E-Green Jukebox: The Development of an Electronic Jukebox That Accept Aluminium Can as Token

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Abstract. Jukebox has been part of the outside dining experience in the western family restaurant in the year 1940s to 1990s. The progression of technology in entertainment industry makes the jukebox become obsolete due to the relatively expensive price to play a song from the jukebox. At the same time, most of the shopping mall food court in Malaysia required the customers to self-service and self-clean after dinning. One of the problem encountered is the customers do not usually separate the waste when throwing the waste. This project aims to revitalize the jukebox by reintroducing the song machine with a slight twist, the token used is aluminium can. This is to encourage the customers who purchase can drink in the shopping mall food court to recycle the aluminium can and in the same time to enjoy the retro feeling of dining experience with song played by jukebox. This paper presented the development of this jukebox called Green Jukebox. The result shows the potential of the prototype for the real application.

1. Introduction

Jukebox, or originally known as nickelodeon, is a device that accepts token from the user to play the song selected by the user. Jukebox is commonly found in the western family restaurant especially in North America in 1940s to 1970s. The trend also catching up in Malaysia in the early 1980s to the late 1990s. The jukebox can commonly found in the western-themed restaurant in Malaysia such as Kentucky Fried Chicken chains, and Mc Donald chains. As the technology progresses, the cost of accessing a music song is relatively cheap compared to the golden ages of jukebox, this makes the jukebox become obsolete. By early 2000s, jukebox no longer can be seen in the market due to the relatively expensive price to play a song from the jukebox.

Nowadays, most of food court in the shopping mall in Malaysia required the customers to self-service and self-clean after dinning. One of the noticeable problem surfaced is the customers do not usually separate the waste when throwing the waste. Thus, this project attempts to address this issue at the same
time repurposing the jukebox. This is done by reintroducing the song machine with a slight twist where the aluminum can is used, instead of the typical coin. The project aims to create a prototype encourage the customers who purchase can drink in the shopping mall food court to recycle the aluminum can and in the same time to enjoy the retro feeling of dining experience with song played by jukebox. This project is not something outside the box as there are several recycle machines that had been introduced in the market. Based on literature survey done, there are four prominent recycle machines that reward user when recycling the recyclable items. These recycle machine are called reverse vending solutions. The first reverse vending machine is called Tomra T-53 Plastic and Can Recycling Machine which refund the money to user when the user insert related plastic or aluminum can [1]. The reverse vending machine fundamentally used the infrared (IR) technology which customize to the product. Tomra patented this technology and named the technology as Tomra Sure Return [1]. Instead limiting itself refunding coin for the recycled items [2], the second reverse vending machine offers several options: 1) food voucher; 2) bus ticket; 3) 10 cent donation to charity group [3]. The second reverse vending machines were installed in Sydney, Australia. Third reverse vending machine produced by Pugedon [4] where each recycled items and the machine will dispense food for the street cats and dogs. Another reverse vending machine is offers a reward points through RFID card instead of coins given [5].

The remaining of this project will explain the methodology of the project, the result and discussion of the project, and conclusion of this project.

2. Methodology

Figure 1 is the block diagram of the proposed prototype which consists of three main parts: 1) inputs; 2) outputs; 3) controller. The controller used in this project is Arduino Mega which have more input and output pins accessible for the programmer to use. Arduino microcontroller is known to be programmer friendly and cost effective where the success of the use of Arduino-based microcontroller can be seen in several applications: educational kit [6][7][8], electronic game board [9][10], can crusher [11][12], etc. There are two inputs of the proposed prototype which are push button, and inductive proximity sensor. Four outputs used in this proposed prototype which are light emitted diode (LED), servo motor, liquid crystal display (LCD), and speaker. The LCD used in this project is 20X4 LCD which has 20 columns and 4 rows of characters. A 100 Watt stereo speakers with external power source are used to play the music chosen by the user. These speakers are connected to the music player 3 (MP3) shield produced by Cytron called C-Sheild-EZMP3. This shield receives instructions from Arduino Mega and select relevant music file stored inside the Micro SD card and translate the file to relevant acoustic voice that to be transmitted via speakers. Several push buttons employed in the product prototype with the purpose to detect user action in navigating and selecting the menu and song. The servo motor is used as a mechanical actuator that move the recycled items into the recycle container. The function of the inductive proximity sensor is to detect whether the recycled items either a metal or a non-metal. Lastly, the LED is used as indicator for the user to inform the user whether the jukebox is ready to accept new recycled item.

![Figure 1. Block Diagram of the proposed prototype](image-url)
In figure 2 shows the schematic diagram of the proposed prototype using Proteus software. Notice that there are several differences between the schematic diagram and actual implementation as there are several components not available in the Proteus software. A simple buzzer is replacing the speaker and the MP3 shield. Instead using the 20X4 LCD with I2C, the LCD used here is 16X2 without I2C module. A pushbutton also being used to replace the IR proximity sensor. The remaining circuitry remained the same. This schematic is essential in order to simulate the prototype before developing the hardware version of it.

