WIRELESS PREDICTIVE TEXT ENTRY SYSTEM FOR THE HANDICAPPED

BY

SEAH NI XUAN

A REPORT

SUBMITTED TO

Universiti Tunku Abdul Rahman

in partial fulfillment of the requirements

for the degree of

BACHELOR OF INFORMATION TECHNOLOGY (HONOURS) COMPUTER ENGINEERING

Faculty of Information and Communication Technology

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I would like to express my heartfelt thanks and gratitude to my supervisors, Mr. Teoh Shen Khang and Mr. Leong Chun Farn, who gave me this rare opportunity to design a new wireless predictive text entry system for handicapped to help them communicate in their daily life. They have given me some new ideas for this project very well.

Besides that, I would like to thanks to my friends and family member. With the help of my friends and ideas, I saved a lot of time during the development of this project. Finally, I am deeply grateful to my beloved family for their continued support and encouragement during this Covid-19.

ABSTRACT

Text entry systems can usually be found in digital devices such as computers and smartphones that use “QWERTY” keyboards to interact with it. These text entry type devices are easy to use among the general population, but these text input systems are not easily used by people with disabilities. The main problem with this text entry system is that it makes it difficult for people with disabilities to input text. Ordinary keyboards contain 101 or 104 keys and require large hand movements. Therefore, it is not recommended for people with disabilities to use this ordinary keyboard, especially those with limited hand movement.

In this project, a new wireless predictive text entry system is created to help handicaps to simplify their text input process so that they can enter text faster. The predictive text input system will be similar to the T9 text input system keyboard, which means it only has a 3x3 grid arrayment key predictive text input system, and it also allows users to select words without typing the entire word in search box. Then, the user’s selected word will be printed in third applications such as notepad.

In addition, input device for this system will be designed to be portable, light in weight, long working hours and user-friendly. The input device will be created same as GUI software which have 3x3 grid arrayment key. In addition, handicaps only use one hand to hold the device and use one finger to interact and typing the text.

Single tap method is used for this system which mean user need to press the intersection point of the infrared text entry board for one time, the selected letter will print in search box and using number key to select the word to print in third applications.

The prediction system uses the Contains method to search for words in the list box, which means that the user enters a letter in the search box and it will start searching for words that contain the following alphabets.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF SYMBOLS

I	Current
P	Power
V	Voltage

LIST OF ABBREVIATIONS

GUI	Graphical user interface
ICT	Information and Communication Technology
IR	Infrared
PCB	Printed Circuit Board
SBC	Single Board Computer
T9	Text on 9 keys
WPM	Word per Minute

Chapter 1: Introduction

The rapid development of ICT has created a huge demand for digital devices such as desktops and laptops [1]. Due to this rapid development of ICT, text input system is needed to interact with these devices such as keyboards. Nowadays, the keyboard provides the most common method of communicating with a computer. Normal keyboards contain 101 or 104 keys and it uses the most common keyboard layout which is “QWERTY”. From the research, it shows that “QWERTY” keyboard is the most popular keyboard which is widely used in digital devices [2]. This keyboard layout is commonly used in computer and smartphones. Unfortunately, this type of text entry system and keyboard can be a barrier for handicaps to interact with the device [3] because it requires large hand movements. It will be very difficult for people with disabilities, although they still can use the "QWERTY" keyboard, but they need more effort to press the key to entry the text.

1.1 Problem Statement and Motivation

From the research, the “QWERTY” keyboard is the most popular keyboard which is widely used in digital devices [2]. For example, the “QWERTY” keyboard is usually used on computers shown in Figure 1.1, while for smartphones, the virtual “QWERTY” keyboard on the touch screen is used which is shown in Figure 1.2.

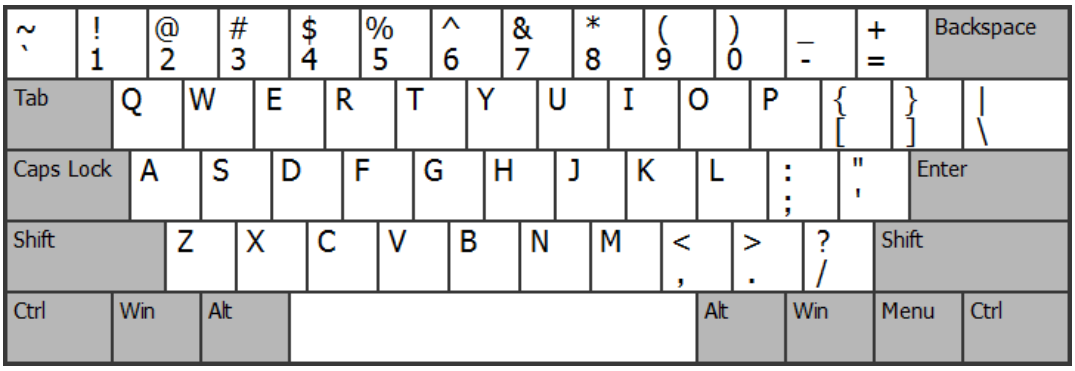

Figure 1.1 “QWERTY” keyboard layout.

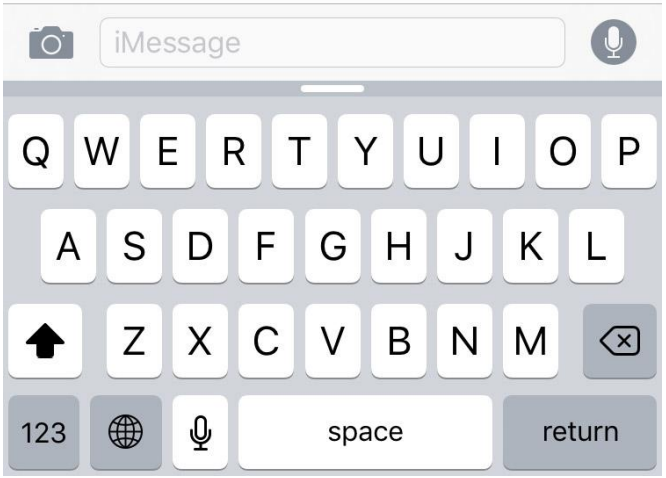

Figure 1.2 Virtual "QWERTY" keyboard layout for smartphone nowadays.

Before the virtual keyboard is used, mostly old mobile devices are using the 12-key keypad to enter the text as shown in Figure 1.3. The first and most common commercial text method is called "multi-tapping". From Figure 1.3, we can see the number 5 keypad is mapped to j, k and l in small capital letters. Users require to press 5 once for j, twice for k, three times for l, and four times for 5 [4]. For caps lock function, user need to press the hash tag button for 2 to 5 second, it will change caps lock mode and then press the number key.

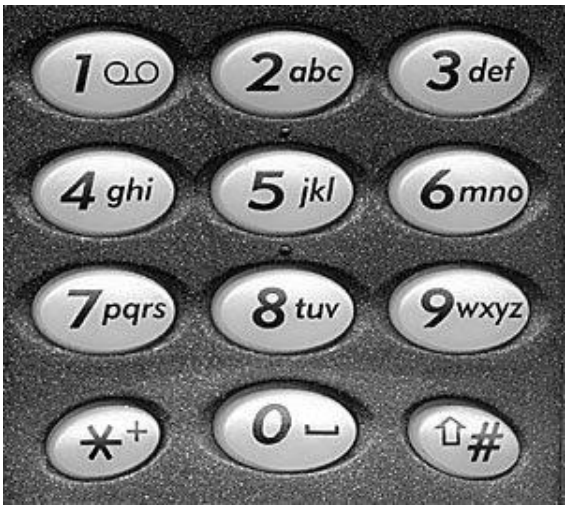

Figure 1.3 12-key keypad on old mobile devices.

Second method for predictive text entry is T9. T9 was invented by Tegic co-founder Cliff Kushler in 1990s, which is short for "Text on 9 keys" [5]. Predictive text technology replaces multiple taps instead of one keystroke to display words.

In 2011, third method was created by Kushler which is Swype. Swype is a text entry system for touch screen and users just need drag fingers to connect points between letters in a word shown in Figure 1.4 [5]. Unfortunately, this type of text entry system can be a barrier for handicapped to interact with the device [3]. It will be very difficult for people with disabilities, although they still can use the "QWERTY" keyboard, but they need more effort to press the key to entry the text.

Figure 1.4 Swype method.

Handicaps with hand disability may encounter difficulties such as taking longer time to enter a full word while using the “QWERTY” keyboard. Their fingers will feel tired or pain when using this type of keyboard and will give up to typing text because when they move their fingers over the keyboard which contain 101 or 104 keys to type the alphabets to complete one word. Although the 12-keypad has fewer keypad buttons, handicaps still need to work hard to enter the text on the 12-keypad and need to wait about one second before entering the next character on the same number key [4].

Although, input devices specially designed for handicapped have been created but it was very expensive and not everyone can afford it to buy such device. A similar T9 wireless predictive text entry system is suggested to enhance the handicapped typing speed, typing more effectively, easily, help them memorize difficult words that need to spell, less finger movements and use a single touch to select the keypad that user want it. Besides that, the predictive text entry system also added to solve the problem and low-cost materials will be use in this predictive text entry system. This system will be a wireless based system such as using Bluetooth module to make it portable and easier to use. However, people with visual impairments are not suitable for this system

because the system uses a predictive system and requires the user to see words and select them in a list box.

1.2 Objectives

For this project, there are 6 objectives that need to achieved. The main objective is to create a wireless predictive text entry system that suitable for handicapped with low-cost material, so that handicapped can affordable to have this device and communicate with others at the same time without making them feel abandoned. This predictive system also help user reduce their typing errors.

There are several sub-objectives that need to be achieved:

1) Device must be portable.
    - The device can bring to anywhere and start using it anytime.
2) Device must be lightweight.
    - The device cannot be too large and can hold in one hand size.
3) The device can operate for long hours.
    - The device needs to run longer without frequent recharging.
4) Device must use wireless connection
    - The device must be wireless such as using Bluetooth and not wired.
5) Device must user-friendly.
    - Only takes a few instructions to operate the device.

1.3 Project Scope

In this project, effectiveness, efficiency, safety, learning, and memorization are considered [6]. The proposed similar T9 wireless predictive text entry system must solve the typing problems that encountered by people with disabilities effectiveness. The device needs to be efficiently so that people with disabilities can use the input device without encounter any problems. In addition, handicap's safety also needs to consider when developing a new system and device. The device must be used safely to prevent unwanted accidents.

This system and device need to be easy for handicapped to learn and adapt to handicaps. The input device is a 3 x 3 grid arrangement key and have 9 input key that makes it easier to enter text. Due to the small size of the device, this device can portable and lightweight. In addition, the predictive text entry system also helps handicaps to

predictive the words without entry all character of the word. The system also needs users select the words after user key-in the characters to choose the word at the list box. Users only need to remember step for using this wireless predictive text entry system.

1.4 Contributions

This project is divided into two parts which is hardware and GUI software to enhance handicapped typing experience. The hardware part will be an input device which should be designed to be small in size to make it easier for disabled people to hold the device and press the intersection with one hand. The developed input device is used for users to typing the text and wirelessly print the word or sentence to the computer. Then, the execution part of the software will be completed on the computer, the software interpreting the word that typing by the user, and also allowing the user to choose a word in list box without having to enter the entire word.

Using this wireless predictive text entry system, handicapped can finish their work faster, more efficiently and improve productivity. Apart from that, the innovation of this project is the predictive text entry system, which means that the user can enter a word without entering the whole word, then the system predicts the word and allows the user to select word in the list box word. It will help users reduce the time to type a word.

1.5 Report Organization

In this section, details of the project are shown in the following sections. Chapter 1 is discussing the introduction, problem statement and motivation to develop this predictive text entry system, objectives, project scope, contributions and report organization. Chapter 2 is literature review, where some technologies and existing text entry system for handicapped is studied. In Chapter 3, system Methodology/Approach is discussing the overall system methodology of this project. Chapter 4 is system design, the details of how the system works and how to create the system. Chapter 5 is system implementation to show how to use the predictive text entry system. Chapter 6 is evaluation and discuss the system testing, performance and result. Chapter 7 will be last chapter that discuss the conclusion and recommendation for this project.

Chapter 2: Literature Review

A number of technologies and research papers will be discussed including the problem that needs to solve, solution, disadvantages and advantages of the system.

2.1 Review of the Technologies

2.1.1 Arduino

Arduino is a microcontroller board developed by Massimo Banzi, David Cuartirlles, Tom Igoe and David Mellis [7]. Arduino is less expensive and very easy to use because it is a microcontroller board that can run a program over and over. Arduino has its own software called Arduino IDE to compile and program Arduino boards and the only programming languages that can be used are C and C++. Arduino is open source. Figure 2.1 show the Arduino UNO.

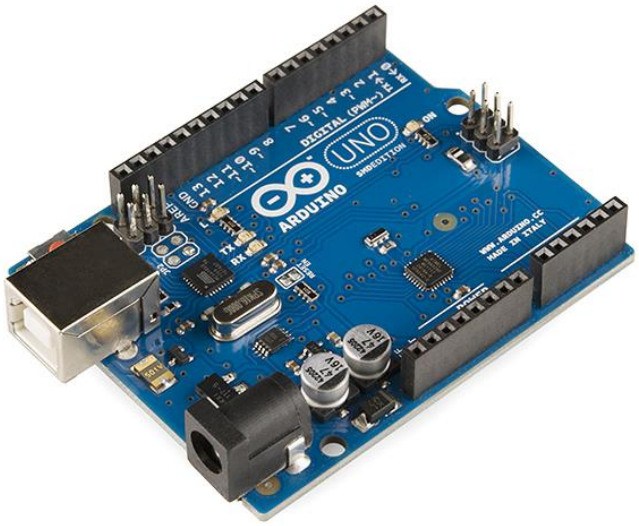

Figure 2.1 Arduino UNO.

2.1.2 Raspberry Pi

Raspberry pi was developed by Eben Upton [8]. It is a microprocessor board that works like a computer. Raspberry Pi is expensive, it has processor, RAM, storage, graphics and different I/O ports like HDMI or AV port, USB port, you can use internet via Wi-Fi or Ethernet port like mini computer or called as SBC. Raspberry Pi is a Linux-based computer that uses the Raspberry Pi operating system. It can run multiple programs and Raspberry Pi is not open source The programming languages available

for the Raspberry Pi are C, C++, Java, Python, HTML and more. Figure 2.2 show the Raspberry pi.

Figure 2.2 Raspberry pi.

2.1.3 C, C++ and C# Programming Language

In 1972, Dennis Ritchie invented the C programming language which is considered to be the oldest programming language [9]. It was designed for developing new versions of Unix, because Unix used assembly language that computers could understand and took very little runtime.

The C++ programming language is an intermediate language because it was as an extension to the C programming language and developed by Bjarne Stroustrup [9]. The C++ programming language actually looks like C, but it is enchanted version that support object-oriented programming features. C++ complies the programs into machine code. It can run almost any C code, but the C programming language cannot run C++ code.

The C# programming language also is an extension of C and is a high-level programming language, but it is based on the .NET framework. It was developed by Anders Hejlsberg in 2002 [9]. It compiles the program into byte code. Although C# is the most technically complex of the three programming languages but it is simple and

easy to understand for first-time users. Figure 2.3 show C, C++, C# programming language logo.

Figure 2.3 C, C++, C# programming language logo.

2.1.4 Summary of the Technologies Review

Arduino and Raspberry Pi each have their advantages, but after consideration, Arduino would be the best choice for this project, since one of the goals of this project was that the device had to be low cost. The Arduino is cheaper than the Raspberry Pi, so handicaps is affordable and it's also easy to use for handicap if the handicap is first time user. For programming languages, C# was chosen because it is very easy to use and easy to learn to create GUI.

2.2 Review of the Existing Systems/ Applications

2.2.1 Qanti: A Software Tool for Quick Ambiguous Non-standard Text Input

A text entry system that using scanning method and alternative input method for handicapped has been developed by T. Felzer [10]. The purpose of this system is to allow handicapped to connect and communicate with others. Figure 2.4 show the Qanti application. As shown in Figure 2.4, the application screen is divided into 4 areas. Upper left area shows the selection with 4 key which is Key 1 to Key 3 is contains 26 alphabets and Key 4 is 2d-board, upper right area show the text area, lower left area show the predicted word and lower right area show the predictive word that needed user to select. First the user needs to use Key 1 to Key 3 to enter numbers. When the desired word appears in lower left area, user must press the Key 4 and use row-column scanning method to select the word that user wants in lower right area. After user selects the word, it will give the user the option to add spaces, punctuation or capitalization first character. The good point of this text entry is use number key to predict the words to save a lot of typing time. Disadvantage will be users need to familiarize themselves to use. The average input rate is between 2.5 to 6.5 Words Per Minute.

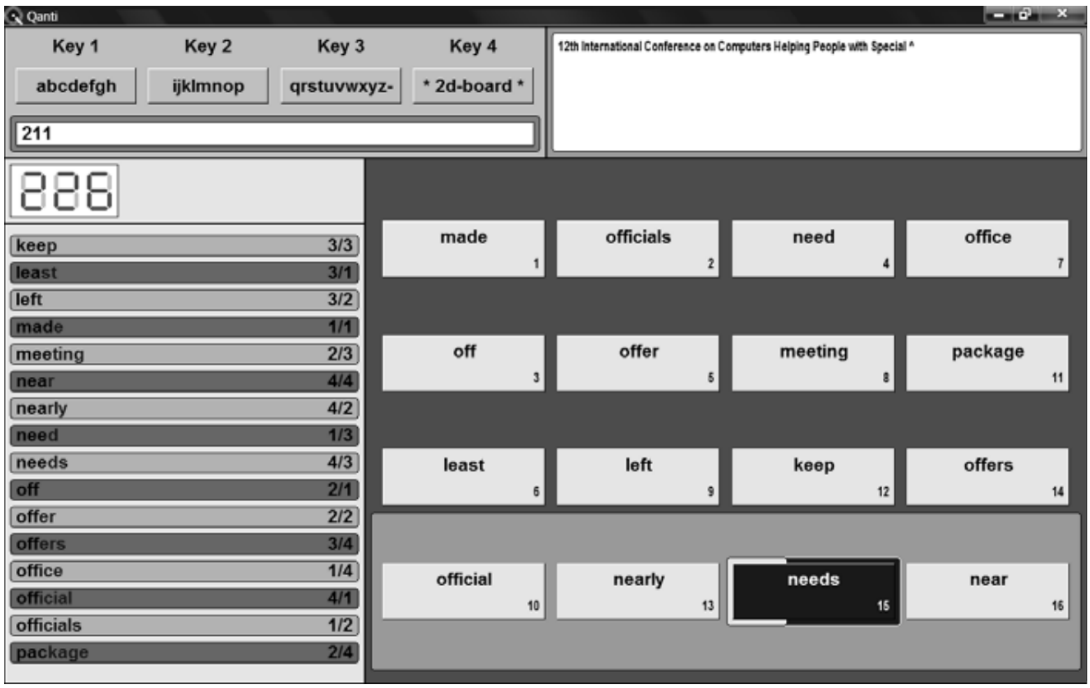

Figure 2.4 Qanti application.

2.2.2 Text Entry Using a Dual Joystick Game Controller

The second text entry system is using Xbox game controllers to develop text entry systems that have been developed by A. D. Wilson and M. Agrawala [11]. From Figure 2.5 we can see that game controller have dual joystick and buttons. The user only needs to use the game controller on the software provided on the on-screen keyboard to enter text. GUI software for this system have 4 types which is Single alpha, Single QWERTY, Dual alpha and Dual QWERTY. Figure 2.6 show the software provided for this system. From Figure 2.6, it uses the "QWERTY" layout for GUI. Users can choose to use single joystick or dual joystick for this GUI to select alphabets and use left trigger or right trigger to enter the alphabets. This text entry improves the convenience for users to type by just using game controller single or dual joystick. The downside is that users need to familiarize themselves to use the game controller to entry text. The fastest average input rate was 9.1 Words Per Minute, while 3.6 WPM was the slowest.

Figure 2.5 Xbox game controller that used in this system.

