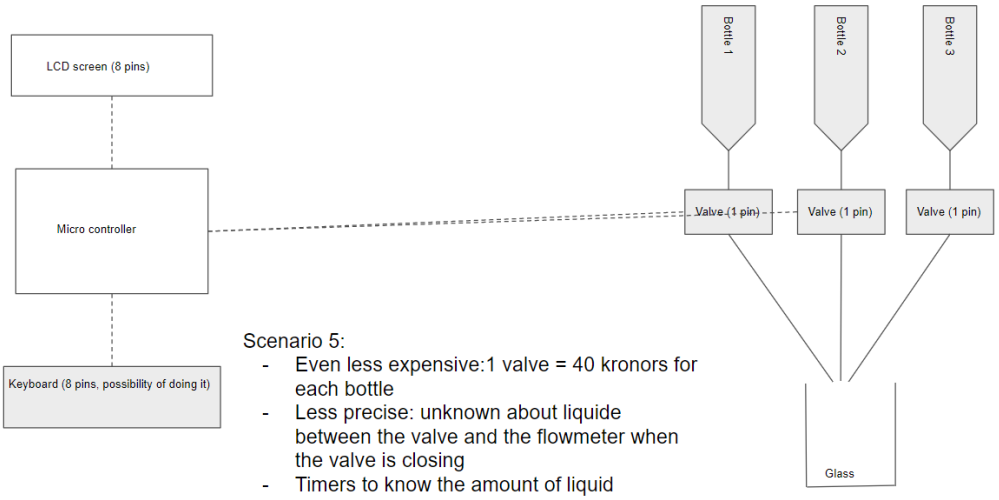
Scenario 3:

- Even less expensive:1 valve = 40 kronors for each bottle+1 level sensor =20kronors
- Less precise: unknown about liquide between the valve and the flowmeter when the valve is closing
- More complex to implement



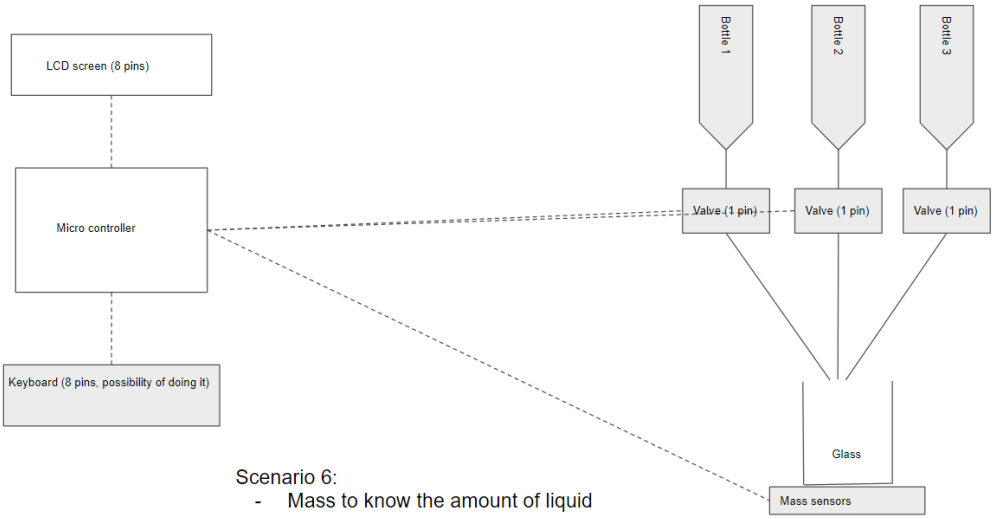
Scenario 4:

- The same as scenario 3 but with the possibility to use every kind of glass and to have a non mobile container for the level sensor, to have less calibration needs



