Automated Bartender Proposal

Team 61

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Project Proposal

Introduction:

Objective

Our project exists as a solution to two problems. At a crowded bar, it is extremely inefficient to order drinks, as many people crowd around the bar waiting and vying for the attention of the bartender. Our automated bartender would solve this problem as we will use an app to order the drink, and the app will notify you when the drink is ready to be picked up. Another concern at bars is the safety of your drink because of sexual assault. To address this, our automated bartender will have a security feature that protects the drink until the correct user is there.

We also have to consider the risks that could be introduced by removing a human bartender. The drinks need to be secure because they no longer have somebody watching them at all times from the initial pour to when it gets to the customer. Having a physical barrier to secure the drink until the correct person is identified is essential for our project to be used in the real world.

Background

The first problem we mentioned is one we have all personally experienced. For example, the other weekend, I had friends visiting. One bar we went to was so crowded that we simply had to leave because we couldn't even talk to a bartender within a reasonable time frame. If we were able to simply order on an app, know for sure that our drinks were coming, and be notified when they were ready, we probably would have stayed. This would allow popular bars to retain more business.

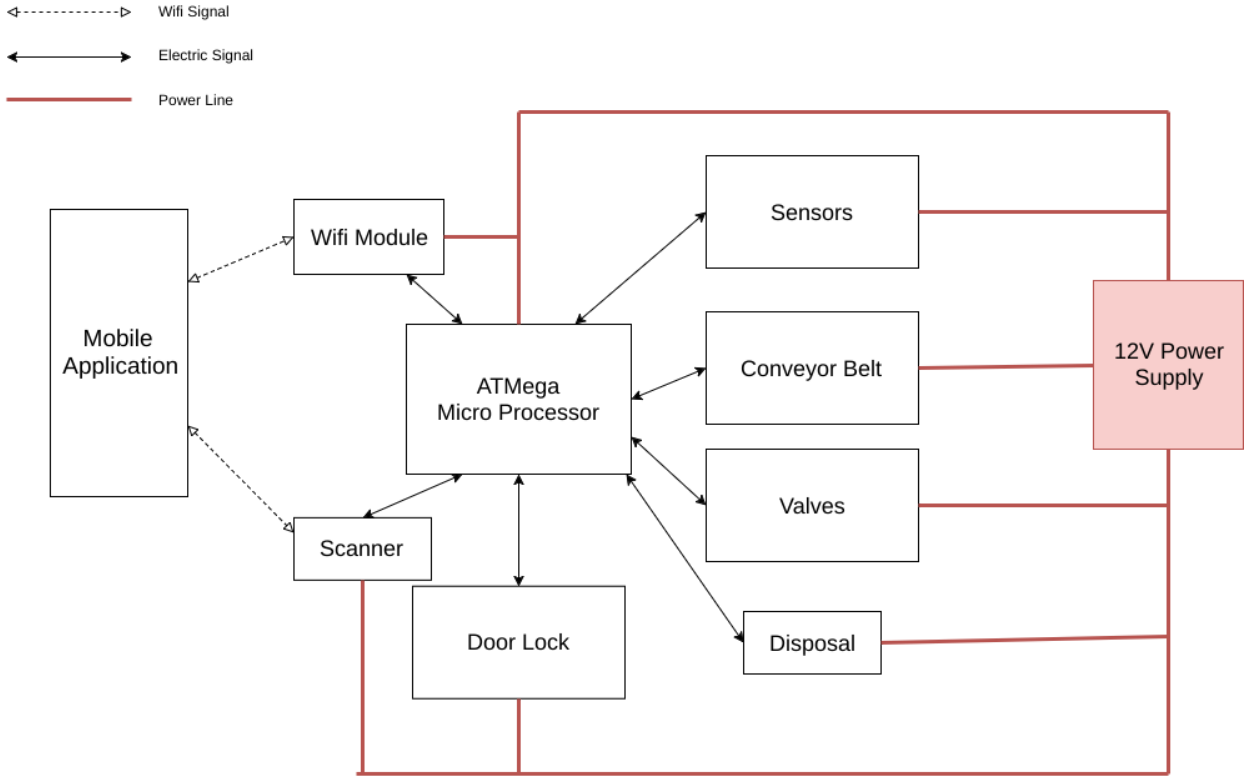
Context

The concept of an automated bartender has been approached in the market before, but it was always simply to improve the convenience of the bar experience, rather than to tackle a social issue. Our implementation focuses directly on mitigating that issue by limiting the exposure of the drink in its preparation stages.

High Level Requirements

- The beverages will be precise in accuracy to the specified proportions by volume to within ±10%
- The time required to prepare a drink, from the moment it is ordered to the moment it is ready to be claimed, will be under 15 seconds.
- The time to process the authentication (when the QR code is scanned to when the door is opened) will be under 3 seconds.