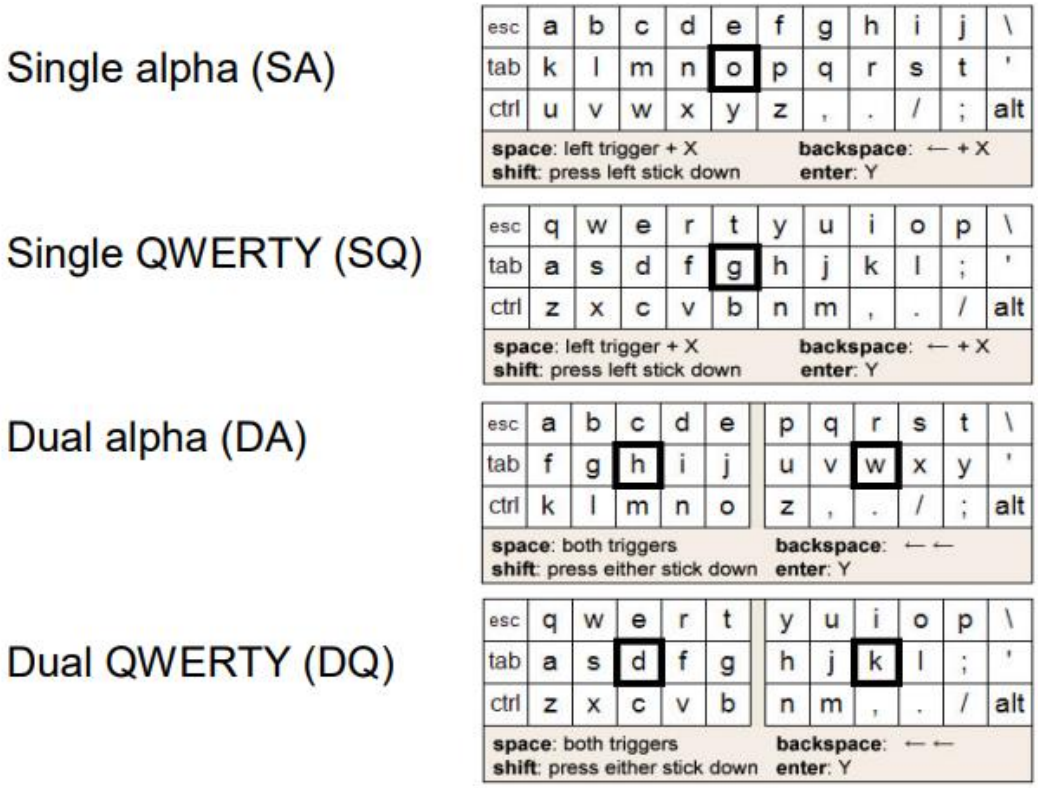

Figure 2.6 4 types of GUI software layout.

2.2.3 Infrared-based Text Entry system for Handicap

Besides that, text input system using infrared rays for the handicaps was proposed by K.W. Yong [12]. For hardware components, infrared receivers and transmitters are used to build 9 intersections representing 9 keys shown in Figure 2.7 and Figure 2.8. When user use fingertip touches an intersection, interrupt signal will be generated. Figure 2.9 show the interface of software GUI program. The good point for this system is layout of software GUI same as T9 method which is have lesser key than keyboard. The disadvantages of this text entry system are non-wireless which will cause the device cannot be portable. Average input rate will be 12.4 Words Per Minute.

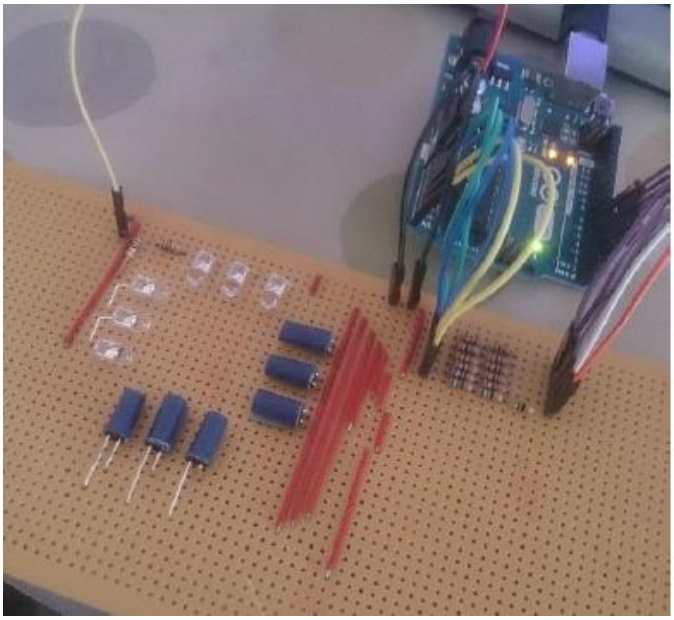

Figure 2.7 Device of Infrared-based Text Entry System.

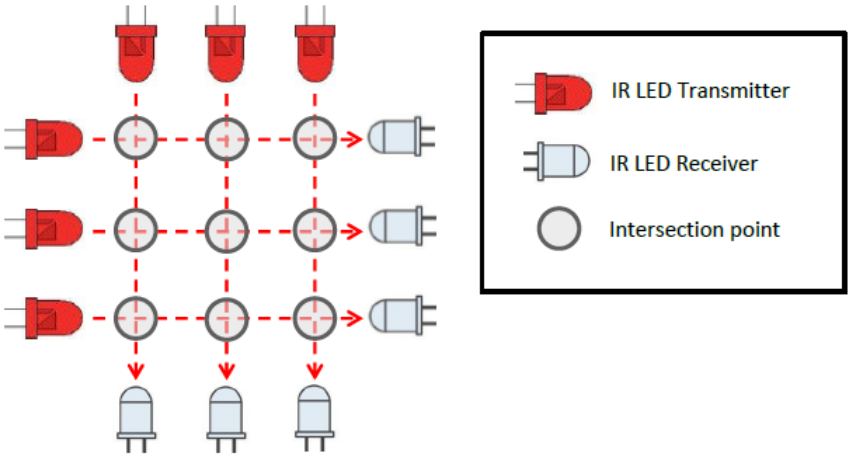

Figure 2.8 3 x 3 arrangement grid of the IR LED.

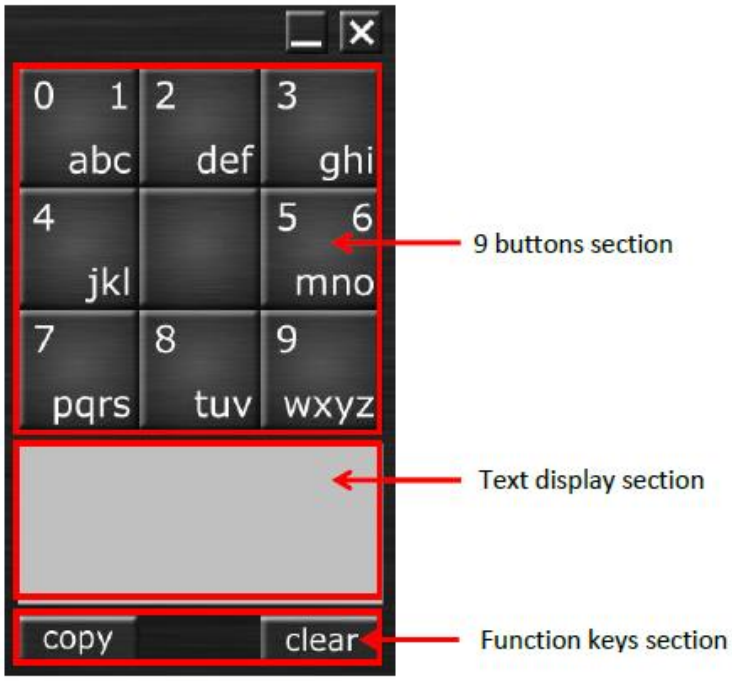

Figure 2.9 Interface of software GUI program.

2.2.4 Wireless-based Text Entry System for Handicap

This text entry system was proposed by W.L. Chooi [13]. For hardware parts, infrared text entry board, Bluetooth module mounted on a Cytron XBee Shield and CT-UNO are used, shown in Figure 2.10 [13]. This text entry system was tested in Window 10. Figure 2.11 show a software GUI program for this system. It quite similar to infrared-based text input system that was proposed by K.W. Yong [12], but it fixes the non-wireless problem by using the Bluetooth module and increase the speed of WPM which is 5 WPM for this system. From Figure 2.11, the interface of GUI software got the features of T9 but lack the predictive technology.

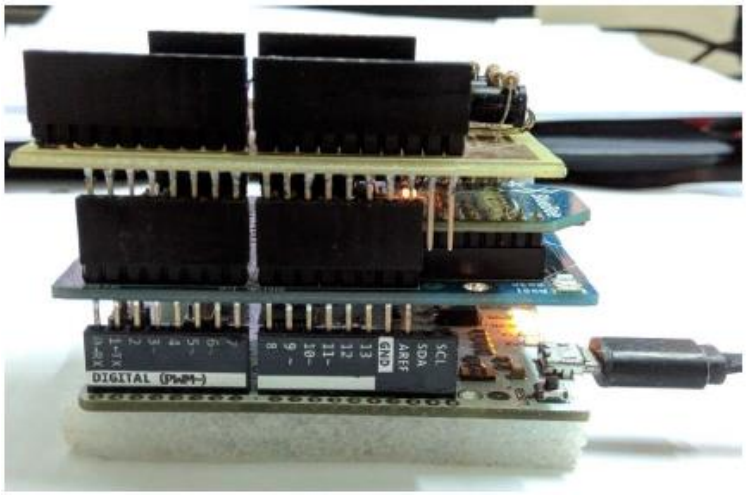

Figure 2.10 Side view of the hardware part.

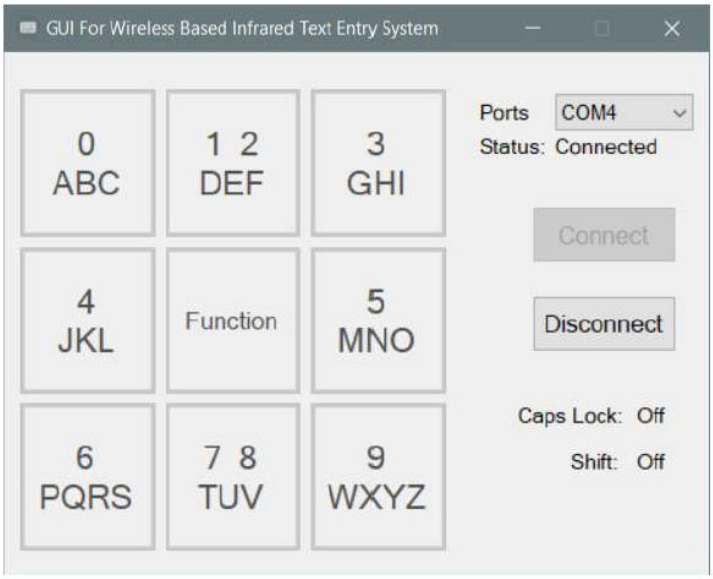

Figure 2.11 Interface of GUI software with the connected Bluetooth.

2.2.5 T9 Predictive Text Input Emulator

Besides that, T9 Predictive Text Input Emulator has been developed by arifwn [14]. This predictive text entry system is implemented using Trie. Trie is an effective information retrieval data structure. By using Trie, the complexity of the search can reach its maximum limit [15]. Unlike the binary search tree, there is no node associated with the node in the tree storage key. Instead, its position in the tree determines the key associated with it. Figure 2.12 show the example of Trie. The advantages of this predictive system are easy to use, for example, word “moon”, so click the keypad number 6 for four times shown in Figure 2.13. At first get “momo”, the click the cycle button to cycle the words to get “moon” shown in Figure 2.14. The disadvantages for this predictive text entry are need to press the cycle button for many times to get the correct words and don’t have grammatical awareness to warn the user the word is wrong.

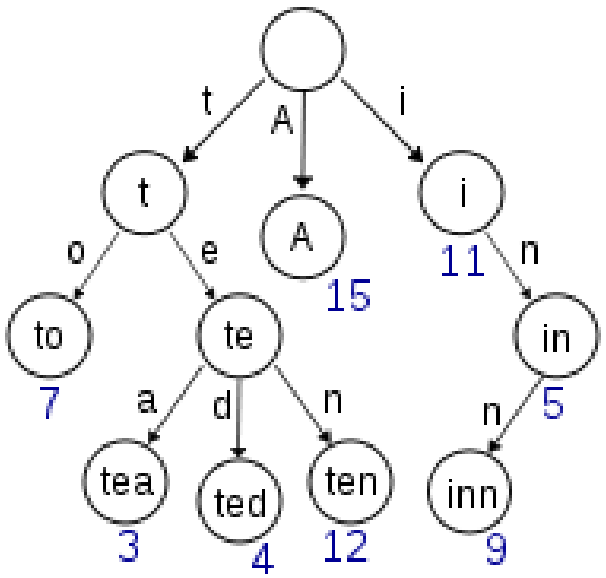

Figure 2.12 Example of Trie.

Figure 2.13 “momo” word after press, keypad number 6 for four times.

Figure 2.14 “moon” word after click the cycle button to cycle the word.

2.2.6 Summary of Existing Systems

There are many researchers who are working hard to include a predictive text entries system for handicaps. Each study has its own strengths and weaknesses. Research presented by K.W. Yong [13] and W.L. Chooi [13], which provided many ideas and improvements for creating predictive text input systems. The study was presented by W.L. Chooi [13], although it was made portable by adding a Cytron XBee Shield with a Bluetooth module installed, was a great improvement from a non-wireless base to a wireless base. But more improvements could be made, like from the device, it could change the resistors to SMD resistors to make it look tidy, and the GUI software could add a prediction system to help reduce the time it takes to type complete sentences.

Chapter 3: System Methodology/Approach

3.1 System Design Diagram/Equation

3.1.1 Methodologies

In this project, a prototyping model was chosen to create an efficient system. A roughly demonstrate the functionality of the system and product will be show by creating a prototype product. Using prototyping model also enable developers to understand customer needs in the early stages of development. In addition, it helps to get reviews or feedback from customers, which in turn helps developers understand customer expectations for the system and product. In addition, the prototyping model method also help to develop complex large-scale systems without the need for systems or manual processes to help developers determine requirements [16]. The Figure 3.1 show the Prototyping Model.

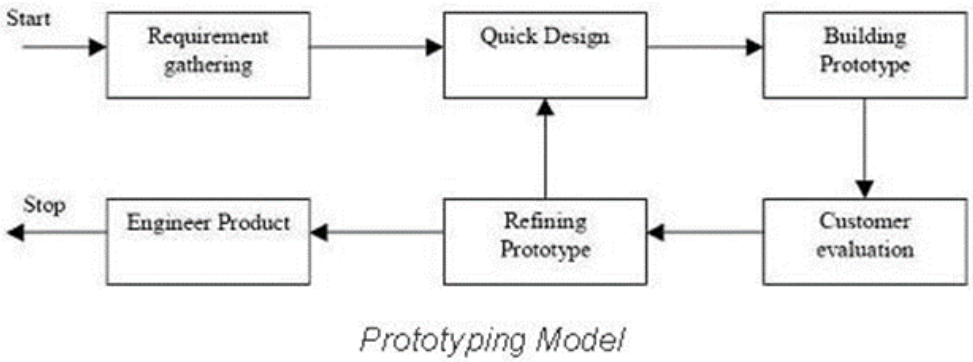

Figure 3.1 Flow of Prototyping Model.

Initially, the requirements for this project were collected, which is a product must be wireless, predictive text entry and made for the use of handicaps. Then, requirements are analyzed, and product requirement's documents also provided.

Next, in quick design, the GUI software is created using the C# programming language and hardware sections will use PCB and CT-UNO. Developers will start designing prototypes based on customer needs. However, the design of the prototypes is rough design, but covered all the key aspects of the system that conveys the idea to the customer.

Next, when building the prototype, the prototype was developed based on the earlier design. The prototype will enable the customer to understand the appearance of

the final product. Then, send the prototype to the supervisor and supervisor will start to appraise the prototype. After supervisor done appraise, supervisor opinions and feedback will be noted down for developers to make the improvement to the product.

During refining prototype, supervisor's opinions and feedback will be reviewed and discussed. The supervisor's opinions and feedback will be used to optimize the product and return to "quick design" step to redo the process until supervisor is satisfied. If supervisor is satisfied with the product, the developer will move on to the final step.

Finally, carry out engineering design to the product. Actual products will be developed based on prototypes. The software and hardware will undergo further maintenance and inspection to ensure that the final product will not cause serious errors.

3.1.2 Hardware Architecture Diagram

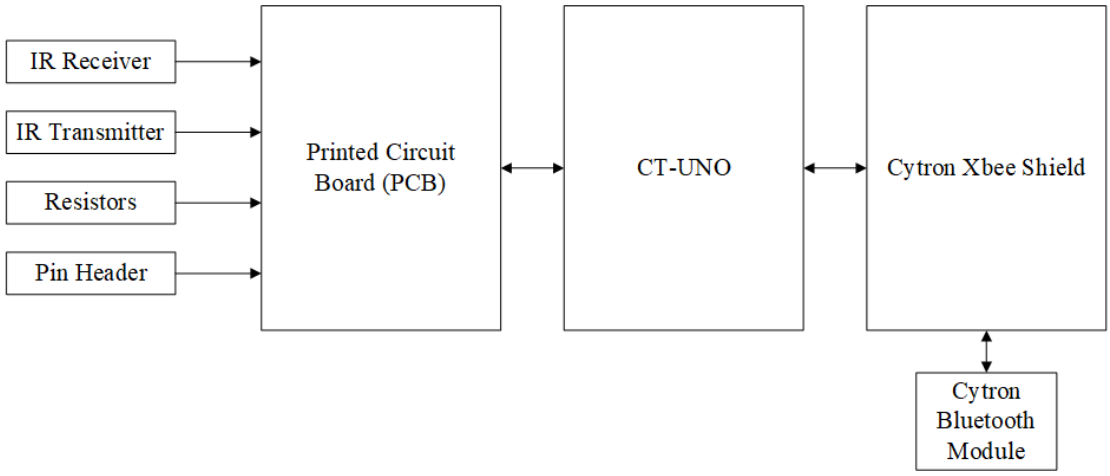

Figure 3.2 Hardware architecture diagram of the input device.

From the Figure 3.2, IR Receiver, IR Transmitter, resistor and pin header will soldering on the printed circuit board (PCB). Then, mount the Cytron Bluetooth Module on the Cytron Xbee Shield. After that, mount the created infrared text entry board on the Cytron Xbee Shield. Lastly it will mount on the CT-UNO. IR Transmitter and IR Receiver is chosen because it can easily detect the IR light and these components will be arranged in a 3 x 3 grid arrangement key. Details of this 3 x 3 grid arrangement key and how this device detect the intersection point that touched by user will be discussed in Chapter 4.

3.1.3 Flowchart of Software Architecture

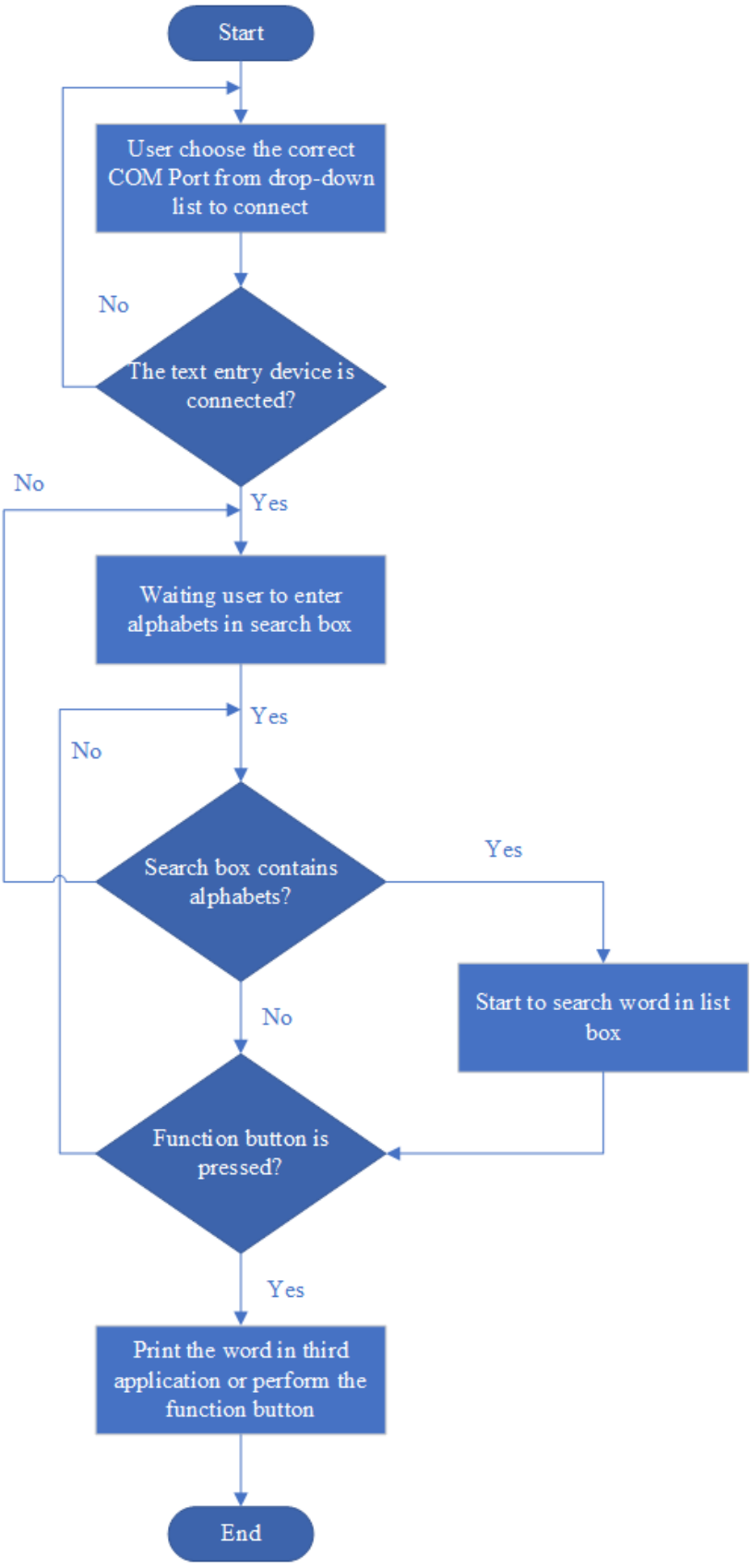

Figure 3.3 Flowchart for the software architecture.

