The Automatic Bartender

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1. Introduction

Upon considering possibilities for a senior design project, it was decided that a rewarding project would be both fun and have an application to our everyday lives. As college seniors we are frequent patrons to the South Bend bars and have committed our senior design project to improving that experience. Faced with the inconveniences of slow service, high competition for drinks, and minimum bar tab balances, our team has set out on a mission to streamline the bar going experience.

2. Problem Description

The efficiency of most drinking establishments today is less than spectacular. Patrons can spend the majority of their night waiting to be noticed by a bartender. Once noticed, the transaction between patron and server can last for several crucial minutes that could be spent on serving other customers.

In order for a transaction to be completed, a patron must first be recognized as the next waiting customer by the bartender. The patron then explains his or her order to the server who then proceeds to make the specified drink. After the drink is served to the customer, the bartender tells him or her the price of the order and the customer in turn pays the bartender by the preferred method of payment. Regardless of payment choice, the payment transaction is very time consuming. Bartenders must enter the order into a touch-screen, swipe a card or open the register, print a receipt and have the patron sign the receipt.

The entire process of ordering a drink at a bar can be both time consuming and a frustrating experience for the server and customer. If a bar was able to serve drinks more frequently then it would increase its revenue. Another problem with the current system is that patrons tend to be served out of order which in turn decreases customer satisfaction.

3. Proposed Solution

The proposed solution for a more efficient drink ordering and payment system at a bar is to have an automatic beverage pouring machine complete payment interface. In other words the machine would act as an automated bartender. The proposed machine would delay payments on tabs, completing the transaction upon closing of the bar. This will make it so that customers do not have to leave their card at the bar, but instead will be able to swipe their card at the machine when an order is placed. This will be done via a card swipe or card scanner integrated to interact with the automated bar tender. Upon placement of an order, the machine will dispense the desired beverage for the customer. The machine will first drop and move cups of the desired size under the correct beverage dispenser then will pour the customer selected beverage into the cup. However, if the drink is something other than a beer that must be prepared by a bartender, the order will be digitally sent to a display behind the bar where the

bartender may view the list of drinks to be made. The customer will be issued a ticket by machine, so that they can retrieve their drink when it is ready. A high level view of the proposed solution can be seen in Figure 1 below.

Figure 1. High Level View of Automated Bartender

4. Demonstrated Features

The features of the automatic bar tender include a touch-screen user interface, an automatic machine to dispense drinks, and a system allowing for communication between the machine on which the order is taken and the bartender.

Computer Interface:

The first feature is a computer interface to be implemented on a touch-screen. This will enable the implementation of a digital drink order. The user will communicate with the automatic bar tender system through this interface. It will have the following features:

- Enable the user to swipe his/her credit card and open a tab
- Keep track of user's running tab in digital database
- Allow user to select desired beverage
- Permit closing of tab/ force close at specified time of night
- Complete card transaction upon closing of tab

Automatic Drink Dispenser:

After a drink has been ordered, this feature will allow for drinks that do not need to be made by a bartender to be instantly available.

- Drops cup onto conveyor belt and moves under appropriate tap
- Microcontroller will signal tap to open
- The flow sensor should determine when cup has been filled, and tap will close

Communication Between User Interface and Bartender:

This feature will make a drink order that has been placed and needs to be made by a bartender viewable on a display behind the bar.

- Wirelessly communicate order over internet application
- Must be capable of instantly transmitting correct order from user interface to bartender display
- Should be able to estimate expected wait time for drink and issue claim ticket for appropriate drink

5. Available Technologies

Much of the technology needed to implement each individual component in the overall system is already in use in many drinking establishments.

A graphical user interface is needed for the patron to select their order and complete their payment transaction. Touch-screens are already used as an integral part of conducting business within bars. They enable the bartender to select the type of drink that has been ordered, and also enable completion of a transaction. The key to our project will be allowing the patron to directly interact with the system in place, selecting the desired drink without needing to order from a bartender.

