Automated Drink Maker

ECE 445 Project Proposal

Team 55

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Introduction

Problem:

In many industries, staffing has become a huge problem due to covid, and no area has been impacted more so than the restaurant industry. Even before covid, restaurants would have staffing shortages due to the limited number of people in the job pool, poor retention of these employees, and lack of motivation[1]. Now these problems are even worse due to the pandemic, and these businesses are suffering because of it. The wait times are now much longer at these establishments, and once loyal customers are leaving unsatisfied. This leads to bad reviews and less repeat customers, which severely hurts a company's income in these already tough times. For this reason, a lot of restaurants have permanently closed because of bankruptcy. Something has to change to fix this problem.

Solution:

Our team has come up with the idea to make a remotely operated autonomous drink maker. This will allow the waiter to put drink orders in while at the table and will free up time for them to help other customers in this new found free time. With this the problem of extremely long wait times at restaurants will be greatly reduced.

1. The remote control for the device will use bluetooth to communicate with the receiver, which will then tell the device's microcontroller which drink it will be making.
2. Once the process is started, a series of three motors will be used to move an arm to pick up a cup from a stack and then load it onto the conveyor belt.

3. The conveyor belt will be controlled by the microcontroller and a photosensor in conjunction. The photo sensor will inform the microcontroller when the cup is in place and then when filling is complete the conveyor will move the cup to the unloading area.

4. The filling system for the machine will be a gravity fed dispenser that will be operated by four solenoid valves. These valves will be connected to the microcontroller to make sure they are being operated correctly. The microcontroller will be incharge of the timing for the motors so that each cup is given the exact same amount of liquid.

5. The microcontroller for this device will be in charge of controlling the precise timing that will be needed for each component of our project. It will also be responsible for dispensing the correct drink.

6. The bluetooth device for our project will have a receiver to relay the data from the remote to the microcontroller, and a sender that will be transmitting the input from the buttons on the remote
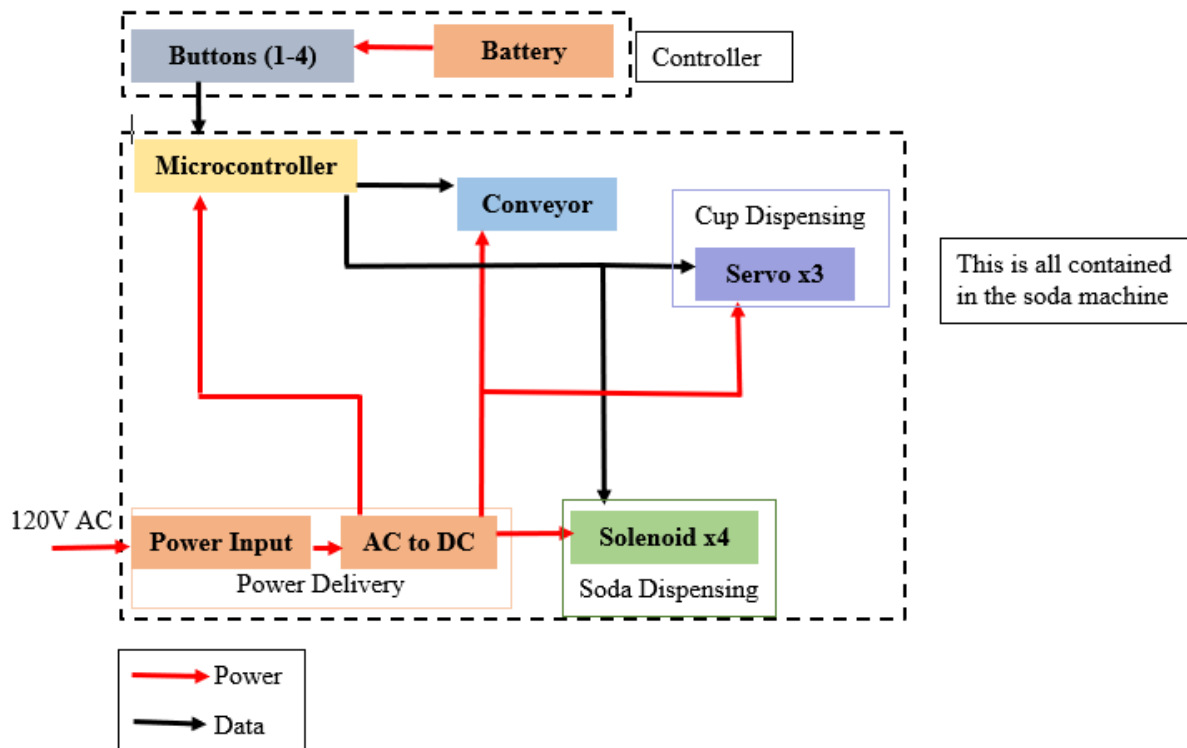
Visual Aid:

High Level Requirements:

1. Pick up and place cups onto the conveyor belt.

2. Conveyor belt moves cup under the nozzle.

3. Machine dispenses the correct amount of the chosen soda at the right time.

4. Remote can control the machine and which soda is dispensed.

Design

Block Diagram:

Subsystem Overview:

1. The power delivery subsystem's purpose is to provide power to the actual soda machine. It consists of a power input to take 120V AC from a wall outlet. It then is paired with a device to change the AC input to DC output for the rest of the components in the machine to run off of.