First, user starts the program, then user needs to select the COM port. After the connection is successful, when user touch the intersection point of the infrared board, it will check the intersection point that user touched and the intersection point's signal will be received by device to interpret which button is touched by user, and finally it will print the character or execute the function of the GUI software. For the prediction system, the user needs to enter a letter in the search box and it will start checking if the letter entered by the user is in the list box. If list box contains the word the user wants, the user can select the word to be printed in the third applications, otherwise the user can press any function button to perform the function. The details and design of the software will be discussed in Chapter 4.

3.1.4 Tools to use

In this project, Microsoft Visual Studio 2015 is used to build a software GUI program to get serial data from the input device and then print the word. Microsoft Visual Studio was chosen because it supports 36 types of programming languages including the C++ and C #. Python also can be used in Microsoft Visual Studio but need to include some plug-ins. In order to create the GUI software for this project, the C# programming language was chosen because the C# programming language is designed to create an application and requires the use of the .NET framework. Therefore, the C# programming language is used to creating GUI software. The Figure 3.4 show the Microsoft Visual Studio logo.

Figure 3.4 Microsoft Visual Studio logo.

To create the infrared board, the EAGLE software is used. EAGLE is chosen because it can draw the schematic diagram easily and can change the schematic diagram to PCB board form. It can easily to add the components form Library Manger. The Library Manger consist may type of components from difference company. Figure 3.5 show the EAGLE software.

Figure 3.5 EAGLE software.

In order to use Arduino, Arduino requires the Arduino IDE to code and upload the code to the Arduino. This software is open source, free and it supports many types of Arduinos. It can use C or C++ programming language to writing the code. It also can used as the serial monitor to monitor the flow of the data with the connected board. Before uploading the code to the connected board, the software needs to choose the correct Arduino and port that used. The Figure 3.6 show the Arduino IDE logo.

Figure 3.6 Arduino IDE software logo.

3.1.5 User requirement

Hardware:

1. Computer or Laptop
    - Must have the Bluetooth Module or the Bluetooth adapter.

Software:

1. Computer or Laptop
    - Windows 10.
    - Microsoft Visual Studio 2015 or greater version.

Chapter 4: System Design

In order to develop a wireless predictive text entry system to help people with disabilities enter text more easily, input devices and software are needed. Therefore, the device has built with low-cost components. The input device is a 3 x 3 grid arrangement key and have 9 input key that makes it easier to enter text. The software also bases on this 9 input key to perform the predictive text entry system. Figure 4.1 show the illustration of 3 x 3 grid arrangement key for input device and software.

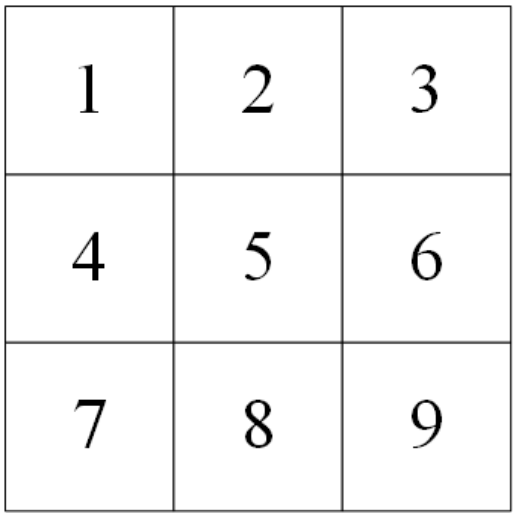

Figure 4.1 Illustration of 3 x 3 grid arrangement key for input device and software.

4.1 System Block Diagram

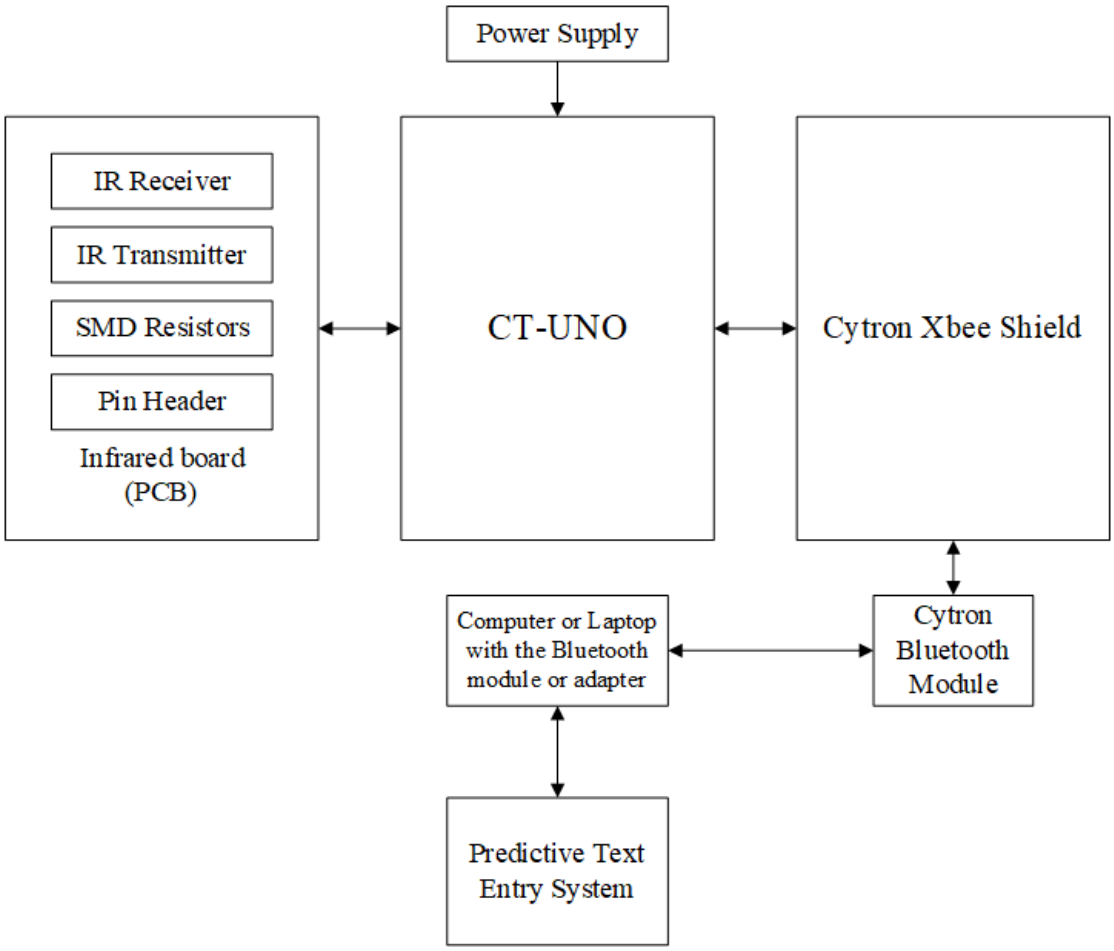

Figure 4.2 System block diagram of full system.

From the Figure 4.2, IR Receiver, IR Transmitter, SMD resistors and pin header is soldered on the infrared board (PCB). Then, mount the Cytron Bluetooth Module on the Cytron Xbee Shield. After that, mount the created infrared board on the Cytron Xbee Shield. Lastly it will mount on the CT-UNO. The IR Receiver and IR Transmitter will detect intersection point that user touched and send it to CT-UNO as an analog signal. The ADC will convert those analog signals into digital signals so that the CT-UNO can interpret and understand them. These analog signals are sent from the device to the computer via Bluetooth because one of the goals is to make it portable. Figure 4.3 show the data transfer of the analog signal between input device and computer via Bluetooth.

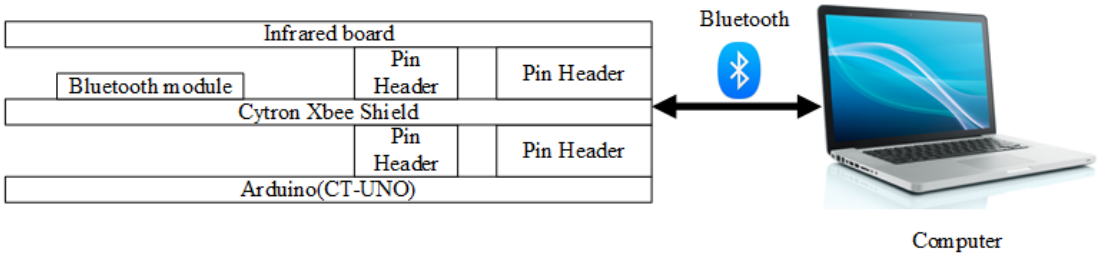

Figure 4.3 Data transfer of the analog signal between input device and computer via Bluetooth.

4.2 System Components Specifications

From the Table 4.1, show the hardware components that used to create the text input device. Figure 4.4 show the hardware that used to create the text input device and Figure 4.5 show the 10K ohm SMD resistors is solder on PCB.

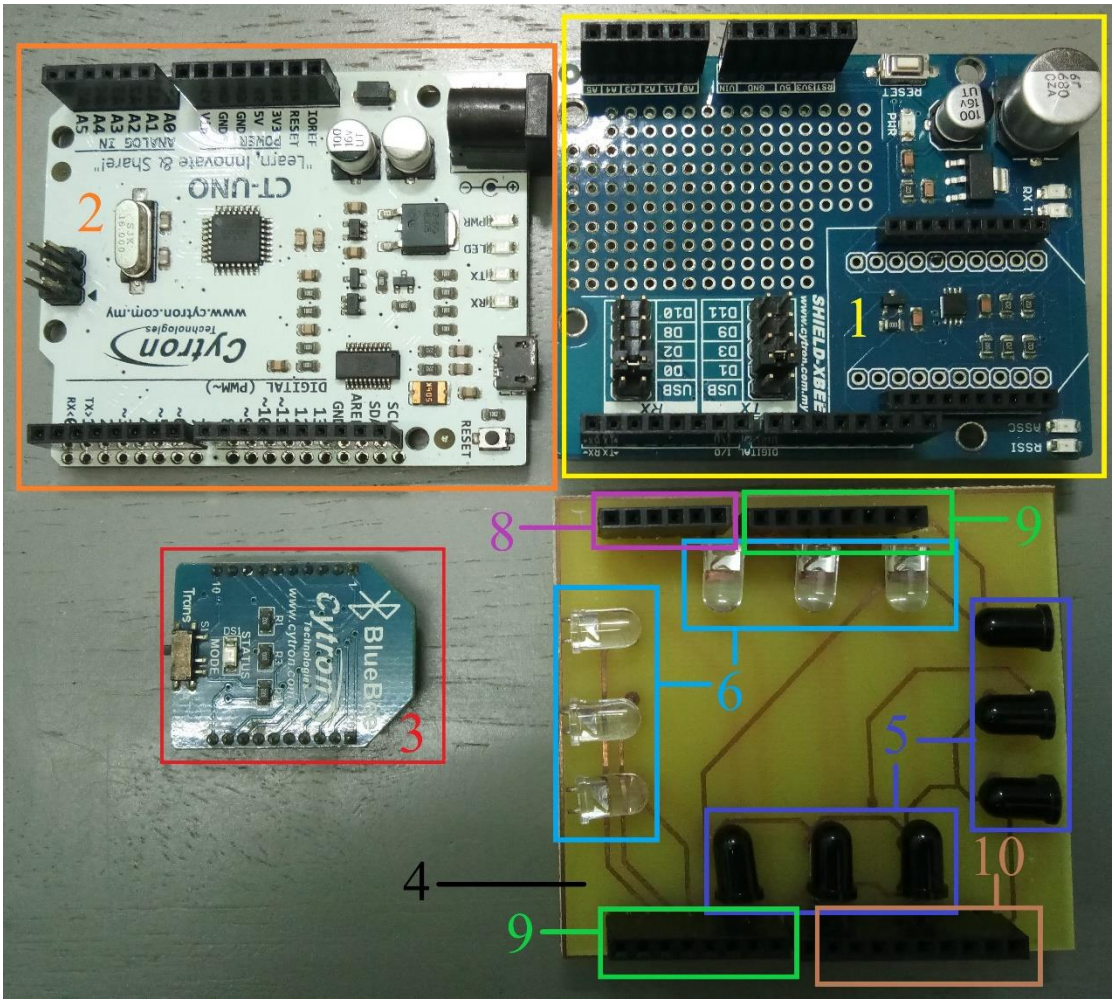

Figure 4.4 Hardware that used to create the text input device.

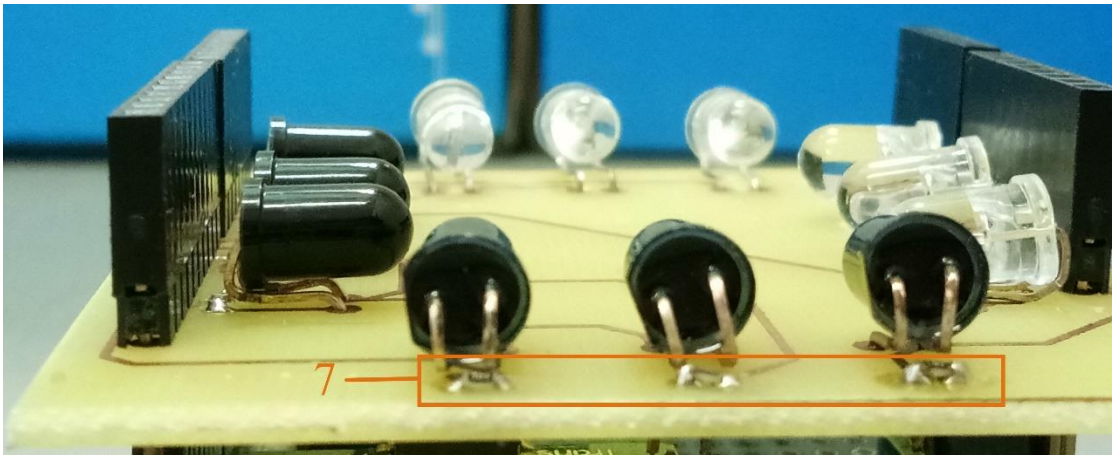

Figure 4.5 10K ohm SMD resistors is solder on PCB.

No.	Hardware Components	Quantity	Price per Unit (RM)	Total (RM)
1	Cytron XBee Shield	1	35.00	35.00
2	Cytron UNO (CT-UNO)	1	58.80	58.80
3	Cytron Bluetooth Module	1	34.00	34.00
4	Printed Circuit Board (PCB)	1	0.00	0.00
5	5mm IR Receiver	6	0.50	3.00
6	5mm IR Transmitter	6	0.50	3.00
7	10K ohm SMD resistors	6	0.083	0.49
8	1 x 6 Female Pin Header	1	1.00	1.00
9	1 x 8 Female Pin Header	2	1.20	2.40
10	1 x 10 Female Pin Header	1	1.50	1.50
			Total	139.19

Table 4.1 Hardware Components that used.

An infrared emitting diode is a light source that emits infrared light. IR transmitter will emit IR light while IR receiver will receive the IR light. Figure 4.6 and Figure 4.7 show the IR Receiver and Transmitter.

Figure 4.6 IR Receiver.

Figure 4.7 IR Transmitter.

The 10K ohm SMD resistor was chosen for this project because the size of the resistor is small and it can make the created device look neat and tidy. Figure 4.8 show the 10K ohm SMD resistor.

Figure 4.8 10K ohm SMD resistor.

Pin Header is used and soldered to the PCB board so that the board can be stacked on Cytron XBee Shields. Three type of pin Header is used is 1 x 6 Female Pin Header, 1 x 8 Female Pin Header and 1 x 10 Female Pin Header. Figure 4.9 show the Pin Header.

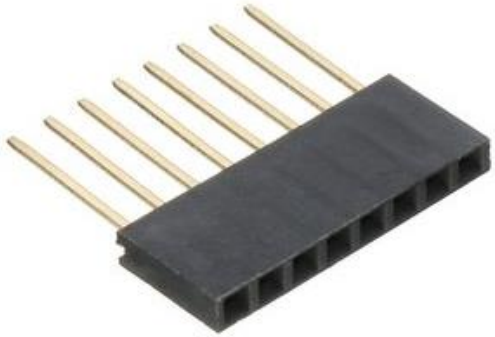

Figure 4.9 Pin Header.

The reason for choosing CT-UNO is that its price is cheaper than Arduino UNO R3. CT-UNO was created by Cytron, which is the Cytron version of Ardunio UNO R3. It has all the functions provided by Ardunio UNO, and also has an additional standard pad to add a shield that can create by user itself. The Figure 4.10 show the CT-UNO.

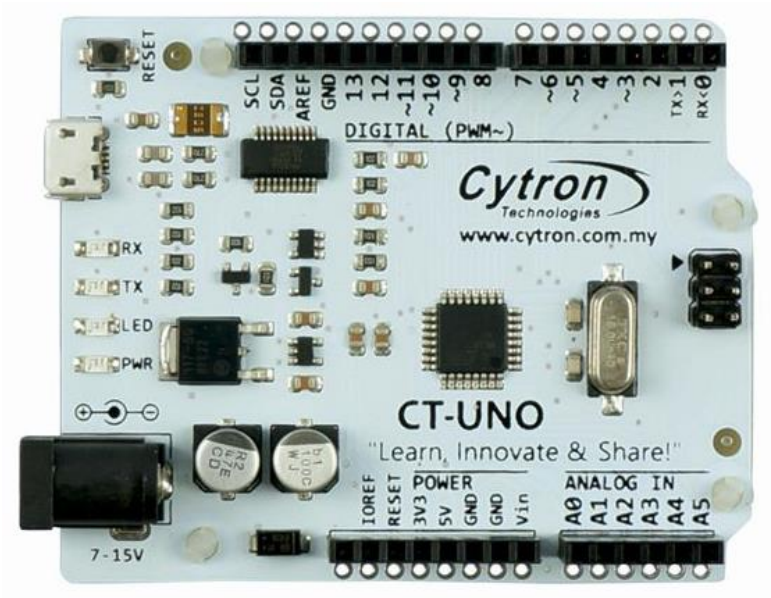

Figure 4.10 CT-UNO.

There are 2 options create the input device run wirelessly, which uses Bluetooth or Wi-Fi to wirelessly transmit data to the computer. After consideration, Bluetooth was chosen because of its portability, and if Wi-Fi is used, users need to make sure the place got the Wi-Fi connectivity. Therefore, the Cytron Bluetooth Module is chosen and it also allow CT-UNO to communicate with computer wirelessly. Figure 4.11 show the Cytron Bluetooth Module.

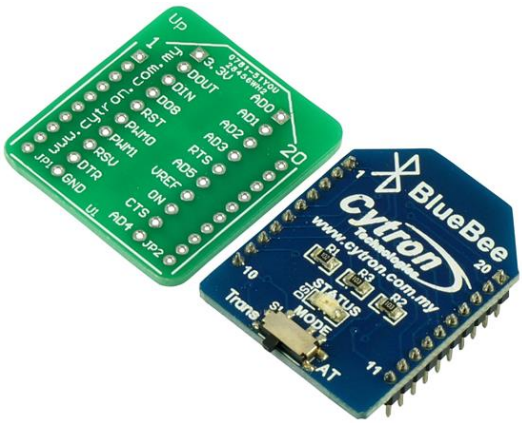

Figure 4.11 Cytron Bluetooth Module.

In order to use the Cytron Bluetooth module, Cytron XBee Shield was needed to install the Cytron Bluetooth module, which can also be used with the CT-UNO. Figure 4.12 show the Cytron XBee Shield.

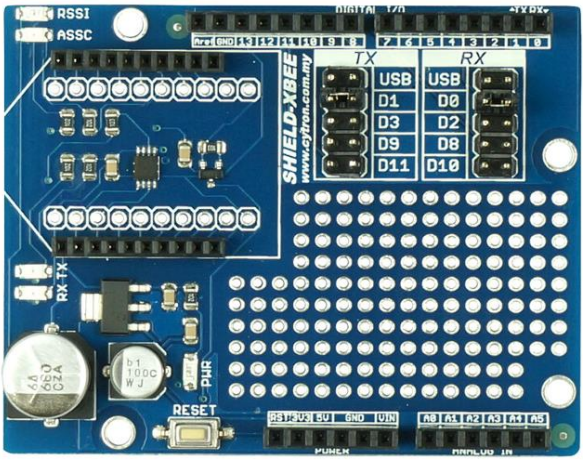

Figure 4.12 Cytron XBee Shield.

4.3 Circuits and Components Design

4.3.1 Hardware Implementation

The input device is a 3 x 3 grid arrangement key that makes it easier to enter text. The IR Transmitter and IR Receiver are placed same as the Figure 4.13 that show the 3 x 3 grid arrangement key to detect which key that user pressed.

