THE SYSTEM ARCHITECTURE OF E-BRAILLE BY USING THE MICROCONTROLLER AND EXTERNAL CONTROLLER UNIT

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ABSTRACT

Blind people always have difficulties to access some information. So the braille language symbols are used to overcome this problem. With this modern technology, the refreshable braille cell was created. This cell is using piezoelectric concept. This refreshable braille cell can refresh the character. The pin for each braille cell is controlled by using piezoelectric bimorph. This will make the pin to rise and down. In this paper, the refreshable braille cell is controlled by the Arduino microcontroller and gets command from the Braille Key Module. The software use for this program is Arduino which use C+ language. The system is tested and successful.

Keywords: refreshable braille cell, arduino, braille panel, DC-DC converter, shift register.

1. INTRODUCTION

Based on the statistics by the World Health Organisation, there are about 285 million are estimated to become visually impaired person around the world [1]. Based on this result, many development device need to be done to help them live like other people in the world.

In year 1821, Louis Braille from French developed a system that helps blind people to read [2]. The Braille system operates by passing through the fingers over the character that made up of array points 4 x 2. These braille codes consist of alphabets, numeral and punctuation marks.

The braille pin operates either by using piezoelectric or magnetic field principles. Raise and fall of the braille pin based on the flow of voltage and electrical current. In the piezoelectric display, each pin usually is attached to the flat metal that contains piezoelectric crystal. With enough of voltage supplied, it can make the piezoelectric bend upward and push the pin. When 0V was applied to piezoelectric crystals, the metal will flat and pin will down [3].

The contribution for this paper, the piezoelectric braille cell will be integrated and controlling by using the modern and cheap microcontroller Arduino. The user will control the braille pin output by using external normal switch button. The coding and logarithm of the Arduino is set by using computer with Windows operating system. The data from the normal switch will send to Arduino and will integrate with the Piezoelectric Braille Cell.

2. SYSTEM ARCHITECTURE FOR THE BRAILLE SYSTEM

The system architecture for this braille module system, we can see from the Figure-1 below. The system consists of four modules. The modules are central processing module, power supply module, Braille Keys module and refreshable braille cell module. As we can see from the Figure, the central processing module is the center of the module. And every modules have their own function.

![Figure-1. System architecture of braille cell.](image-url)

Basically, based on the system above the Arduino will get the command from the Braille Key module and the Arduino will give command to the refreshable braille cell. The logarithm and coding for Arduino Microcontroller was set up to interpret data from the Braille key module. The power supply module is used to operate the CPM and Braille Cell module.

A. Power module

Power supply module is a module that give regulated DC power supply to the Central Processing Module (CPM), and Refreshable Braille Cell Module (RBCM).
This power module gives two different output voltages for CPM and RBC. 12V DC input voltage come from the power source, the DC-DC converter will convert the DC voltage to two different voltage, 5V and 200V. The maximum power for this converter is 2.5W [3]. The Arduino need 5V DC to operate properly [4] while the piezoelectric pin need 200V to maintain the raise of piezoelectric crystals [3]. The DC-DC converter stores the electrical energy in the storage components like inductor and capacitor.

### B. Central processing module (CPM)

Most important module is Central Processing Module that contain Arduino microcontroller that control the entire data signal. The Arduino Microcontroller is capable to storing and running the program. The Arduino is very popular nowadays because the device is cheap and easy to handle the programmer. For learning process, Arduino is very suitable microcontroller for user. This module will act as manager and administer to the system interfacing between the modules in the System architecture Braille Cell. The Arduino microcontroller can see in the Figure-3 below.

![Figure-3. Arduino microcontroller [4].](image)

The CPM get the power source 5V DC from the power module. The CPM also will process the input data from the Braille Key Modules to give output to the Refreshable Braille Cell Module.

### C. Braille key modules

Braille Key Modules consists of button, keys and switch based on their functionality. For this module, it can divided into 4 categories that are Perkin Braille keys, navigation key, power switch button and GPS switch key. The Perkin Braille keys consists of 8 buttons which is separate by two, 4 keys button on the left and 4 keys button on the right. The navigation key consists of ENTER, UP, DOWN, BACK, FORWARD, BACKSPACE and Escape (ESC) buttons. The ENTER button function as to agree with current command, the UP, DOWN, BACK and FORWARD buttons to choose between the list command and also as the choose and correct for braille alphabet data for braille words. The BACKSPACE button acts as delete button for wrongly input braille alphabet. ESC button performs as exit button from the current menu system.

![Figure-4. Perkins key controller.](image)

![Figure-5. Perkins key braille.](image)

### D. Refreshable braille cell module

RBCM is the main module that as significance for this successful of the system. Basically the main objective of this module is to convert the normal alphabet to braille alphabet. The braille alphabet presented by the piezoelectric concept.

Piezoelectric Braille Cell represents a single unit of braille character that can be displayed and refreshed itself to any Braille character depending on a command input. Each cell has eight dots in a rectangular array 4 x 2 and it controlled by piezoelectric bimorph [13]. Voltage applied to this Braille Cell around 200V DC. The pin will rise up when 200V voltage is applied to the pin and the pin will fall down when 0V is applied [14]. Figure-6 below show the picture of P20 Braille cells. The 8 pin of piezoelectric for each cell is controlled by the high voltage of HV509 shift register.

![Figure-6. P20 Braille cells.](image)
3. DESIGN OF THE BLOCK SYSTEM

First, the system is required to power on and initialized. The power source comes from the power module. In data input processing, the Arduino program (Figure-8) will wait from the Braille Key module will be pressed. The arrangement of the key is like in the Figure-4. The key is typewriting to write the braille character.

Simultaneously, by pressing different type of combination keypads, it will create the braille alphabet on the Refreshable Braille Cell Module. When the Arduino microcontroller receives command from the Braille key module Figure-9, it will process and give command to the shift register. The shift register will spread the data through the parallel braille cell.
The result is displayed like below. The pin will rise up based on that braille keypad command.

**Figure-11.** Refreshable braille cell display.

### 4. CONCLUSIONS

This paper has introduced and presented the system architectures of electronic braille cell using the Arduino Microcontroller and external switch. The system architecture has several modules to develop the system. The system is tested based on theory and the result is practically appear. The braille display shows the pin based on braille key controller command.

### REFERENCES


