A Coaster type Sensing Device for Supporting Safe Limits of Alcohol Consumption

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Abstract
For safe limits of alcohol consumption, it is important not to over drink to the point of not being of sound mind and body. In this study, we developed a coaster type device that can detect amounts of drinking. By displaying information of users’ on the coaster, they can know whether they have been drinking excessively or not. Moreover, they can also use it for managing their health by connecting the coaster to a PC or a portable smart device and analyzing his own drinking information on those devices.

1. Introduction
It is very common for people to drink alcohol in the quest of releasing from everyday stress and oppression. However, if they drink over their limit, they may impair their own health. In addition, they may cause discomfort to other people who are drinking happily in the same place. Moreover, they risk causing a traffic accident by driving after they drinking [1]. Therefore, various devices that can detect alcohol consumption by using alcohol-sensing devices have been developed in recent years [2]. By using these devices, people are able to know how much they have been drinking. However, since conventional devices had complicated measurement methods, people had to stop drinking to measure. This rendering, conventional devices unsuitable for detecting alcohol consumption.

For this reason, in this study, we developed a coaster type device that can sense alcohol consumption. The device mimics a coaster, and displays the user’s amount of drinking in real time by using full-color LED. Therefore, by using the coaster, the user can detect the amount of drinking without regard to measuring. In addition, by recording temporal changes in the amount of drinking, we will be able to measure individual differences.

2. Elements of the System
(1). MCU (PIC16F88)
PIC16F88 is a very power-saving MCU made by Microchip Technology Inc., and it is suitable for embedded use.

In our device, MCU is embedded in the top plate of the coaster as shown in Figure 1. By connecting MCU to load Cell, full color LEDs, and a Bluetooth module, it can run acquisition of measured values, control of the LEDs and control of the Bluetooth module.

(2). Load Cell
To measure the amount of drinking, we use a load cell which is used in common electronic scale. A load cell is a transducer which is used to convert a force into an electrical signal by embedded strain gauge. By using this, the coaster will be able to measure weight; however the signal obtained from the strain gauge is very weak. Therefore, we performed an amplification of the signal by using an instrumentation amplifier circuit (IAC).
(3). Full-color LEDs (LATBT66B)
We use full-color LEDs to display the amount of drinking. For example, when the amount of drinking is increased, the color of LED turns from blue to red. By such a turn in color, the users can visually know how much they have been drinking. In addition, people who are in the same place with the users can also know the status of the users’ drinking.

(4). Bluetooth Module (SBT1-T-S)
We adopt Bluetooth to external communication because of the convenience of connection. By using Bluetooth, this device will be able to easily communicate with PCs and mobile devices. In addition, the Bluetooth module that we use in this study can be controlled by using two signal lines connected by UART communication; therefore it is easy to embed on the circuit.

3. Measuring Method and Calibration
3.1 Measuring Method
To detect the amount of drinking, it is necessary to measure the weight of the drink. First, a user sets a glass on the coaster and pours a drink into it. Then, the device sets a point when the user pours the drink into the glass to an original point. Next, the device records differences in weight as user’s drink. The drink in the glass decreases from the original point gradually, and it will eventually become empty. However, accompanied by cultural manners, people sometimes pour more alcohol into an unfinished glass. Accordingly, the device monitors the amount of weight change as drinking occurs.

3.2 Calibration
Analog signal obtained from the load cell is a measured value recorded by 10-bit digital signal by MCU. Accordingly, we convert the measured value to a unit of mass (ml) by using the electronic scale. However, the measured value is drifted by changing the temperature of the load cell. Therefore, we proposed the processing to correct for drift in the measurement algorithm.

4. Measurement Experiment
We performed a simple experiment to measure the amount of drinking by using the device. In the experiment, we measured the amount of drinking, correction value of drift, the weight of the entire glass, and the number of times the glass was picked up. The results are as shown in the graph in Figure 2. We see from the graph that the amount of drinking is increasing in connection with acquiring the difference of the weight of the glass. Therefore, we can measure the speed of drinking hourly, and the amount drunk per each time. Figure 3 shows the device and an Android application that displays user’s drinking information by connecting the device.

5. Conclusion
We developed a coaster type device that can measure amounts of drinking. Thereby, users can record their individual amount of drinking and how to drink. In the future, we would like to make research about the relationship between drinking styles of the weak and strong and the process of becoming drunk. We would also like to confirm whether this coaster is useful for prevention of excessive drinking.

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References