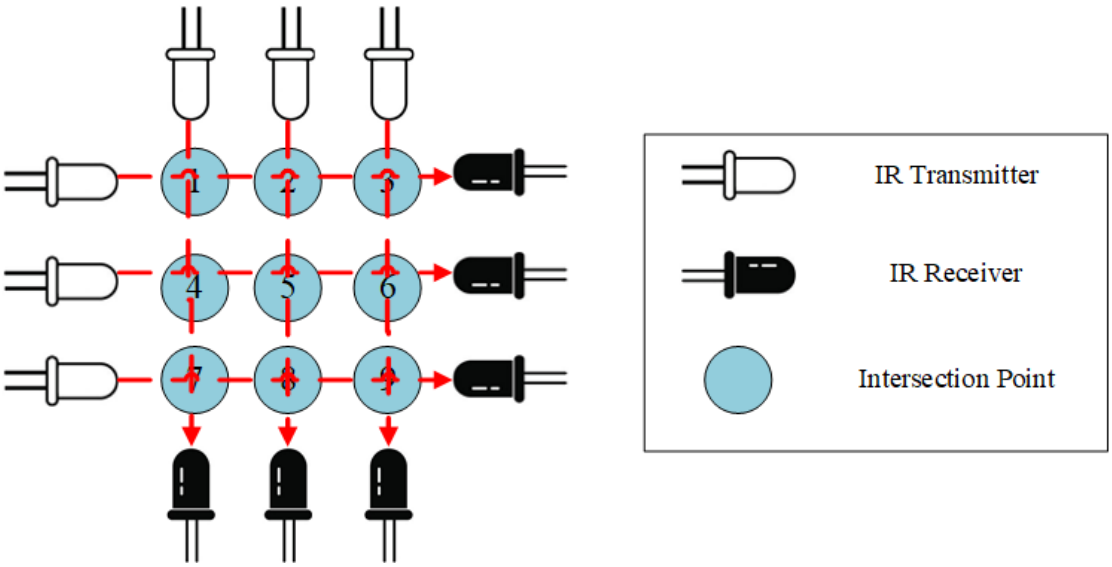

Figure 4.13 3 x 3 grid arrangement key to detect which key that user pressed.

From Figure 4.13, the infrared light propagates directly from IR Transmitter to IR Receiver. When intersection point is touched by user, the infrared light emitted by IR Transmitter of that path will be blocked. By using this concept, the IR Receiver is connected to the CT-UNO's analog pins. The CT-UNO has 10-bit ADC which mean that when input voltage is between 0 to 5V and it will convert it into digital values between 0 to 1023. The CT-UNO will receive the intersection point touched by the user as an analog signal and convert it to a digital signal. The GUI software will receive the digital signals to perform which key is pressed.

4.3.2 Infrared Board (PCB)

To create infrared board, EAGLE software is used to create the PCB. First, need to draw the schematic diagram for infrared board. The components that used in this schematic diagram is Arduino Uno R3 Shield, 6 x 10Kohm SMD resistor, 6 x 5mm IR Receiver and 6 x 5mm IR Transmitter. Figure 4.14 show the schematic diagram of infrared board.

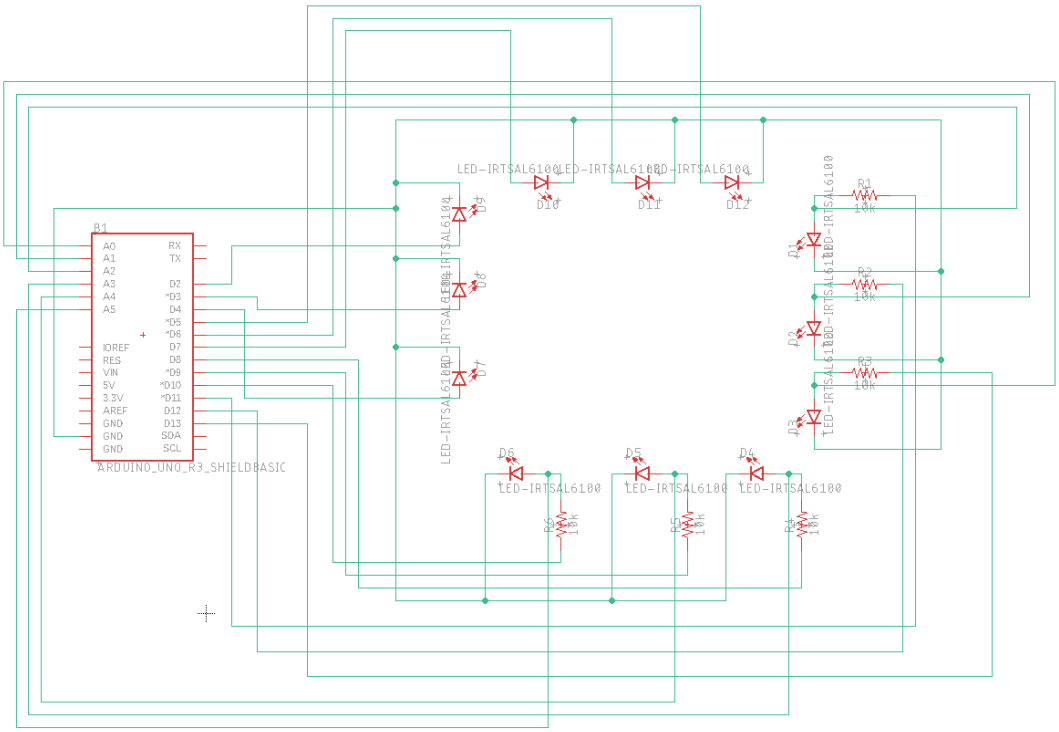

Figure 4.14 Schematic diagram of infrared board.

Then the following schematic diagram is converted to board format and do the wire routing. For the size of this PCB board will small in size so that user can hold it in one hand. Size of this PCB board will be 6.19 cm width and 5.587 cm height. Figure 4.15 show the board diagram of PCB.

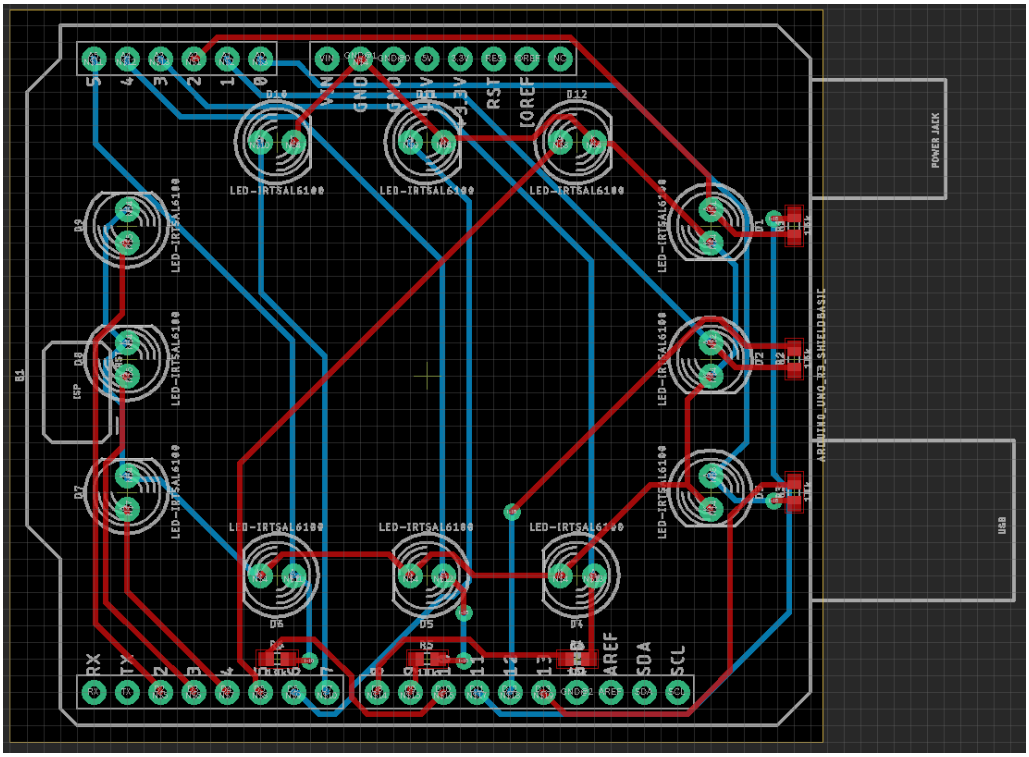

Figure 4.15 Board diagram of PCB.

After covert to Gerber format and done wire routing, the following design sends for PCB fabrication. Figure 4.16 show the PCB board after done fabrication.

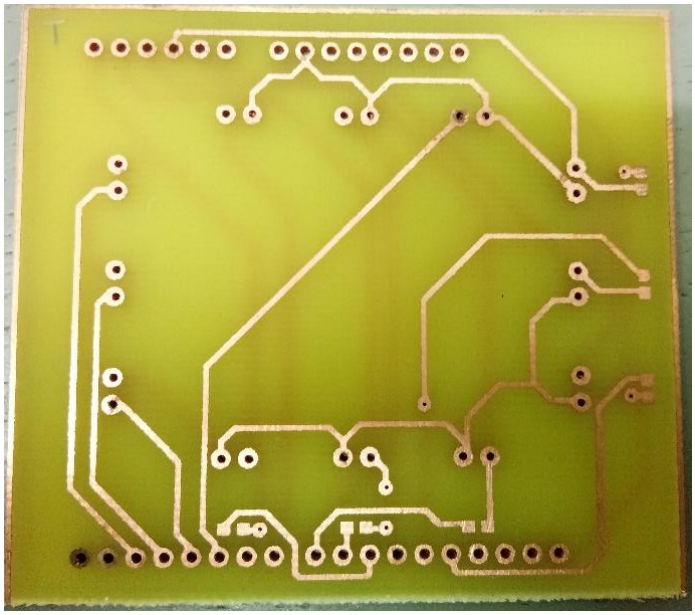

Figure 4.16 PCB board after done fabrication.

The components that mention in components specification will be solder on this PCB board. Figure 4.17 show the components that solder on PCB board.

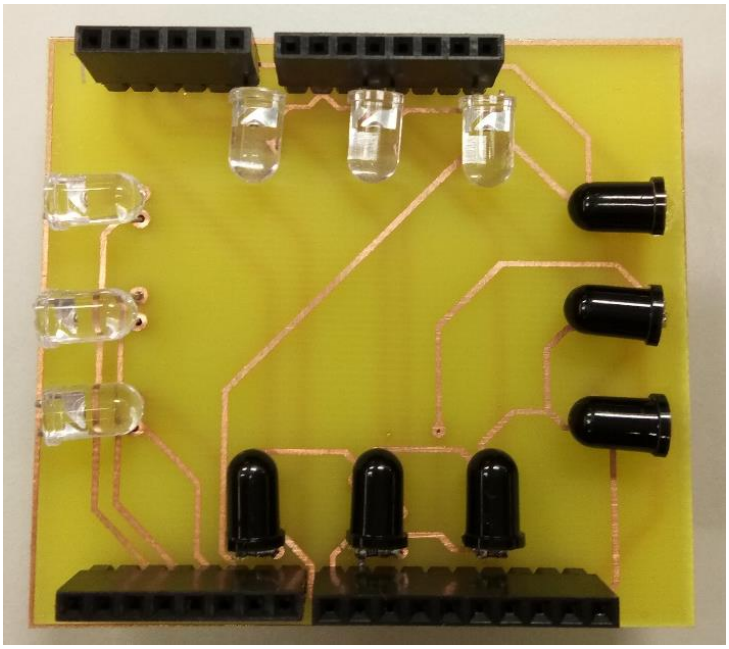

Figure 4.17 Components that solder on PCB board.

Then, use Arduino IDE to write the code to detect the intersection point that touched by user. From Figure 4.18 show the input device with the intersection point, user will know which intersection point that user need to pressed to represent which key is pressed in GUI software.

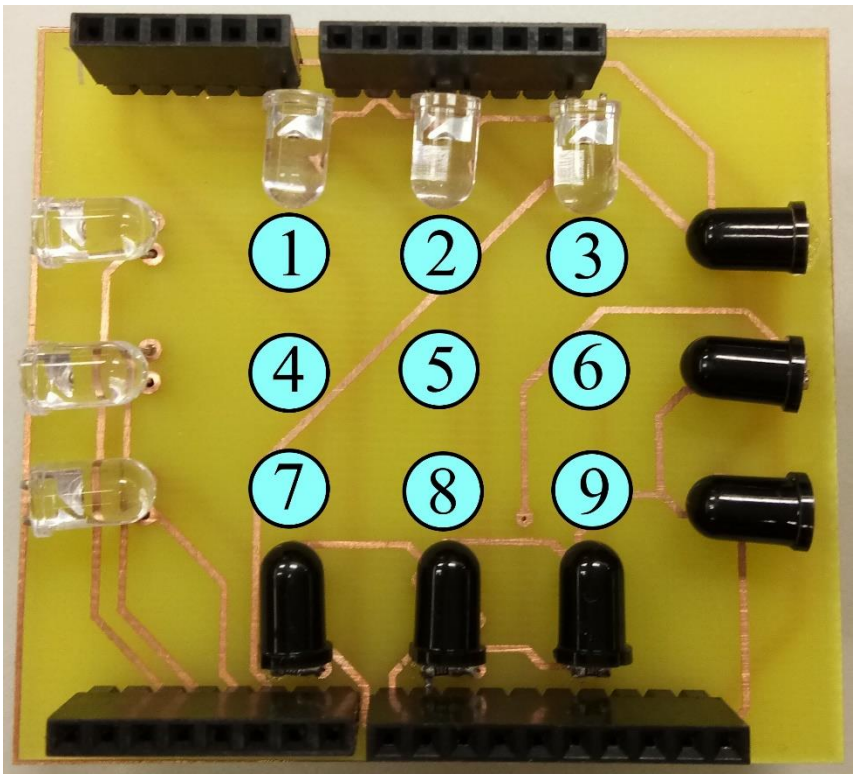

Figure 4.18 Input device with the intersection point.

4.3.3 Software Implementation

The GUI software is developed by using C# programming language. The interface of GUI is created similar to the input device which mean have 9 buttons that arranged same as input device which mean 3 x 3 grid arrangement key. Each button will having their own function which is 26 alphabets, numbers from 0 to 9, punctuations, Caps Lock, Shift, Enter, Tab, Backspace, Space, Select All, Copy, Cut, Paste, selection number from 1 to 6 to let user to select word, selection number from 1 to 6 to let user to remove word and Esc function.

This GUI software have “Connect”, “Disconnect” button and drop-down list to let user choose the COM port and connect to the input device. This GUI software also have a search box to let user enter the alphabets to search the word in list box and the list box is contain more than 58000 English word to let user choose to print on the third application by using the selection number. Single tap method is used for this system which mean user need to press the intersection point of the infrared text entry board for one time, the selected letter will print in search box and using number key to select the word to print in third applications.

The prediction system uses the Contains method to search for words in the list box, which means that the user enters a letter in the search box and it will start searching for words that contain the following alphabets. For example, user typing “hap”. The search box will start to search the word which contains “hap” such as “chapter”, “happy” or “perhaps”. Figure 4.19 show the demonstrate of the GUI display and Figure 4.20 show the demonstrate of the GUI display with indictor.

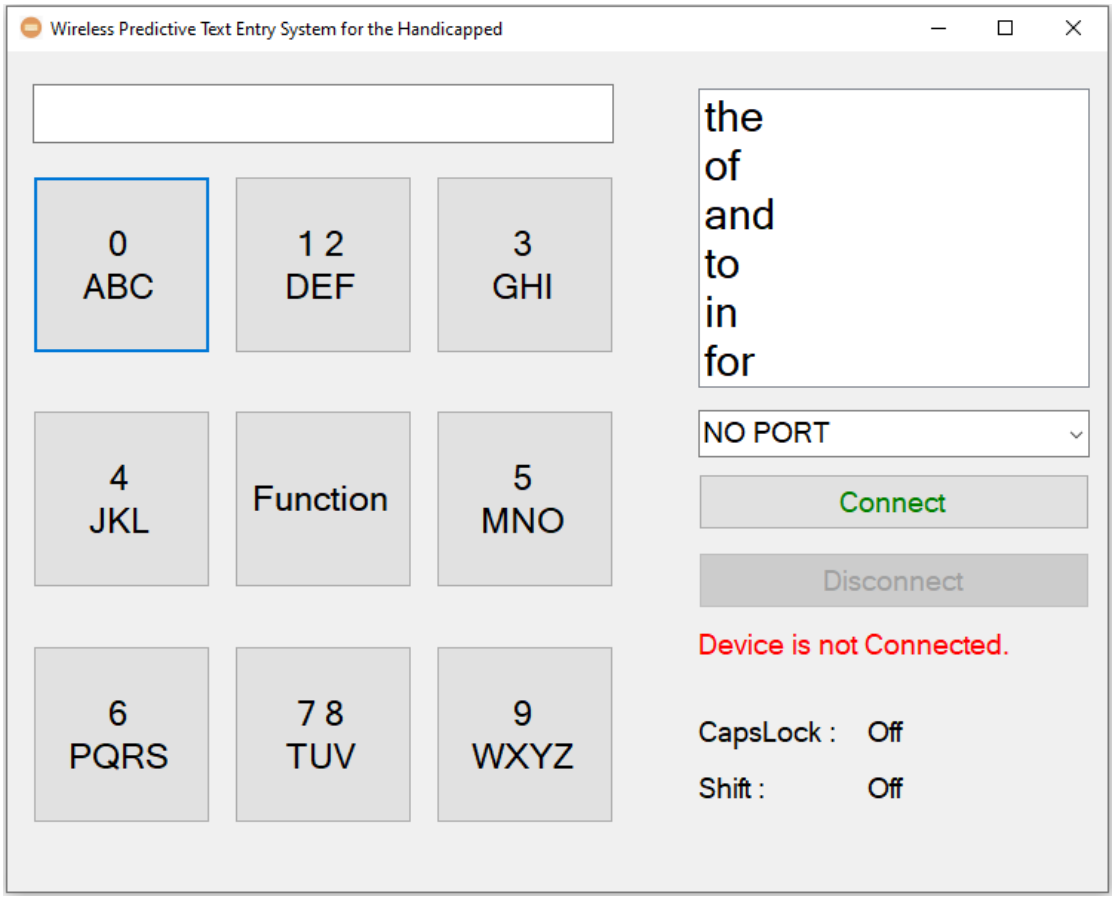

Figure 4.19 Demonstrate of the GUI display.

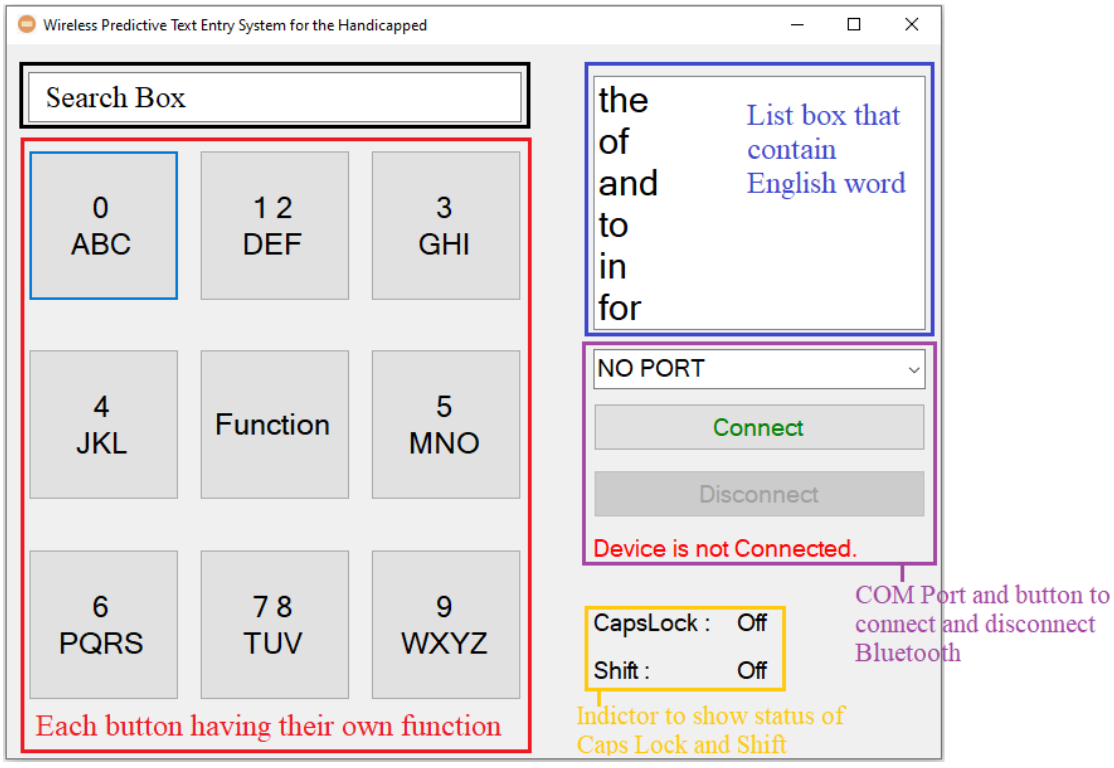

Figure 4.20 Demonstrate of the GUI display with indictor.