The automated bartender system will require a credit card scanner and/or a means to accept cash payments that will need to be integrated with the graphical user interface. Because of monetary constraints, it is likely that the final product will be exclusive toward accepting credit cards because of the high price of cash machines. The cheapest cash machine found is the ICT V6 Bill Acceptor for $225[1]. Credit card scanners are much more affordable. The Logic Control's MR2000 Magnetic Strip Reader sells for around $50. It also has the ability to interface with the USB, PS/2 and RS232 protocols and is easily programmable[2]. Many scanners are sold at this price and have the ability to scan credit card numbers.

The most expensive aspect of our project is the desired touch-screen on which orders are to be placed. A starting price for this technology is about $350.00, but this price quickly rises with increasing quality. If the price of the screen exceeds the budget, it is possible to use a computer monitor in place of the touch-screen. It is possible to obtain a new ASUS VH198T 19": wide screen LCD display for $113.[3]

This system necessitates the development of much software. Transaction data needs to be stored in a database and then processed upon completion of the order. All bars that allow customers to open tabs possess the ability to link a customer's order with their credit card information. We will need to grant our system access to updating the tab within this software. The interaction between the user interface

[1] http://www.vendorsequipment.com
[2] http://www.racoindustries.com
[3] http://www.powermax.com

and the display located behind the bar will also require the development of software. This will be run through an online server which will automatically send 'message' or orders to a display located behind the bar. The order screen and bartender display should be able to run on typical computers that are running Windows and are connected to the internet.

The mechanical system to control flow will be created to connect to a keg of liquid. In order to keep a constant pressure in the keg, a gas tank with a constant pressure valve will be needed. Pre-made "kegerator" rigging[4] can be bought for about $100 and would be the cheapest way to purchase spigot, tubing, keg adapter, pressure valve, and gas tank. A flow sensor would be needed to gauge the amount of liquid dispensed, however, with constant pressure, beer amounts could also be calculated as a function of flow time. The flow sensor or timing circuit would indicate to a controller when to start and stop flow which could be actuated through a electromagnetic normally closed solenoid valve. A relay and voltage source may be needed to supply an adequate voltage to the solenoid, and further research will indicate such need.

The controller mentioned above could just be a standard microcontroller with digital outputs. The microcontroller would also be used to control a set of small motors and conveyors if the dispensing action is implemented. A small motor could control a basic mechanical function of dropping a cup onto a conveyor belt which would position the empty glass under the spout in order to be filled, and on completion of pouring will be signaled by the microcontroller to push glass to serving area. The small digital outputs from the microcontroller will most likely need to actuate relays connected to a larger voltage source to run the motors, conveyors, and solenoid. Further research, will be needed to determine size and current requirements for the motors which will most likely be quite small.

6. Engineering Content

There are several main blocks that are part of the automatic bartender system. Proper integration of these blocks must be accomplished in order for the automatic bartender system to function properly.

The user interface needs to be developed in such a way to allow the patron to enter in his or her order. This will involve creating a GUI either on a touch-screen or regular monitor with keyboard and mouse. The GUI will prompt the customer to choose among the available options and then proceed to the payment section. The customer will swipe his or her credit card to complete the payment transaction. This functional block involves a heavy amount of software development. The accompanying software must be able to securely read credit card numbers, process financial transactions, communicate orders to other monitors and machines, and store various transaction data. Most of the testing for this part of the system will be done in software. It will be possible to debug the user interface in the Integrated Development Environment (IDE) that will be used to develop the software. Once the GUI is created further testing will be completed by "end users" who will simulate ordering a drink at the bar and

[4] http://www.beveragefactory.com

completing a payment transaction. The data storage component will be tested via analyzing that the correct data is being stored in the appropriate places securely.

The second functional block is the bartender's machine. This machine must be able to store all necessary transaction data such as credit card numbers, and time of sale. The machine's primary purpose is to display the drink order queue. As the bartender serves drinks, he or she will check off that the drink has been served. When the bar is closing at the end of the shift, this machine must also process all of the transactions such as closing out credit cards, followed by saving the appropriate data. Testing of this block of the system is similar to the ordering machine. The GUI and the data storage can be tested via software and a simulated "end user".