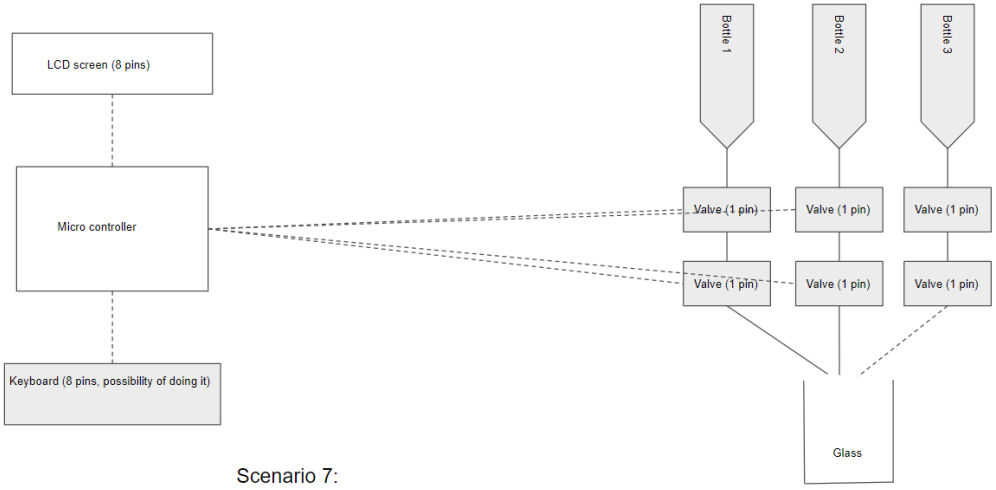
Scenario 5:

- Even less expensive:1 valve = 40 kronors for each bottle
- Less precise: unknown about liquide between the valve and the flowmeter when the valve is closing
- Timers to know the amount of liquid



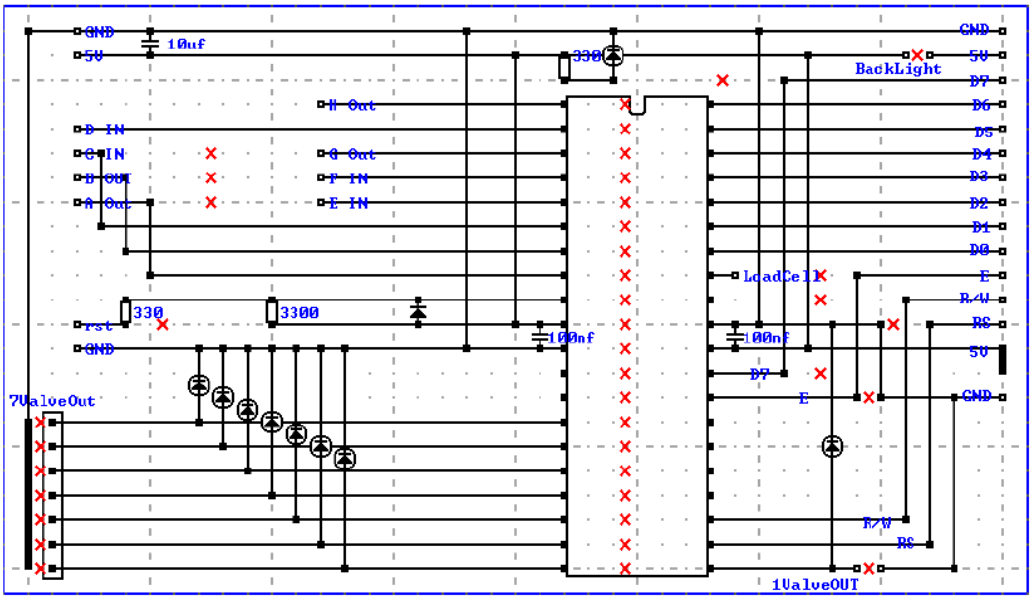
Scenario 6:

- Mass to know the amount of liquid



Scenario 7:
- Volume interval between the two valves

A.2 Electronic design



A.3 Final Outputs/Inputs

PA0: LCD	PB0: Keyboard	PC0: LCD	PD0: LCD
PA1: Valve	PB1: Keyboard	PC1: LCD	PD1: LCD
PA2: Valve	PB2: Keyboard	PC2: JTAG	PD2: Flow meter
PA3: Valve	PB3: Keyboard	PC3: JTAG	PD3:Flow meter
PA4: LCD	PB4: Keyboard	PC4: JTAG	PD4: LCD
PA5: Valve	PB5: Keyboard	PC5: JTAG	PD5: LCD
PA6: Valve	PB6: Keyboard	PC6: LCD	PD6: LCD
PA7: Valve	PB7: Keyboard	PC7: Valve	PD7: LCD

A.4 Construction