4.4 System Components Interaction Operations

4.4.1 Flowchart of Hardware

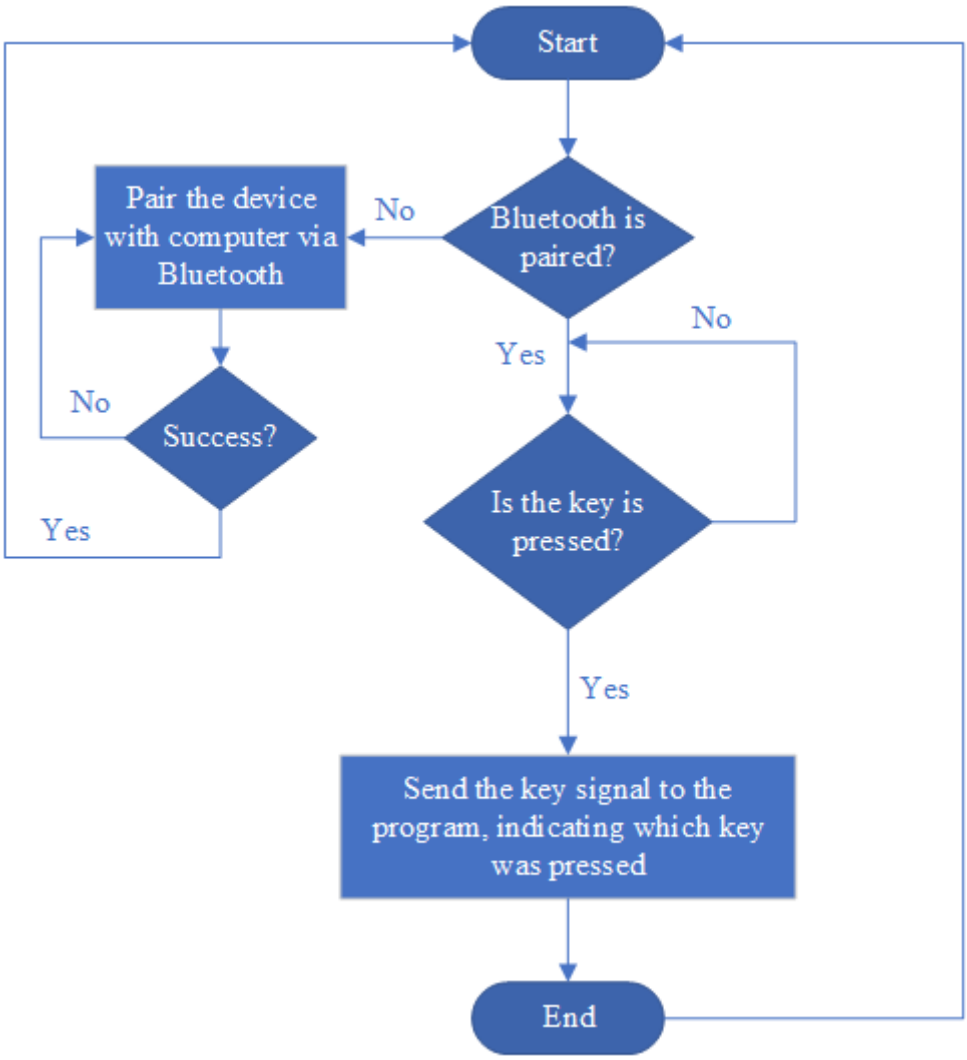

Figure 4.21 Flowchart for the hardware part.

From the Figure 4.21, it shows the flow for the hardware part. After starting the device for the first time, the user must first pair the input device with the computer via Bluetooth and it is one-time process. After the pairing is complete, the input device will wait to detect the intersection point that touched by the user. If the first intersection point is touched, the first key signal of the intersection point is sent to the GUI software, instructing the GUI software to press this button, and then the GUI software will continue.

4.4.2 Flowchart of Software

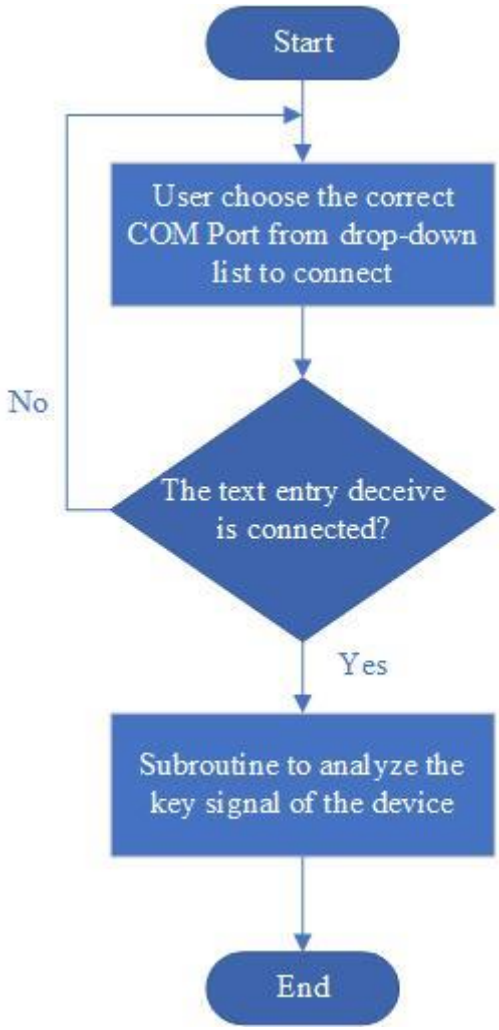

Figure 4.22 Flowchart for the software part.

From the Figure 4.22, it shows the flow for the software part. First, user starts the program, then user needs to select the COM port. After the connection is successful, when user touch the intersection point of the infrared board, it will start run the subroutine of this software. This subroutine will check the intersection point that user touched and the intersection point's signal will be received by device to interpret which button is touched by user, and finally it will print the character or execute the function of the GUI software. Appendix A show the flowchart of the subroutine.

4.4.3 Flowchart of Hardware and Software Implementation

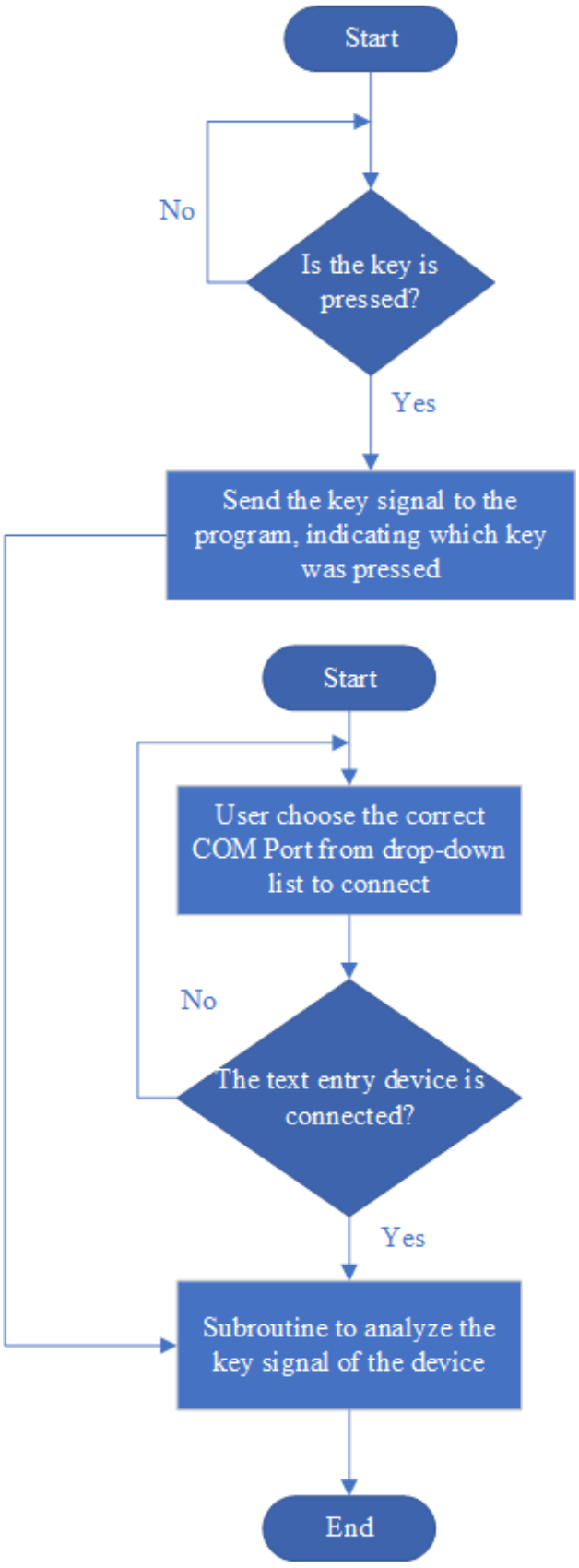

Figure 4.23 Flowchart for the hardware and software implementation.

From the Figure 4.23, it shows the flow for the hardware and software implementation. The user needs to plug in the power supply for the input device first. After starting the input device, user can now start to launch the GUI software. After the user starts the GUI software, the user must manually select the COM port of the input device, and click the “Connect” button. Then, if a connection is established between the input device and the GUI software, the GUI software will change the indictor status to “Connected to the device” and this wireless predictive text entry system is ready to use. If the user wants to close or stop input device from connecting to GUI software, user only needs to click the “Disconnect” button and close the program.

Chapter 5: System Implementation

5.1 Hardware Setup

First, mount the Cytron XBee Shield on the CT-UNO. Figure 5.1 show the side view of the Cytron XBee Shield is mounted on the CT-UNO.

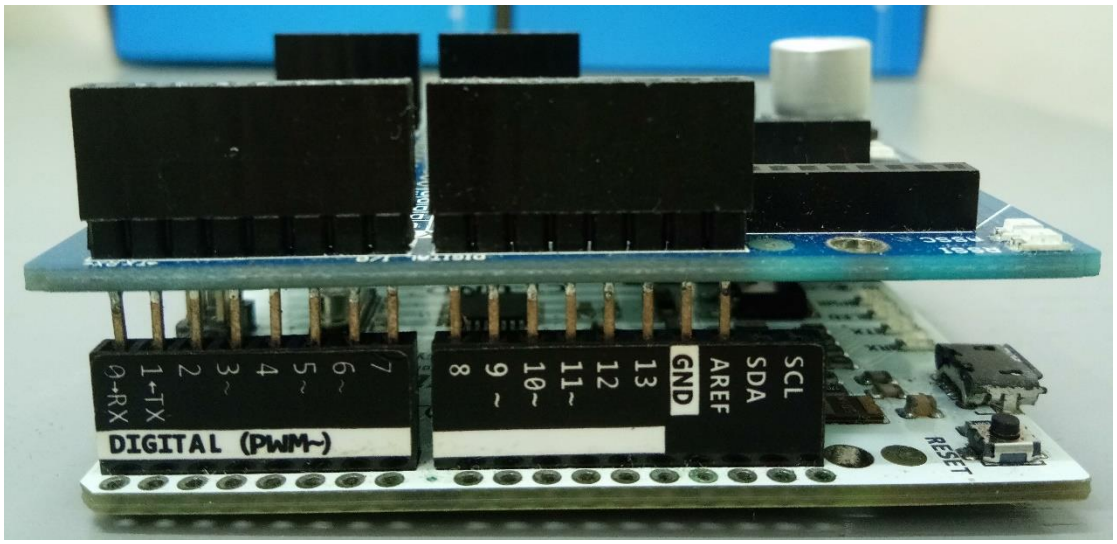

Figure 5.1 Side view of the Cytron XBee Shield is mounted on the CT-UNO.

Then, change the Cytron Bluetooth module to Trans mode before mounted it on the Cytron XBee Shield and change the TX and RX jumper of the Cytron XBee Shield to D1 and D0. From the Figure 5.2, the red box shows the place that Cytron Bluetooth module that need to mount and purple box show the TX and RX jumper. From Figure 5.3 the green box show the Cytron Bluetooth module change to Trans mode. Then, mount the Cytron Bluetooth module on the Cytron XBee Shield. Figure 5.4 show the side view after mounted Cytron Bluetooth module with Cytron XBee Shield and Figure 5.5 show the top view after mounted Cytron Bluetooth module with Cytron XBee Shield.

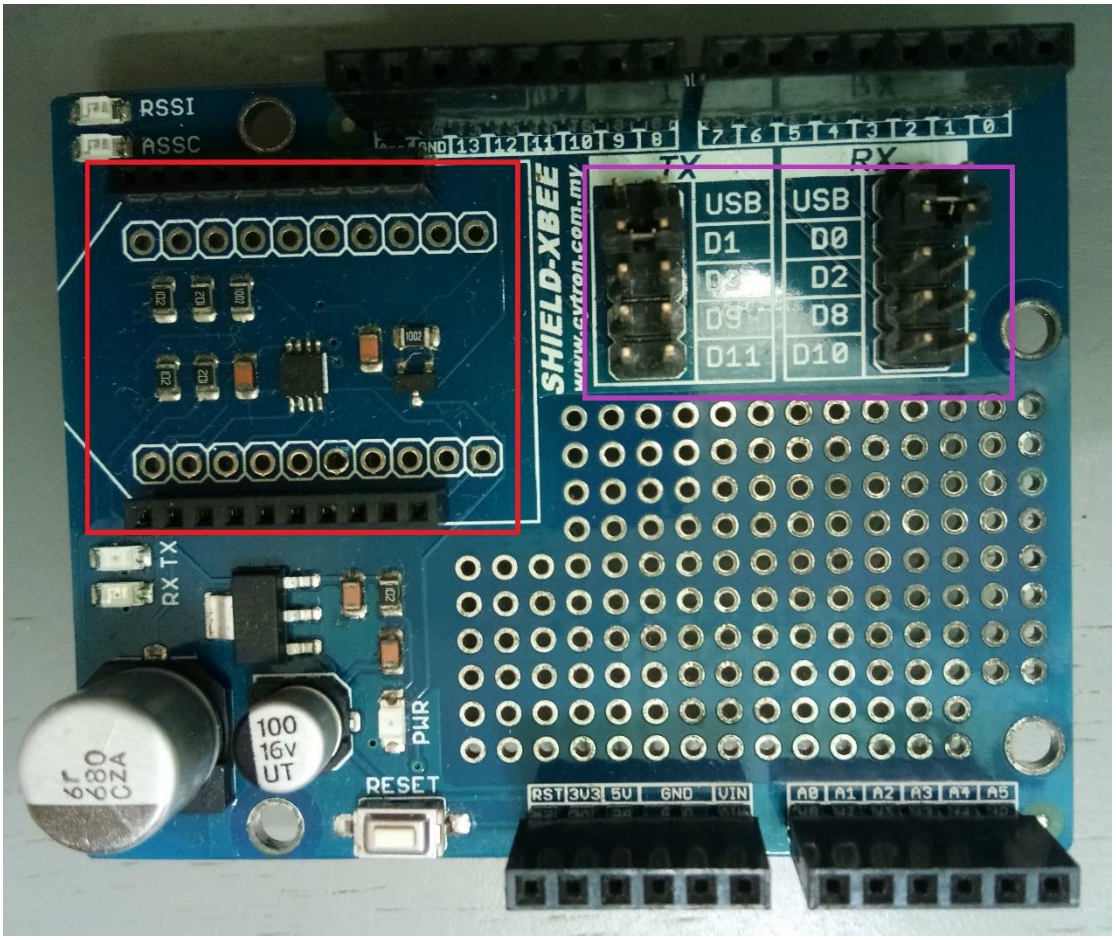

Figure 5.2 Red box shows the place that Cytron Bluetooth module that need to mount and purple box show the TX and RX jumper.

Figure 5.3 Green box show the Cytron Bluetooth module change to Trans mode.

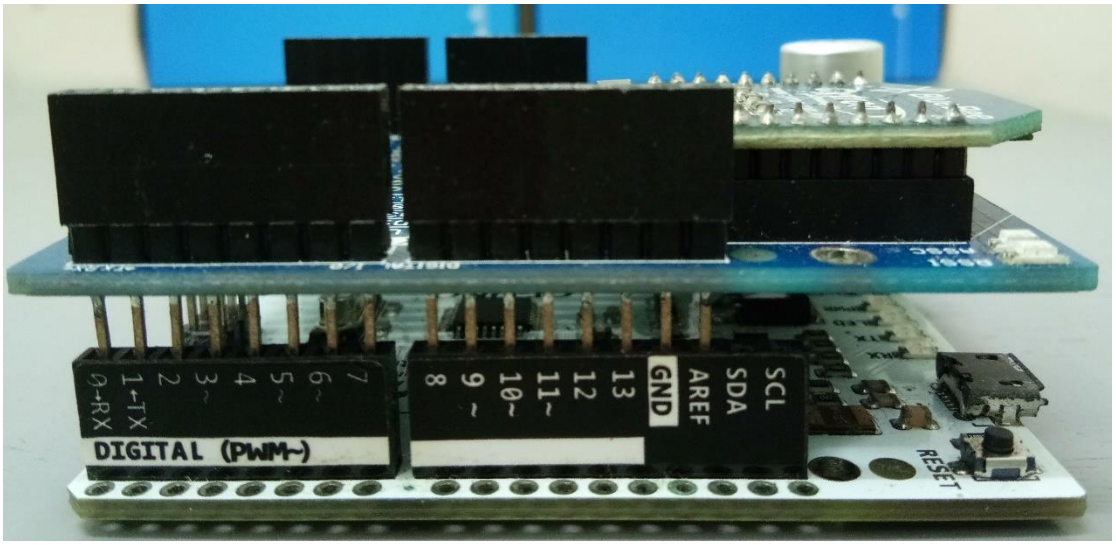

Figure 5.4 Side view of the after mounted Cytron Bluetooth on the Cytron XBee Shield.

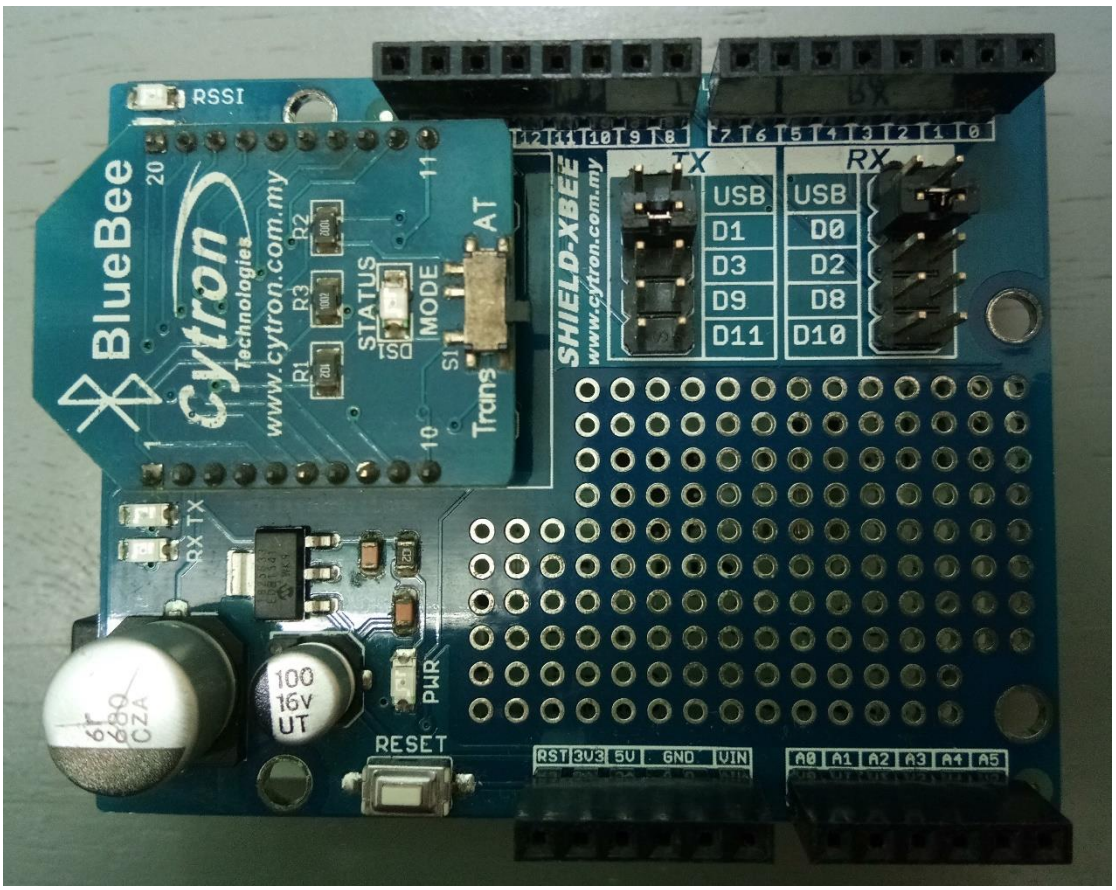

Figure 5.5 Top view after mounted Cytron Bluetooth module with Cytron XBee Shield.

Lastly, mount the created infrared board on the Cytron XBee Shield. Figure 5.6 show the side view after mounted created infrared board on the Cytron XBee Shield.