2. The controller subsystem is detached from the machine so it has its own power source in the form of a battery housed inside the controller. The other main component housed inside the controller is the four buttons, one button per drink in our machine. The buttons send data via Bluetooth to the microcontroller housed inside the soda machine.

3. The microcontroller gets power from the power delivery subsystem and receives data from the controller. It uses that data to determine when to dispense a cup, when to move the conveyor, and when to dispense the soda. It will be the brain of the machine and have a hand in every aspect of it short of the power delivery.

4. The cup dispensing subsystem has power given to it in order to run the 3 planned servo motors needed to have the cups be dispensed properly. There will be a motor arm that will move in order to grab cups off of a stack of them. It will then move these cups over to the conveyor belt to move through the process.

5. The conveyor belt will take data from the microcontroller in order to know when it should start moving. It will start moving after the cup has been placed on it and the arm has gotten out of the way. It will then move the cup underneath the soda fountain waiting for the proper amount of soda to be dispensed. After the soda has stopped, it can then commence moving the cup to the end of the track waiting for it to be taken by the user.

6. The soda dispensing subsystem is the final one. It takes power, data from the microcontroller, and uses solenoids, in order to dispense soda into the cup placed

underneath it by the conveyor belt. There will be a timer in order to know when the solenoids should turn off to stop dispensing the soda. There are planned to be four solenoids total, one for each drink planned to be inside the soda machine.

Subsystem Requirements:

1. The cup dispenser must grab the top cup and attach to it so that it can move it. Next, it has to lift the cup out of the stack so it can move it around without knocking the rest over. It then has to swing the cup around so that it can place it on the conveyor belt. Finally, it has to lower and release the cup onto the belt so that it can be filled with a drink. It resets to a home position after that. All the movement will be done by servos controlled by the microcontroller.

2. The conveyor belt must move the cups to the correct positions at the correct time. A cup will be placed on it by the cup dispenser, and from there the conveyor has to move the cup under the nozzle to have soda dispensed into it. After it is filled, the cup moves further along the belt and is led to a dispatch area.

3. The soda dispenser must be able to sense a cup when it comes near, and begin to dispense the correct soda into the cup. The microcontroller needs to know which soda to dispense, and then open a valve to allow the correct amount of soda into the cup so that it is full but not overflowing.

4. We must be able to use a controller to make the machine work. There will be 4 buttons on the controller, each one describing a different drink. When a button is pressed, a cup must be grabbed, moved to the dispenser, filled with the chosen soda, and then moved along to be picked up.

Tolerance Analysis:

There are a lot of aspects to this project that could break the whole thing. If the remote doesn't work, we won't be able to dispense any soda. If the cup dispenser doesn't work, we won't have any cups to fill. If the conveyor doesn't work, the cups won't be in position to be filled by the machine. If the dispenser doesn't work, we may overfill the cup or not fill it enough. We could also dispense the wrong drink, which would also be a failure.

The vast majority of these errors will be solved with proper coding. A lot of it comes down to timing, which electronics can do very well when designed correctly. Making sure this works will be the hardest part of the project, but we are confident that it will be done.

Ethics and Safety

There are a few safety concerns with making a machine like ours. First of all, it will need to be cleaned periodically, so that bacteria doesn't grow inside. We can do this by running warm, soapy water through the machine to flush out any leftover drink, and clean the tubing too. The dispenser also has moving parts that can create a pinch point. This can be partially combated by shrouding moving parts like servos, but the exterior will still move. However, since it is an autonomous machine, people shouldn't need to be around while it is moving. Warning labels will be applied in case though, so that people are aware of the pinching dangers. We will also have electronics around liquids, so those will be waterproofed as well to prevent short circuits and shock hazards.

We will be following the IEEE code of ethics in all ways possible. We will design our machine to be safe and not cheap, to protect the users from harm when operating the device. We will seek assistance when necessary, and credit all help which we receive. We will hold each

other accountable to this code of conduct, and make sure that all tenants are being followed. The full code of ethics can be found [here](#).

References

[1] *10 restaurant staffing issues and how to address them*. GloriaFood Blog. (2021, November 9). Retrieved February 11, 2022, from https://www.gloriafood.com/restaurant-staffing-issues

"IEEE Code of Ethics." *IEEE*, https://www.ieee.org/about/corporate/governance/p7-8.html.