The interface between the ordering machine and the bartender's machine is necessary for the functional blocks to be integrated into the system. This interface may be implemented via through the internet or it may be tied into a main processing unit. The bartender must be able to see which orders are in the queue as well as a "call for help" from a customer who is having trouble ordering. This interface must also filter out the unnecessary information that the bartender does not need to see at the point of sale such as credit card information. This interface may be tested by the IDE that is used to develop the software. Once completed the interface will be tested by ensuring the correct data is being transmitted between the correct places. Software debugging will rely heavily on simulating the use of the system in its intended environment.

The third functional block will be the dispenser machine and flow control mechanism. This part of the system will involve intense mechanical design. The keg pressure system will come pre-made so will not require design. However control of the system will need to be implemented. The hand spigot will need to be replaced by a solenoid valve which will be actuated by a digital output from the microcontroller. The amount of time needed to fill a drink will need to be tested under the desired pressure. If pour time is constant, a timed pouring algorithm will be programmed into the microcontroller, and may be easily changed for different sizes of beverages. Otherwise, a flow sensor will be needed in the flow path to send signal to the microcontroller which will then control the solenoid. The flow sensor will most likely produce an analog signal, which will need to be converted into a usable digital output to be received by the microcontroller.

The cup dispenser will be comprised of a cup dropper and a cup revolver or conveyor. Essentially a motor will be needed to actuate a mechanism to drop one plastic cup by holding rest of a vertical stack up while pushing the bottom cup down. This will be positioned over a motor controlled revolver or conveyor which will be ordered by microcontroller to move the cup into a desired position. This will require a state machine to be programmed into the controller to dictate the next movement of the cup. A sensor will be needed to determine when beer has been taken, or it will need to be mechanically designed to move beer away from the device. This system will complete the beverage delivery process.

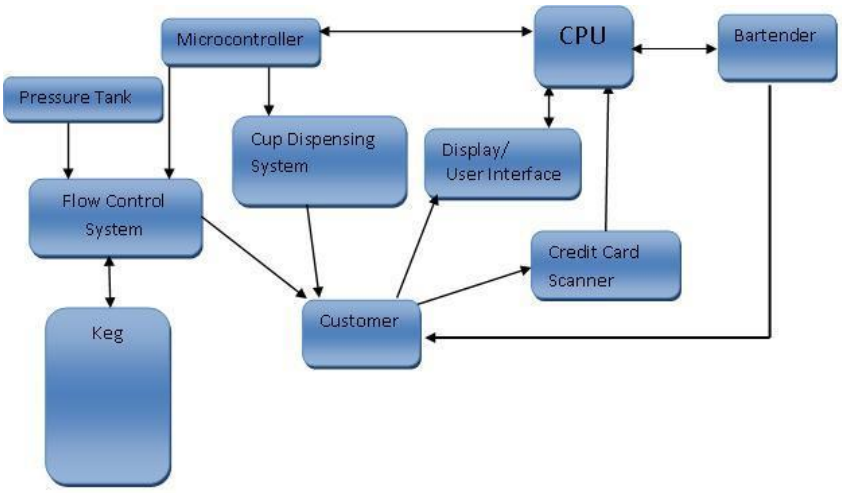

Figure 2. Flow Chart of Overall System

7 Conclusions

A frequently encountered, irritating experience faced by many college students is the inevitably long lines found at almost every bar. These lines cause unnecessary frustration for the bar goers, and additionally decreases the number of sales obtainable by the bar on a given night. Our proposed solution will speed up the entire bar tending process by eliminating transactions at the bar. Furthermore, it will restructure the way in which drinks are ordered by making the process of obtaining a drink entirely automated. It will enable the rapid delivery of drinks and will also reduce the workload of the bartenders, allowing them to focus solely on drinks that need to be mixed.

It is expected that this project will pose many challenges. Although much of the software needed to store customer information regarding payment and tracking orders is already implemented, this software must be integrated with new hardware and software components. Additionally, a user friendly GUI must be developed. The end goal is an improvement in customer satisfaction along with increased revenue for the bar.