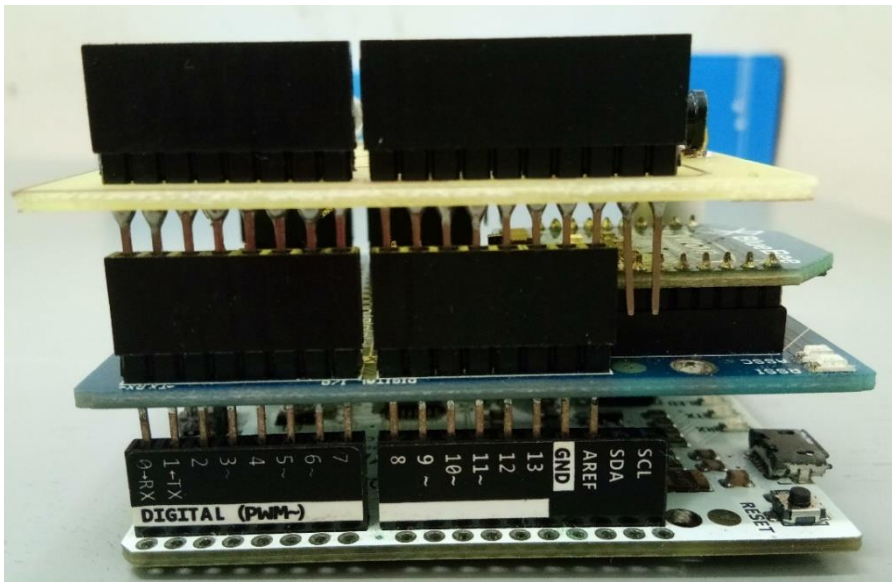

Figure 5.6 Side view after mounted created infrared board on the Cytron XBee Shield.

User right now can use this input device by plug in the power bank with USB Micro-B. Figure 5.7 show the input device after plug in with the power bank.

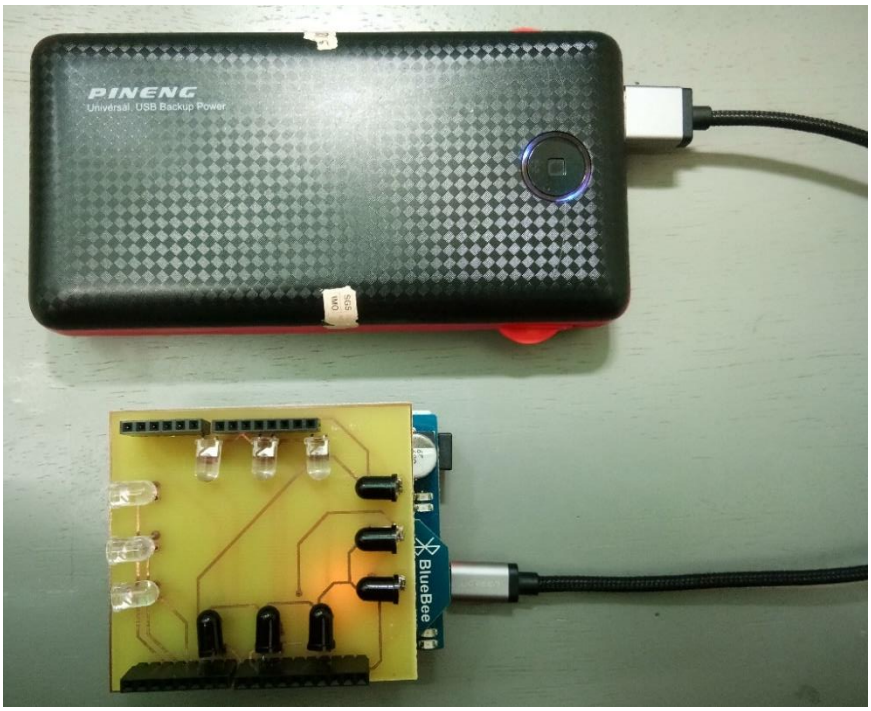

Figure 5.7 Input device after plug in with the power bank.

5.2 Software Setup

First, install the Arduino IDE software, this software can download from the Arduino official website. Figure 5.8 show the interface of Arduino IDE software after installed.

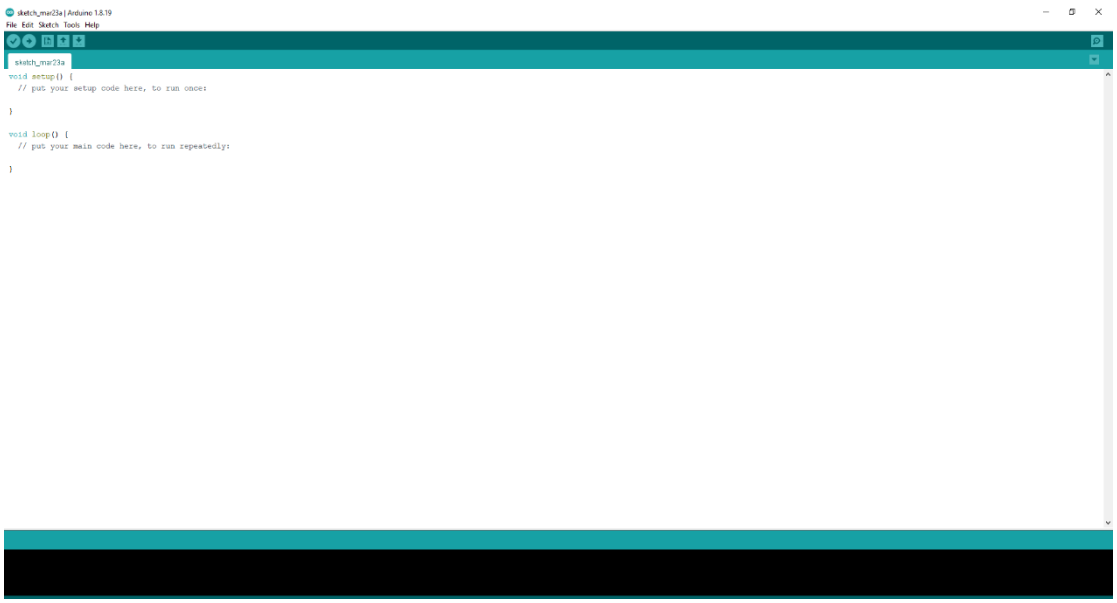

Figure 5.8 Interface of Arduino IDE software after installed.

Second, install the Microsoft Visual Studio software, this software can download from the Microsoft Visual Studio official website. Figure 5.9 show the interface of Microsoft Visual Studio software after installed.

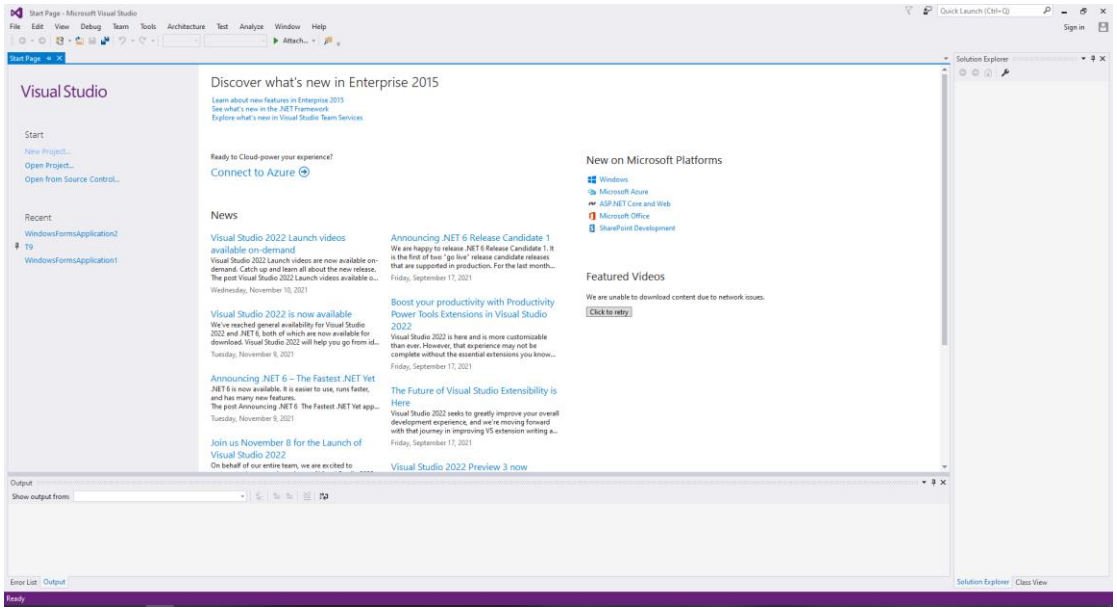

Figure 5.9 Interface of Microsoft Visual Studio software after installed.

5.3 Setting and Configuration

First user needs to connect the device with the power supply. User can use power bank to turn on the input device.

Before connect the input device with the predictive text entry system, user need to connect the device with computer or laptop via Bluetooth. First, user need to open the Bluetooth setting menu first. User can find the Bluetooth setting menu in Setting > Devices. Then user need to need to click the Bluetooth to turn on. Figure 5.10 show the setting menu and Figure 5.11 show the Bluetooth setting menu.

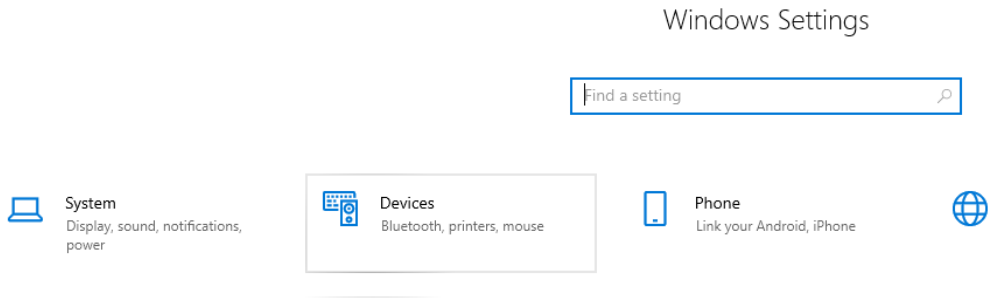

Figure 5.10 Setting menu.

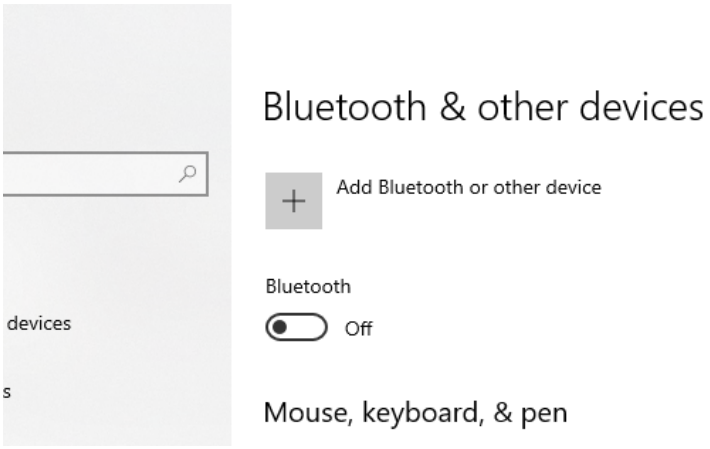

Figure 5.11 Bluetooth setting menu.

After turn on the Bluetooth, user need to click “Add Bluetooth or other device”, then click “Bluetooth” and it will start searching device automatically. Figure 5.12 show how to add device. When it founded the Bluetooth device name, “H-C-2010-06-01”, user need to enter the PIN number “1234” and click “Connect”. After done connect the device, it will show that device is ready to use. Figure 5.13 show how to connect the Bluetooth device and Figure 5.14 show that device is ready to use.

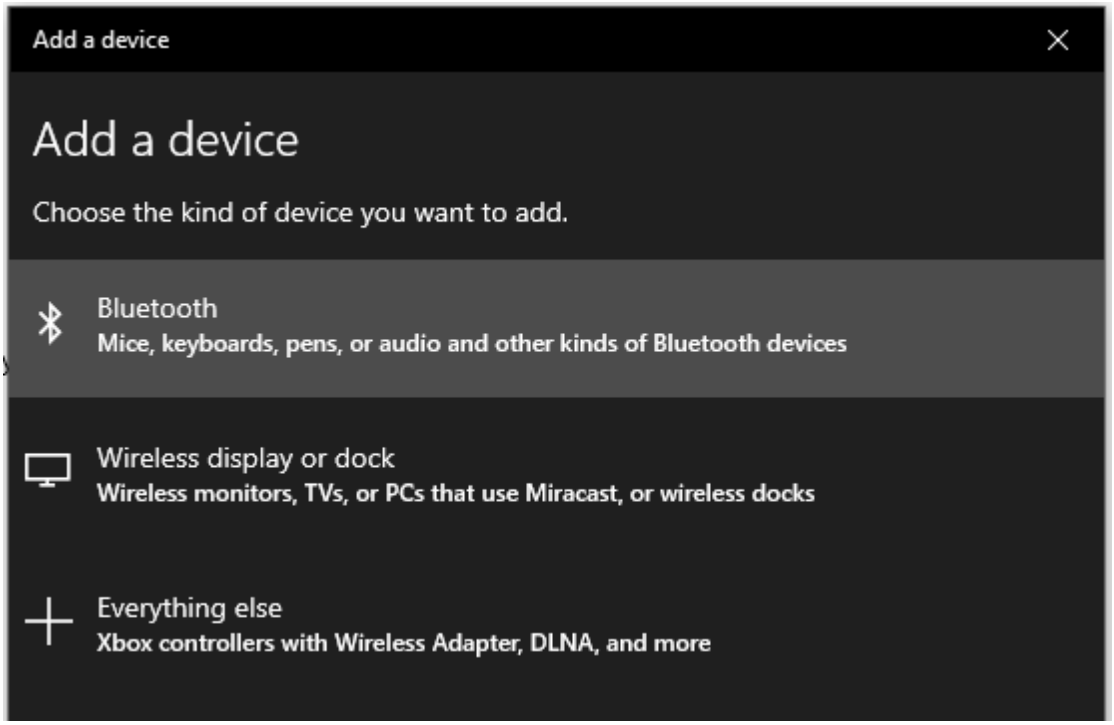

Figure 5.12 How to add device.

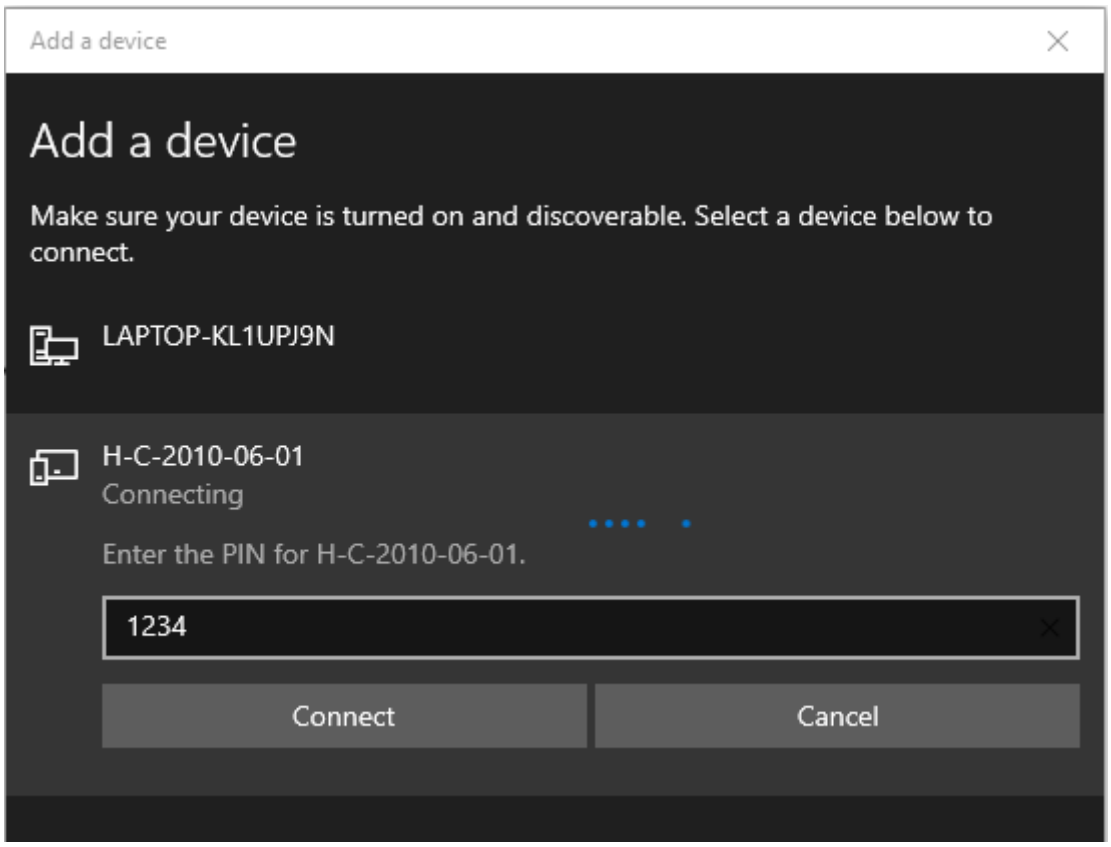

Figure 5.13 How to connect the Bluetooth device.

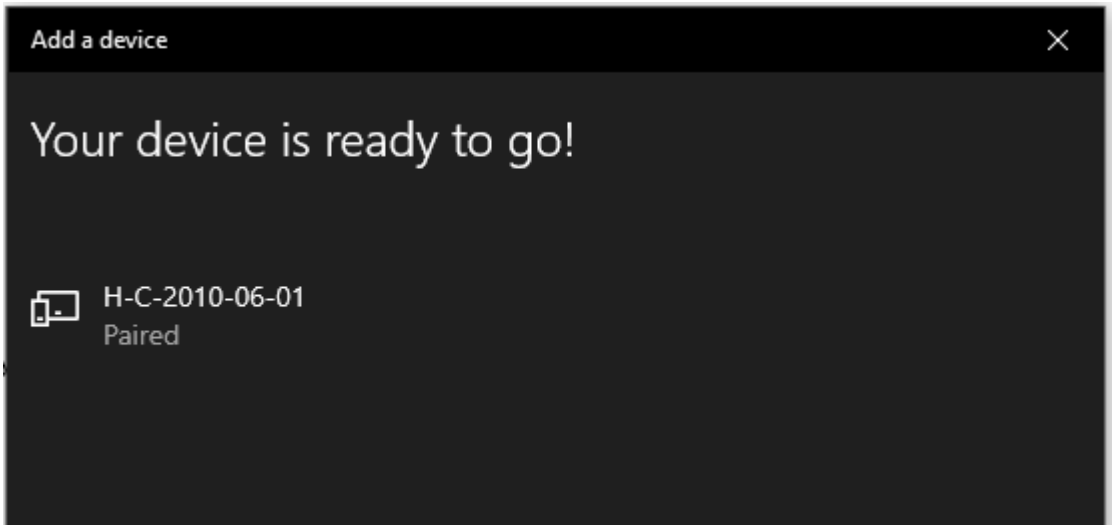

Figure 5.14 Device is ready to use.

Then user need to know which COM port is connected to this input device. User can go to Control Panel > Hardware and Sound > Device and Printers, then choose the Bluetooth module name “H-C-2010-06-01” and click right click to choose properties. Then user click “Hardware” tab to see which COM port is used for this device. Figure 5.15 show the COM port that used by input device.

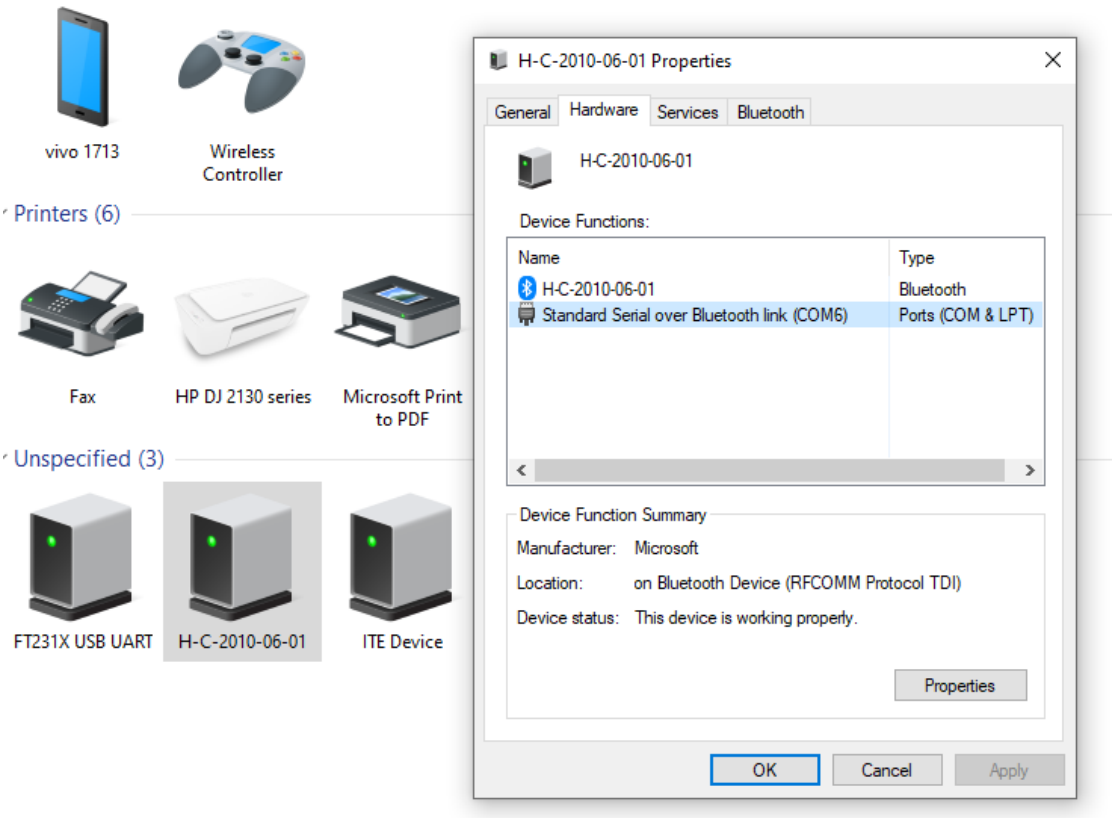

Figure 5.15 COM port that used by input device.