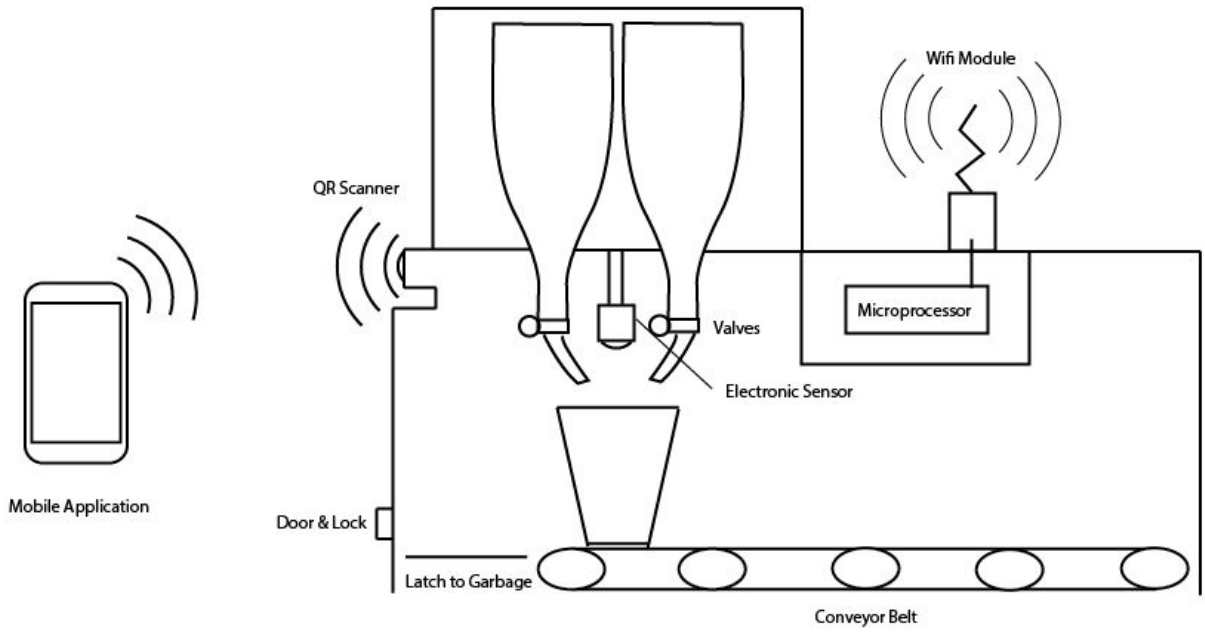
Design:



Summary

The main procedure that occurs to produce a single beverage is a user makes a request from a mobile application. The Wifi module receives the request and forwards the details to the the microprocessor, which will be a variant of the Arduino processors (Atmega). On a high level, the microprocessor controls the mechanical system which takes a cup as input, moves it on a conveyor belt to the necessary location to be filled, opens the valves in the proper proportion to dispense the liquids, and then sends a response to the mobile application to signify the completion of the request. The response contains a unique code which will allow the user to authenticate themselves. The scanner begins sampling for a particular QR code for a given amount of time, and when the user approaches and scans their code, the latch opens until the door is opened and the beverage is taken. All modules are powered from a power supply, and are centrally operated by the microprocessor.

Physical Design:



Modules:

- Microprocessor
    - This module will have access to the internet and be listening on a port on the wifi for a signal from the mobile application. It will also consist of an Atmega processor chip which will be the control for our machine. It will connect to different components, motors, and valves that will control the operations of the machine.
    - *Requirements*:
        - This module must be powered.
        - The processor must have data connections to the Scanner, Door Lock, Valves, and Conveyor Belt modules in order to send control signals to them.
        - The processor must have data connections to the Sensors module in order to determine the position of the cup.
- Mobile Application
    - The mobile app will be a simple interface which will allow the user to order a drink. It will then send this signal over wifi to our server for processing. After the drink is completed, the phone will receive a QR code displayed to the screen which will need to be scanned at the drink machine for authentication. This app will just run on an Android phone and must be able to access to the internet.
    - *Requirements*:

        - This app will run on an Android phone which is connected to the internet
        - This app must be able to send two bytes of data (proportion of two beverages)
        - This app must be able to receive a uniquely generated QR code from the microprocessor
- Scanner
    - The scanner will scan for QR codes and send them to the server.
    - *Requirements*:
        - The Scanner module must have the ability to scan QR codes presented on a phone screen with full brightness
        - The Scanner module must be able to communicate signals to our microprocessor for comparison.
        - The Scanner module must run from a 12V power supply
- Door
    - The door and locking mechanism will work together to prevent access to the beverage until it is ready, and the user has authenticated him or herself.
    - *Requirements*:
        - This door will have to be secure and not easily penetrable. If it is penetrated, it should be easily detectable that it was tampered with.
        - The door module must be electrically controlled so that the microcontroller is able to lock and unlock it with an electronic signal.
        - This module has to be large enough so that when the door is opened, it is convenient to remove the drink.
- Conveyor belt
    - The microprocessor will utilize a belt to transport the cup to certain locations (below the drink to be poured, in front of the shield to be picked up by the customer)
    - *Requirements*:
        - The conveyor belt has to be able to be controlled by a single motor, which the microprocessor will turn on and off. The motor will provide rotational motion to the belt, a surface that can act as a belt, and other small axis-type things for the belt to go across.
        - The belt should be able to move the cup forward and backward at a speed of 1.5 mph.
- Valves
    - The drink pourer needs to be able to receive signals and pour drinks based on what it receives. It will combine two different drinks according to the specified proportion.
    - *Requirements*:
        - The Valves module should be able to control the rate of pouring of the two different drinks individually.
        - We should be able to pour at a rate of at least 1 ounce per second using open 2L bottles flipped vertically, with the bottoms removed

- Disposal Mechanism
    - This module will allow for disposal of unclaimed beverages. If the user either (1) fails to authenticate within a certain period of time, or (2) they authenticate and the door opens but nobody claims the beverage in time, the beverage will be automatically dumped out.
    - *Requirements*:
        - This module needs to communicate with the microprocessor to respond to a timer, and dispose of the beverage when the timer expires.
        - The module must be able to dispose of a cup cleanly so that it is reuseable.
- Power Supply
    - The power supply will come from a 12V battery for this iteration of the project
    - *Requirements*:
        - The power supply must be able to provide current to all the modules which require power. These include the microprocessor, the wifi module, the scanner, the sensors, the conveyor belt, the valves, and the lock.
        - The power system must be insulated to prevent short-circuits that may occur on contact with spilled liquids.

Risk Analysis:

The component that poses the largest risk for us is the microprocessor. It will function as the central control logic of the project and any bugs will cause significant malfunctions. If we fail to program it with executable code, we will be unable to control any of the modules, or receive any requests. As a result, all that will remain of our project is a PCB which serves no purpose. We are able to abstract away the processor by testing with an Arduino, which is straightforward to program. However, in the final version, we would like to have our own PCB with the ATMega processor.

Commercial Final Version:

We have several additional ideas in mind for this project which we may not be able to achieve on the first revision:

1. We would hope to set up an intranet and a server so that the client must be on the same WiFi network as the device in order to make an order, preventing them from ordering far away.
2. We would have the various drinks lined up individually, and the cup would spend a given amount of time under each one to allow more variety in drinks.
3. We would also like to add another belt to separate the cups arriving from our abstracted dishwasher mechanism.
4. Pressurized pouring mechanism to speed up rate at which drinks are made. We would also like to be able to contain carbonated beverages.

5. We would have multiple machines in a distributed network so that users could order and either the first one available would prepare the drink, or the machine of their choice.
6. The disposal system would be better. We plan on making sure that the cup disposes of the liquid and is sent back to the bars dishwasher. We would do this by implementing another conveyor belt to bring it back to the dishwasher.

Ethical Analysis:

The ethical aspect of this project is what makes it stand out among the others. Our product is designed to make the world a safer place by removing the opportunity for malicious bartenders or patrons to inject someone's drink with a potentially harmful substance. By automating the drink preparation process and ensuring that only the person who ordered the drink is coming in contact with it, we successfully eliminate any uninvited interactions between the drink and a stranger.

The first rule stated on the IEEE Code of Ethics describes an individual's responsibility to the welfare of the public in all circumstances. In our scenario, we have observed a dangerous process that occurs frequently, and thus it is our responsibility to do everything in our power to rectify it. We can thus improve the safety of bars, which are so often known to be dangerous places.

In the actual implementation and physical design of our automated bartender, we will be extremely diligent to produce no harm. We will accomplish this by observing all the necessary security precautions to ensure that tampering with our device is difficult, if not impossible. These precautions include establishing a secure connection with the client, and preventing our messages from being tampered with or falsified. As for the machine itself, we will be using relatively little power, so there is no electrical danger, and though fluids may be splashed, all of our hardware will be protected and insulated.

Ultimately, our main objective is to design a machine which will allow partygoers to have a good time and ensure their safety, while saving the bar itself money in the long run. We realize that this will not stop all sexual assaults from occurring, as tragically there are countless more situations in which these incidents occur, but we hope to make a dent in what seems, at first glance, to be a daunting problem.