Figure 3 shows the actual image of the construction of the proposed prototype. The LCD and the push buttons being display on the top of the jukebox. The area for the user to place the aluminum are also located at the top of the jukebox. The containers are place at the bottom of the jukebox where the left container is for the non-aluminum and the right container is for the aluminum.

Figure 4 shows the flowchart of the proposed prototype. After the prototype being turned ON, the LCD will display the welcome menu, the EZ-MP3 shield will play a voice that read out the menu displayed at the LCD and require the user to press push button A. User is expected to insert the recycled item and pressed button A. Once the Arduino able to detect the user pressed push button A, the IR proximity sensor will detect the item recycled in the container. If the item is empty or non-aluminum item inserted, Arduino will prompt the LCD to notify the user that item is a non-aluminum item and EZ-MP3 shield will play a voice that read out the notification. After five second delay, the servo motor will be activated to rotate to the left or -90º which displace the item into non-aluminum container. Then, Arduino will prompt the LCD to display the main menu the EZ-MP3 shield will play a voice that read out the notification. On the other hand, if the IR proximity sensor detects an aluminum-based item, Arduino will prompt the LCD to notify the user that item is an aluminum item and EZ-MP3 shield will play a voice that read out the notification. Then, the servo motor will be activated to rotate to the right or +90º which displace the item into aluminum container. Soon after that the user is requested to choose song to be played by pressing push button 1 to go the next song, and push button 2 to return to previous song. The LCD will update the corresponding song to the action by the user and the EZ-MP3 shield will read out the song and the artiste name. Once
the user, pressed button A again, Arduino will prompt the EZ-MP3 shield to play the song at a greater volume that can be heard in the targeted area. Once the song is finished, Arduino will prompt the LCD to display the main menu the EZ-MP3 shield will play a voice that read out the menu displayed at the LCD and require the user to press push button A.

![Figure 3. Construction of the Proposed Prototype](image)

![Figure 4. Flow Chart of the Proposed Prototype](image)
### 3. Result and Discussion

Table 1 shows the scenario tested in order to verify the functionality of the proposed prototype. All possible scenario is tested which consists of 16 steps which are listed in Table 1. The result shows that the actual outcome is similar to the expected outcome. This shows that the proposed prototype function according to the requirement.

**Table 1. Result of the testing of all scenario for the proposed prototype**

| Step | Description                                                                                                                                                                                                 | Image |
|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| 1    | At the beginning, the LCD will display “GREEN JUKEBOX Hi Let’s Recycle Push A start recycle” and follow with the sound of the Green Jukebox speaking based on the text appear on the LCD. | ![Image](image1.jpg) |
| 2    | If the user place a plastic bottle (non-metal) in the platform.                                                                                                                                               | ![Image](image2.jpg) |
| 3    | Button A is pushed to activate the proximity sensor. The sensor will recognize the item thrown based on the magnetic field concept.                                                                    | ![Image](image3.jpg) |
| 4    | When the non-metal item detected, the servo will send the item to the left compartment of the Green Jukebox. Followed by the sound of the E-Green Jukebox speaking based on the text shown on the LCD.                     | ![Image](image4.jpg) |
|   | The program will return to main menu. Step 1 is repeated. |
|---|---|
| 6 | Now, the aluminum can is placed in the platform. |
| 7 | Button A is pushed to activate the proximity sensor. The sensor will recognize the item thrown based on the magnetic field concept. |
| 8 | The sensor will detect the metal based on monitoring the reading of proximity sensor. The servo motor will turn to right and the aluminum can will fall to metal compartment. Followed by the sound of the E-Green Jukebox speaking based on the text shown on LCD. |
|   |   |   |
|---|---|---|
|9  | Then, button B is pressed to proceed | ![Button B pressed](image1.png) |
|10 | LCD will display the first song title and artist name. | ![LCD display](image2.png) |
|11 | If the user want to change the song, the user will press button 2 to view the next song in the list | ![Button 2 pressed](image3.png) |
|12 | LCD will display the second song title and artist name. Led will light up when the button being pressed. | ![LCD display with LED](image4.png) |
If the user want to return to previous song, the user will press button 1 to view the previous song in the list.

If the user want to play the song, the user need to press button A.

The song will be played. LED will light up when playing song.

When the song completed, LCD display “Thank You Go green!! Malaysia Boleh” and follow with the sound of the E-Green Jukebox speaking based on LCD display. A delay of five seconds, then it goes to Step 1 back.

4. Conclusion
This paper presented the prototype of the proposed electronic jukebox that accept aluminum can as token. The proposed project is operates using Arduino Mega as controller, four push buttons as inputs, IR proximity sensor as sensor, EZ-MP3 module, and several outputs such as the servo motor, LCD, LED, and speaker. The proposed prototype tested using two materials: 1) plastic; 2) aluminum and the result shows it able to detect all the beverage correctly.
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