After done connect the input device with computer via Bluetooth. User now can connect the GUI Software. First, user need to launch the GUI Software, then choose the correct COM port for input device, in this case, COM port 6 is used for this input device. Then click the “Connect” button to connect the device via Bluetooth. Figure 5.16 show the GUI software connected to the input device.

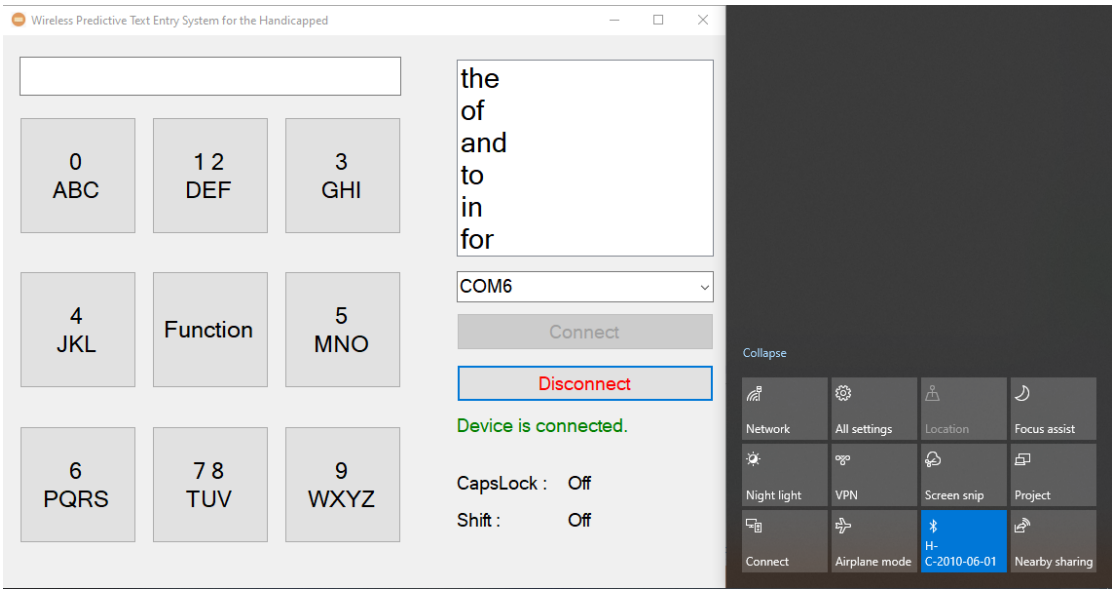

Figure 5.16 GUI software connected to the input device.

5.4 System Operation

5.4.1 How to use the Program

Figure 5.17 show the main menu when the user starts the program. From Figure 5.17, on the main menu of the program, the program was created using a 3x3 grid arrangement key, and it also has a list box that contains frequently used words by users. In addition, it also has the function that required user to manually select the correct COM port to connect to the text input device. It also has the search box that allows typing some character of the words without typing the entire words and then search the words inside the list box.

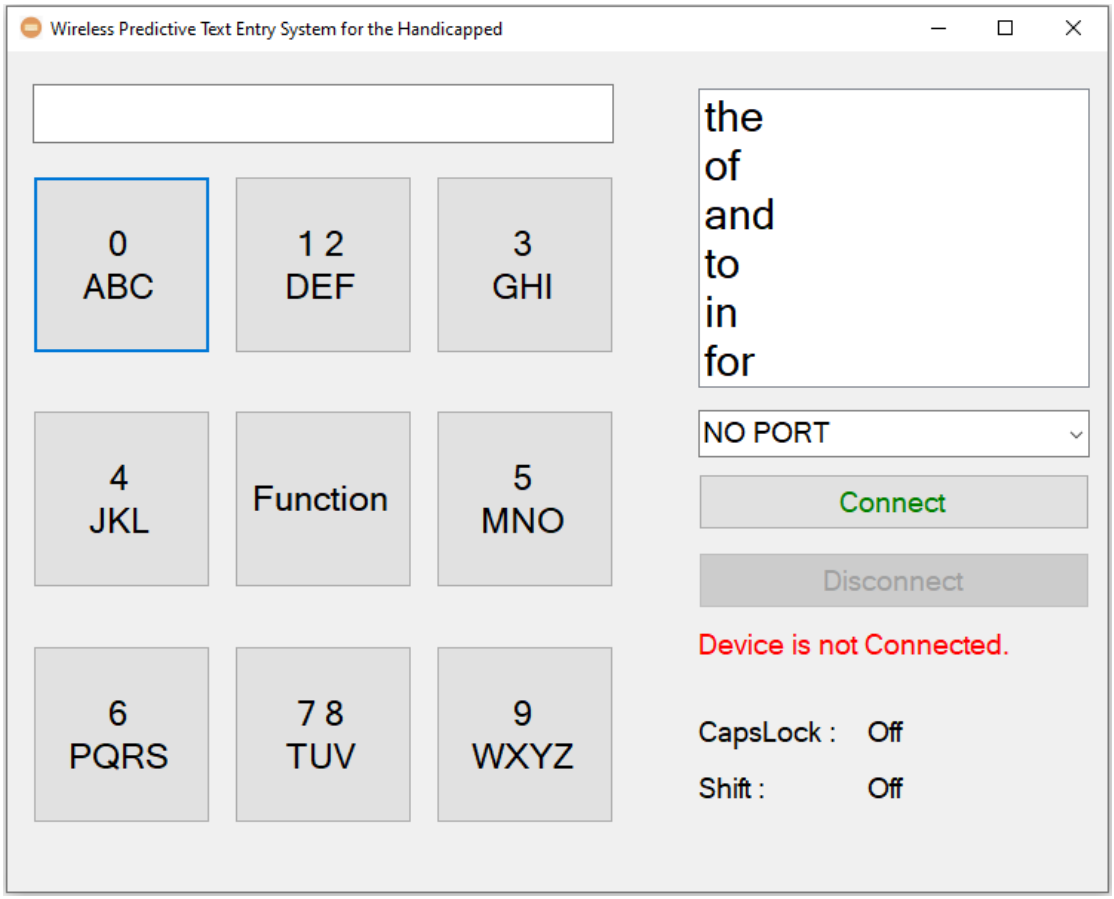

Figure 5.17 Main menu when the user starts the program.

Before starting the GUI software, a third application, such as Notepad, needs to be opened. Then, select the correct COM port to connect to the input device. There is an indictor will be showing the status of device at the right bottom of the program. Figure 5.18 show the interface of this program after connect with the input device.

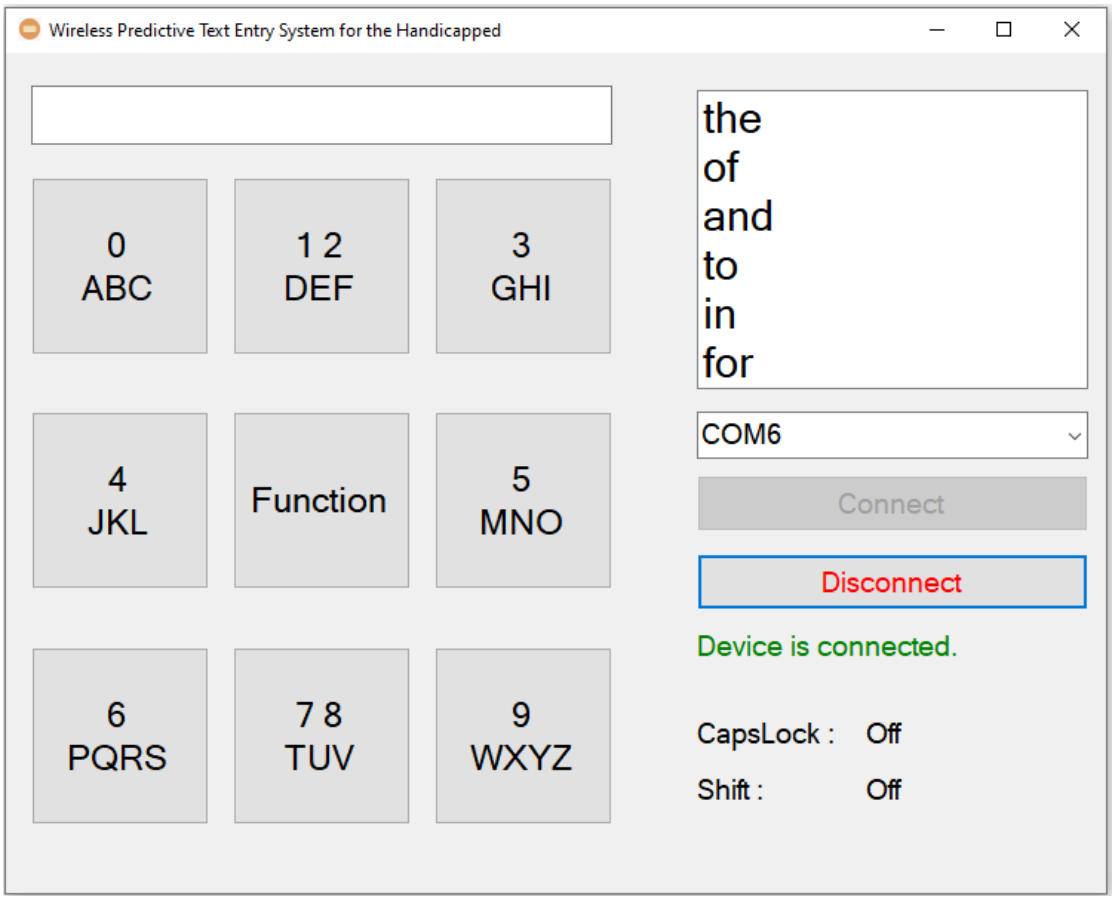

Figure 5.18 Interface of this program after connect with the input device.

This system using single tap method. For example, the user wants to typing the "surprisingly" on the computer. First, the user needs press 7th key intersection point of the input device for one time and GUI program will receive the signal from the input device and represent 7th button is pressed in GUI program. After that, the program interface will switch to second page and displaying the letters "p", "q", "r", "s" and the numbers "6". Figure 5.19 show the GUI software interface when the 7th key is pressed.

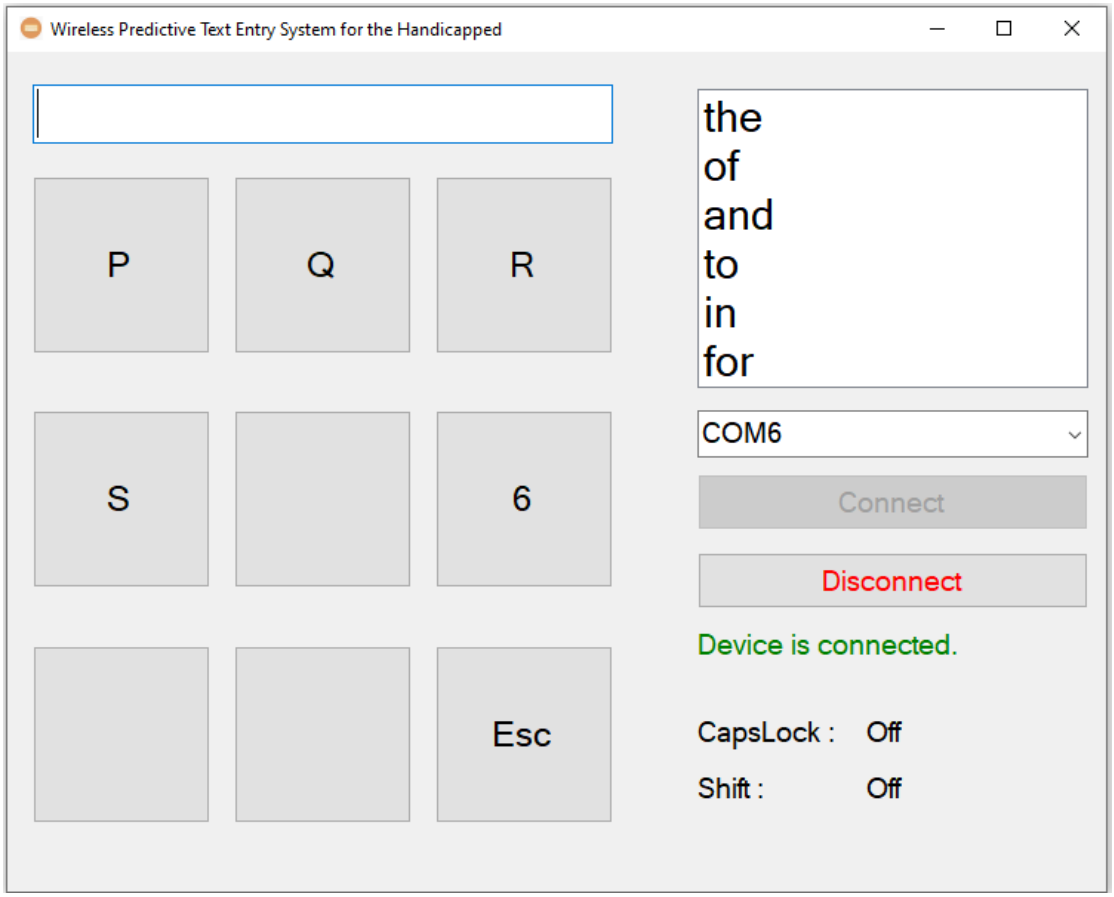

Figure 5.19 GUI software interface when the 7th key is pressed.

Then, user need to press the 4th key of the input device to enter the letter “s” in the search box and the list box will start to find words starting with the letter “s”. The program also will return to the main page of the program after the letter pressed. If the list box does not display the word that the user wants in the list box, user needs to continue typing until the word that the user wants is displayed in the list box. From the Figure 5.20 show the program interface after the 4th key is pressed and list box show the words that user wants.

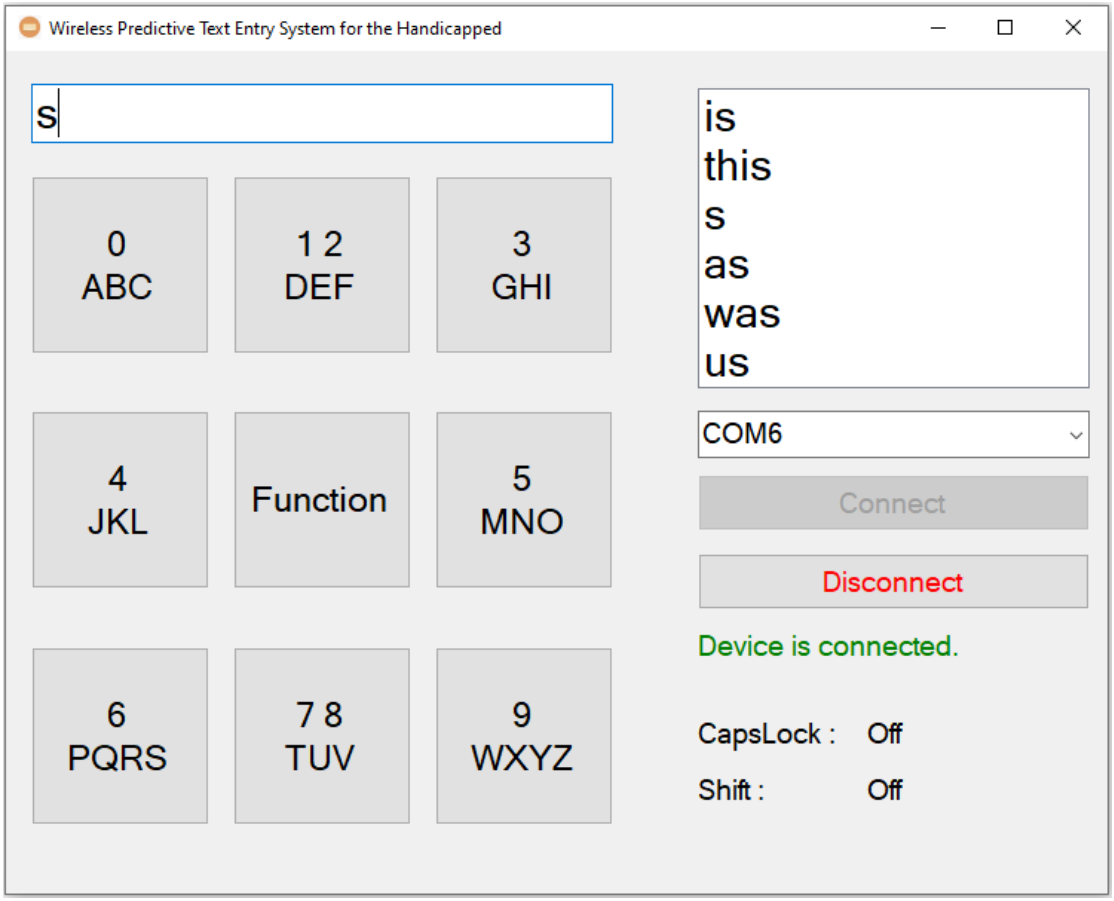

Figure 5.20 Program interface after the 4th key is pressed and list box show the words that user wants.

When the user wanted words is show in list box, the user presses the “Function” button which is 5th key of the input device. Figure 5.21 show the second page of the “Function” button pressed. Then, user press the press the “Choose” button which 8th key of the input device.

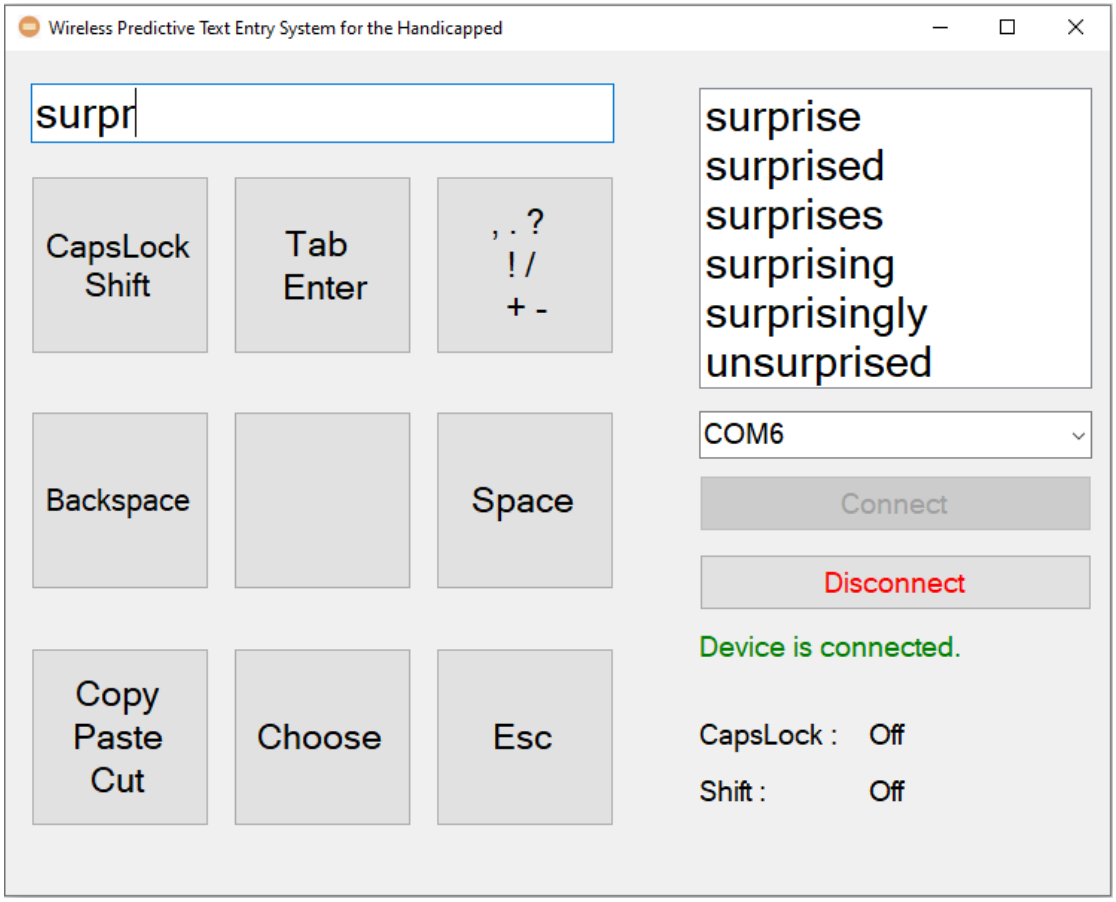

Figure 5.21 Second page of the “Function” button pressed.

