## **Purdue ECE Senior Design Semester Report**

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| **Course Number and Title** | ECE 477 *Digital Systems Senior Design Project* |
| **Semester / Year** | Spring 2017 |
| **Advisors** | Prof. Thottethodi, George Hadley |
| **Team Number** | 8 |
| **Project Title** | Barbot |

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| Senior Design Students – Team Composition | | | |
| **Name** | **Major** | **Area(s) of Expertise Utilized in Project** | **Expected Graduation Date** |
| Yudu Wu | Comp E | Software, PCB | May 2017 |
| Junjie Wang | Comp E | Software, PCB | May 2017 |
| Mengshi Feng | Comp E | Software, PCB | May 2017 |
| Siyi Cai | Comp E | Software | May 2017 |

**Project Description:** Provide a brief (2-3 page) technical description of the design project, as outlined below:

1. Summary of the project, including customer, purpose, specifications, and a summary of the approach.

Barbot is an automatic bartender. Itis targeted at people who want to enjoy cocktails at home without the help of bartender.

This machines is built to mix between 8 alcohol or drinks. User can order the drinks via a drink menu in a mobile application that communicates with Barbot through Bluetooth module. In the drink menu, there are two sections, one section is for drinks with default recipes, and the other section allows user to customize their own drinks. An automatic slider will carry the cup move along the metal rod to the target position and the target drink will be poured down into the cup. After dispensing all the drink needed, the cocktail will be ready for users.  In addition, the information about the status of machine (what kind of drink it is making and whether it is finished) will be displayed on a LCD screen on the device.

1. Description of how the project built upon the knowledge and skills acquired in earlier ECE coursework.

This project utilizes the skills learnt from ECE 362 Microprocessor System and Interface. This includes programming the available on-chip peripherals of selected microprocessor. In addition, the project required interfacing the microprocessor with external modules, such as Bluetooth module. In programming the device, the team used C language, which was learnt at ECE 264 Advanced C language.

1. Description of what new technical knowledge and skills, if any, were acquired in doing the project.

During the process of project, we learnt a lot of new skills and knowledge. First, design and layout of Printed Circuit Board(PCB) was a new skill for most of us. Soldering skill had a great improvement after experiencing soldering different electronic parts, such as microprocessor, ICs, and capacitors, etc. The team also gained technical knowledge about the communication protocol between microprocessor and Bluetooth module. The team had a great understanding of the usage of different ICs, such as the drivers for linear actuator and the stepper motor. In the software aspect, building an Android module application was a new experience for most of us.

1. Description of how the engineering design process was incorporated into the project. Reference must be made to the following fundamental steps of the design process: establishment of objectives and criteria, analysis, synthesis, construction, testing, and evaluation.

## In the stage of establishment of objectives, the team set up the problem needed to solved in this project, and analyzed the problem to figure out the final criteria and requirement of the project. During the process of analysis, the team analyzes the project in both hardware aspects and software aspects. The analysis composes of choosing the appropriate microcontroller, and decision on the function and property of external module required. At synthesis stage and construction, all software was almost ready for final test in corporate with hardware, and all modules were tested for ensuring the functionality. The package of Barbot was also almost finished and waiting for final test. The team needs to working on packaging. All the module will be tested individually during the test stage. At final evaluation, based on the performance of Barbot, optimization will be made and test again to ensure the functionality.

1. Summary of how realistic design constraints were incorporated into the project (consideration of most of the following is required: economic, environmental, ethical, health & safety, social, political, sustainability, and manufacturability constraints).

## **Economic:** Based on the consideration of low cost, Barbot choose cheap and reliable parts, which increases the affordability of the products among the consumers.

## **Environmental:** The device was designed to lower the environmental impact, Barbot mainly use material that could be recycled in the future as the main resource to build the frame and parts.

## **Ethical:** It’s because Barbot is a cocktail machine, so the target users for Barbot will be adults over 21 years old. For users at home, they need to pay close attention to their children to avoid them accidentally drink the liquor or run into the Barbot.

## **Health & Safety:** The design process took into consideration of water proof by building a water proof case to cover the control module of the Barbot, because the circuit will catch on fire easily if liquid leak on it. The waterproof case greatly deduct the safety threat from this problem.

## **Social:** Barbot provides alcohol to users. Drinking too much alcohol will affect people’s social life. people’s performance at work of will be affected after drinking. Also, the violence rate between family members will increase because of addiction in alcohol. Users need to control the alcohol consumption everyday.

## **Sustainability:** All the parts of Barbot has a long enough life cycle, and especially all the electronic parts under proper utilizing will maintain a lift cycle for almost 50 years. The Barbot could be used for more than 10 years at least.

## **Manufacturability:** Assume that all the electronic parts could be soldered on PCB in an automatic process. The rest work will be building the frame, which is with a simple structure and won’t take a long man-hour. Building the automatic slider is the main part during the production of Barbot. Automatic slider may take worker some time on building, but with a pipeline production, this process won’t take too much man-hour. At the same time, the liquor dispenser could be ordered directly from the factory. All the rest will be assembly all the part together. Barbot with a simple structure is also easy to repair or replace parts.

1. Description of the multidisciplinary nature of the project.

## This project mainly requires the skills set from computer engineering, electrical engineering, and mechanical engineering. For computer engineering skill, the team required to program a microcontroller to output signal for ICs, and make sure it can work with external module, such as Bluetooth module. This programming requires the skills of coding in C language. For electrical engineering, all the electronic parts are needed to be layout and connected to build a circuit that could drive the whole system. Electrical engineering knowledge was necessitated to finish design the circuit and interface external modules to microprocessor. Last, building the automatic slider needs the knowledge from mechanical engineering. The slider composed of stepper motor, metal rod, time belt, and gear. All the knowledge of the usage of parts was required to successfully build an automatic slider.

1. Description of project deliverables and their final status.

The final prototype performs all the required functionality. Barbot can receive order from Android mobile application, and Barbot can process the order right away after receiving the order. The LCD displays the drink status during the process. Barbot controls the position of the platform and dispenses target drink with required amount. Finally, after the drink is ready, the platform returns to the stat point of automatic slider, and sends information back to the Android mobile application to tell user the drink is ready.