After user press the “Choose” button, the user can start to select the words in list box by press the number key which is from 1st key to 6th key. Figure 5.22 show the third page after “Choose” button is pressed.

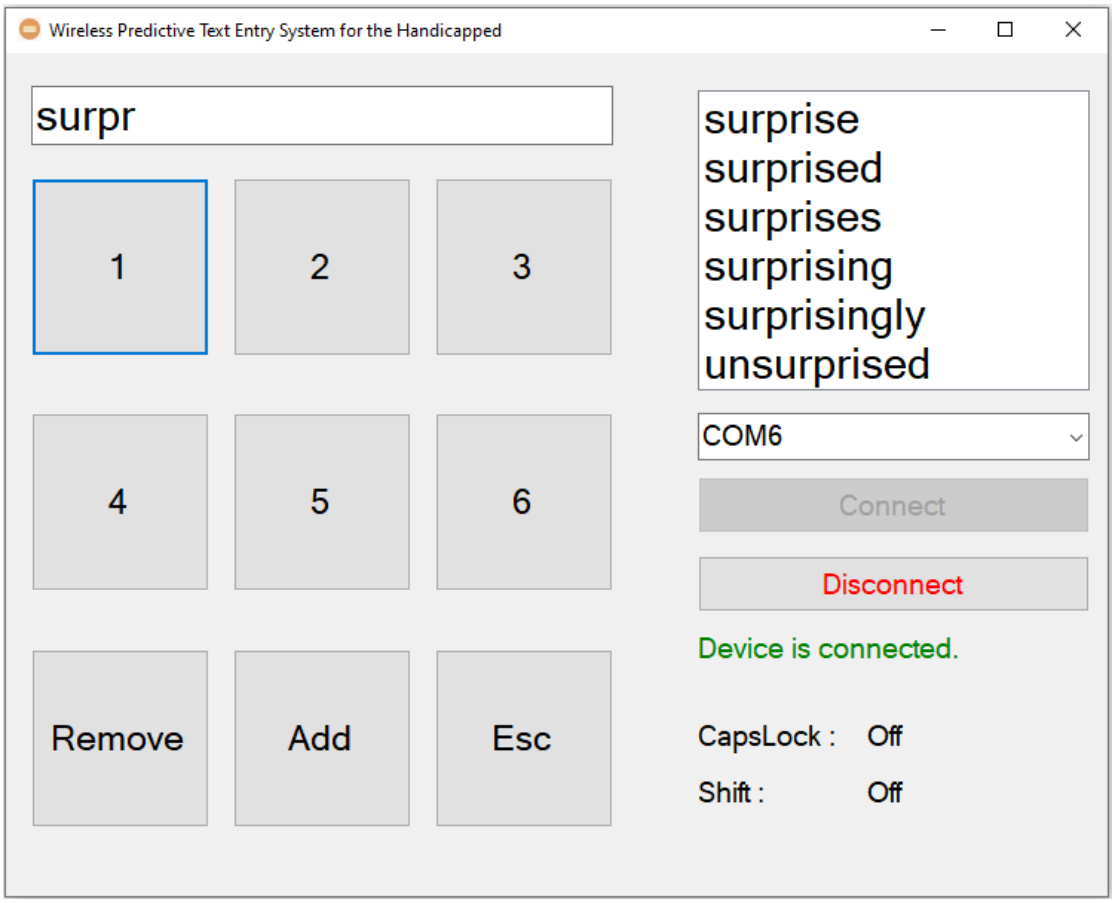

Figure 5.22 Third page after “Choose” button is pressed.

After the user press the number button, the selected words will be printed in the third applications and the GUI program will return to the function page of the program. Figure 5.23 show the selected words have been printed and the program return to function menu.

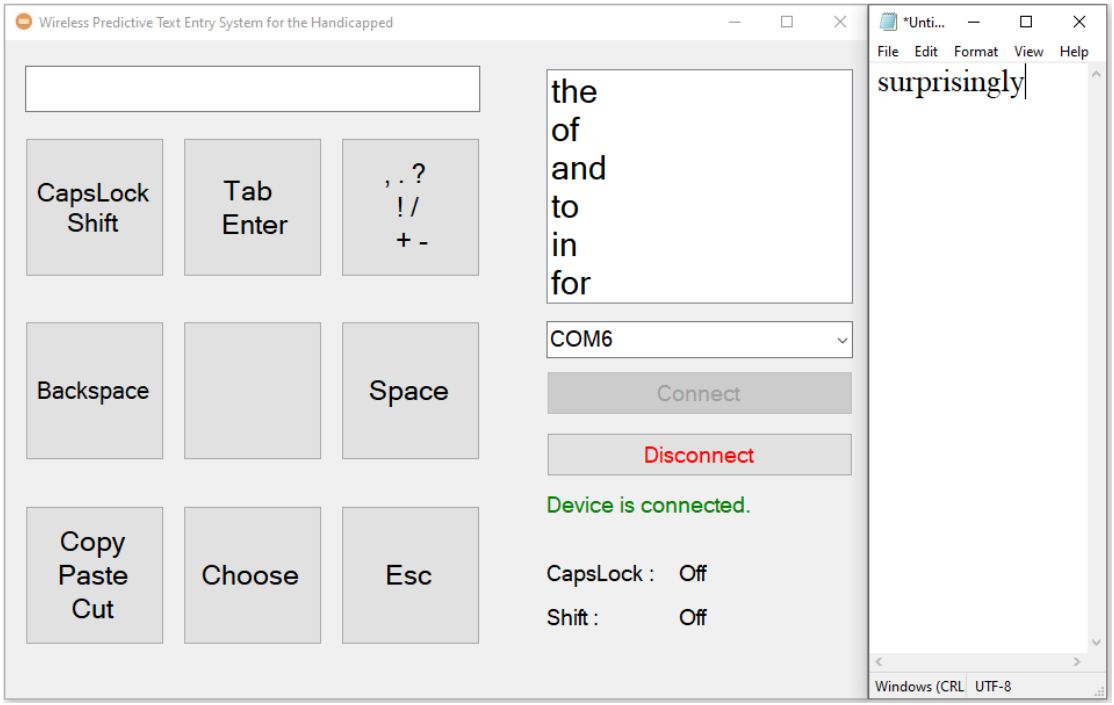

Figure 5.23 Selected words have been printed and the program return to the function menu.

If the user enters some words that not inside list box, user press the "Add" button in the "Choose" page, the unknown word will save inside the User Dictionary file. Figure 5.24 show the "Add" button.

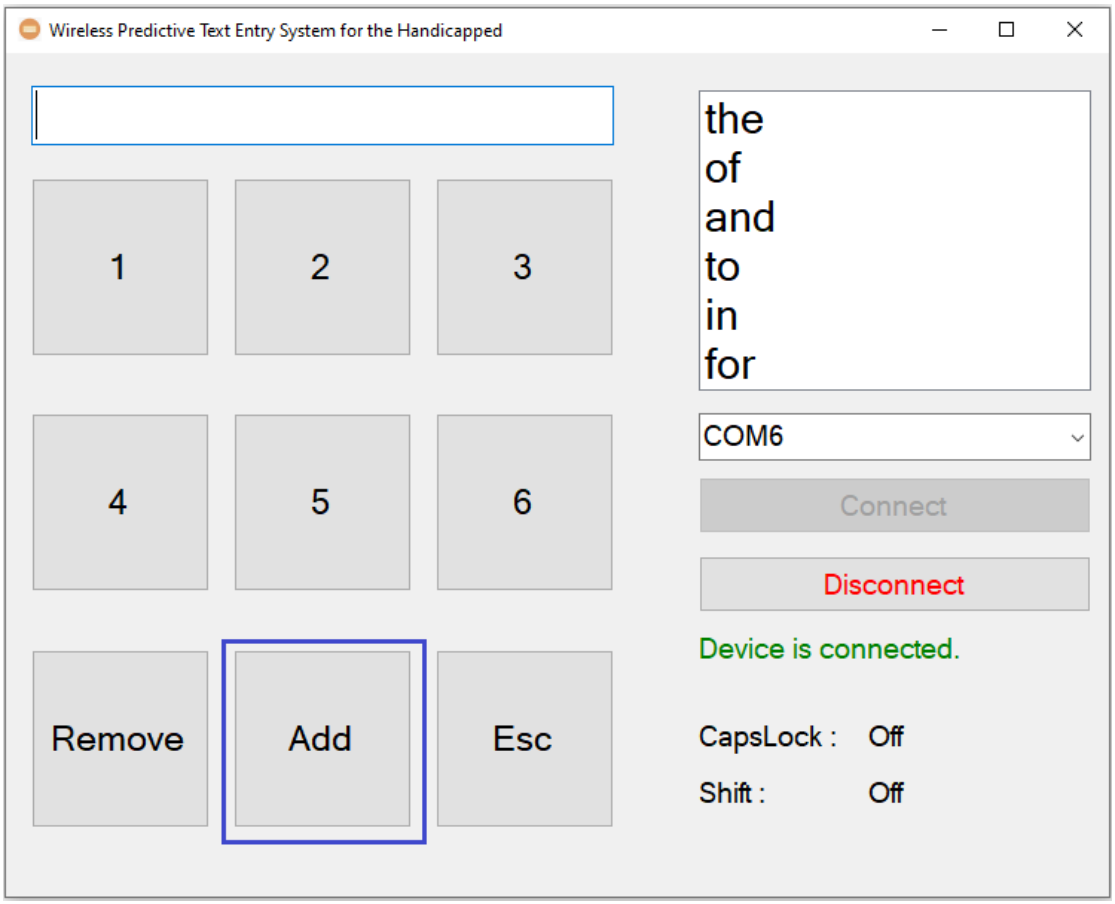

Figure 5.24 "Add" button.

If the user presses the wrong button by mistake, user can press the 9th key in the "Esc" program to return to the previous page. Figure 5.25 show the "Esc" button.

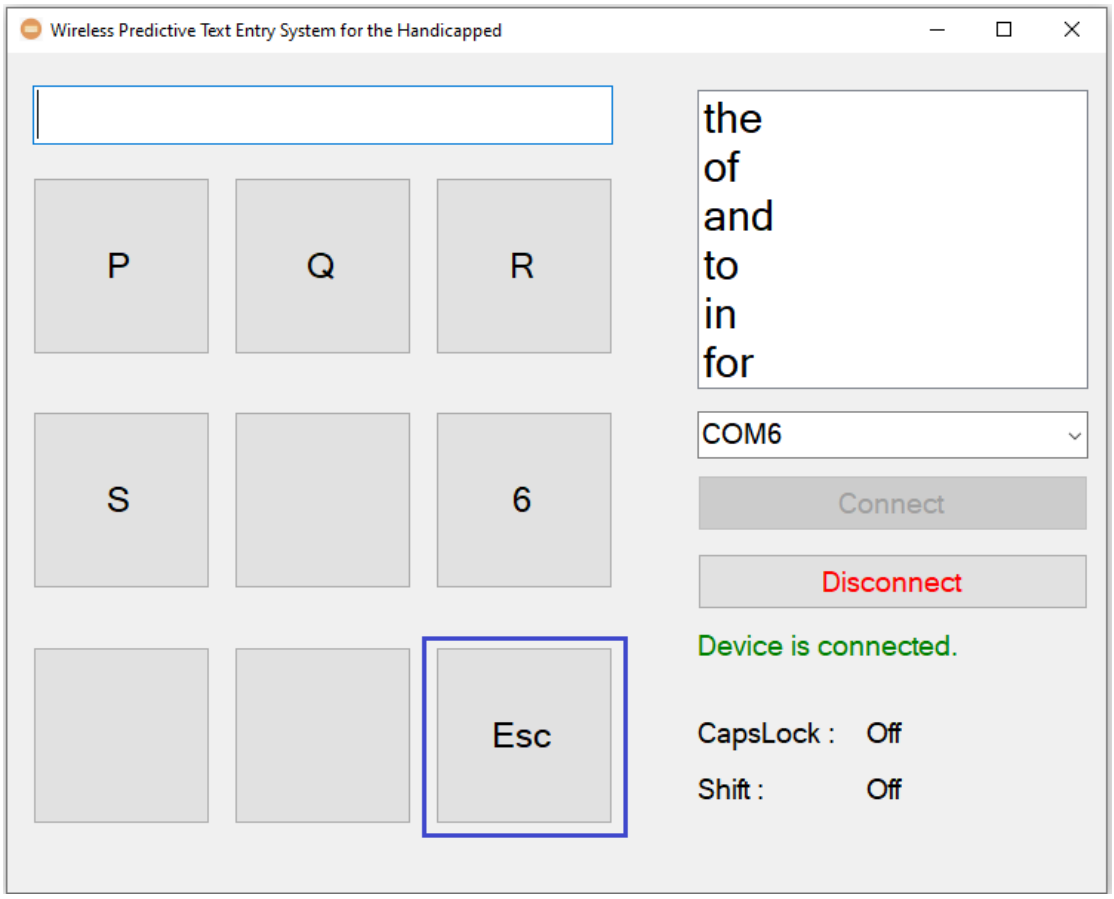

Figure 5.25 “Esc” button.

5.4.2 The "Function" button in the program

The "Function" button of this program is located in 5th key in the main menu. Figure 4.8 show the "Function" button. After the "Function" button pressed, program will show the second page of the "Function". Table 5.1 and Figure 5.26 show the interface of the program after pressed "Function".

Key	Button
1	Caps Lock, Shift
2	Tab, Enter
3	Punctuation
4	Backspace
5	-
6	Space
7	Copy, Paste, Cut, Select All
8	Choose
9	Esc

Table 5.1 Function of the program after pressed "Function".

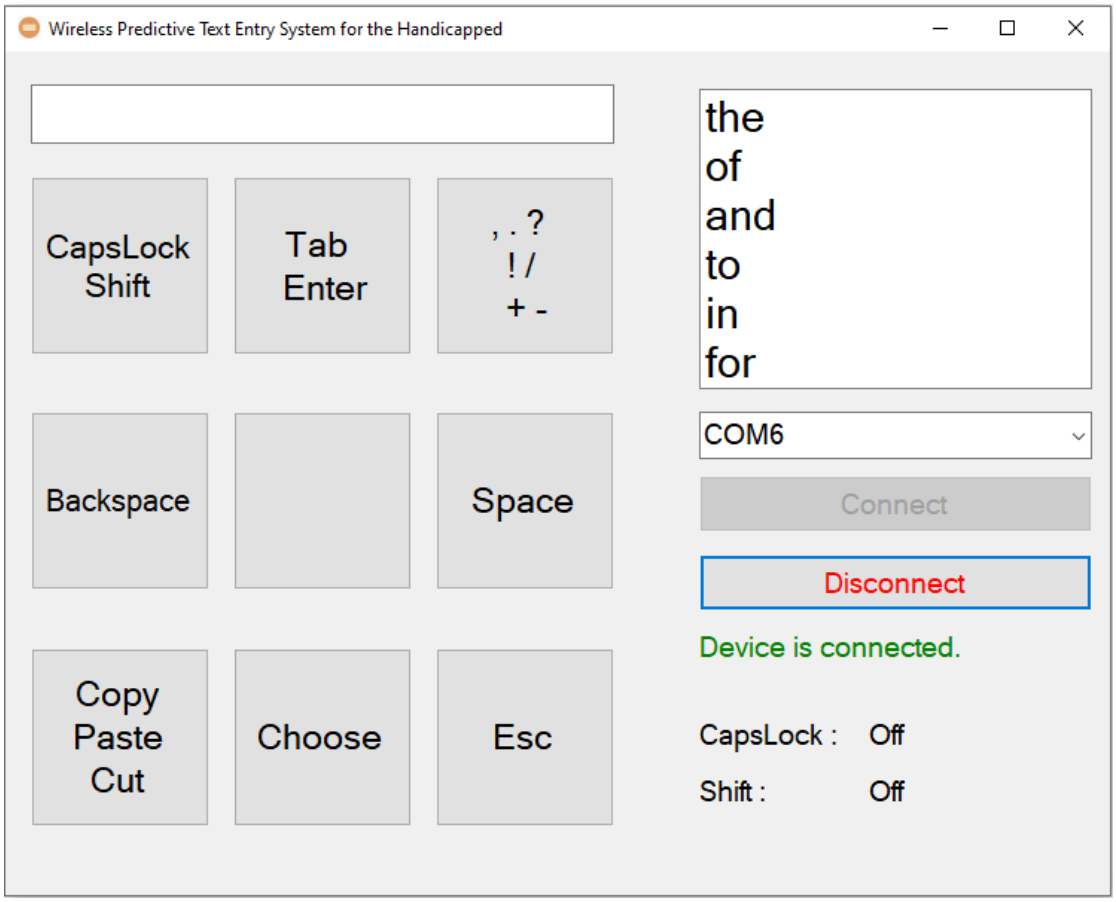

Figure 5.26 Interface of the program after pressed “Function”.

5.4.3 Caps Lock and Shift

User need to press the 1st key in program after the “Function” button is pressed to have the “Caps Lock” and “Shift” function. Figure 5.27 show the interface of the “Caps Lock” and “Shift”.

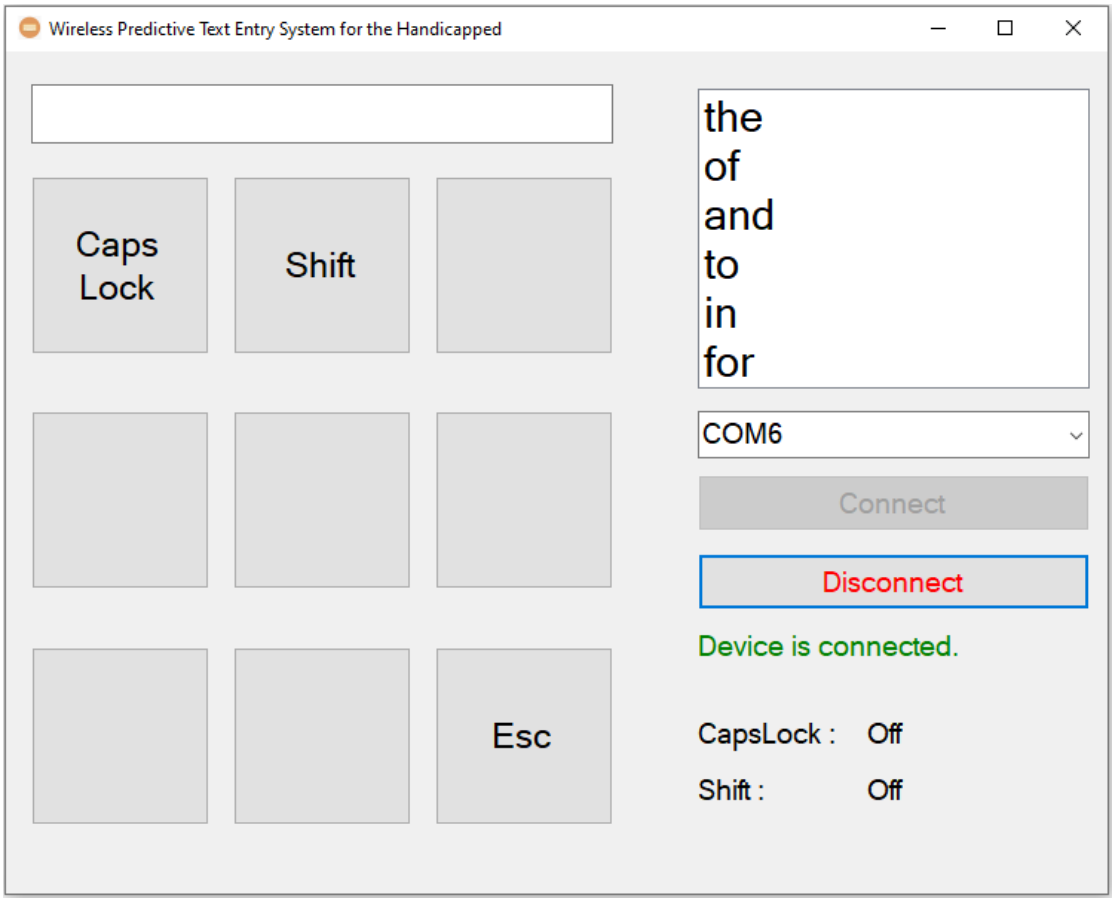

Figure 5.27 Interface of the “Caps Lock” and “Shift”.

User can enter the words in upper case by press the “Caps Lock” button in the 1st key of the program. The letter that user enter will be in uppercase until user press again the “Caps Lock” button to switch off. There is an indictor will be showing the status of “Caps Lock” at the right bottom of the program. Figure 5.28 show the test case when the “Caps Lock” is pressed.

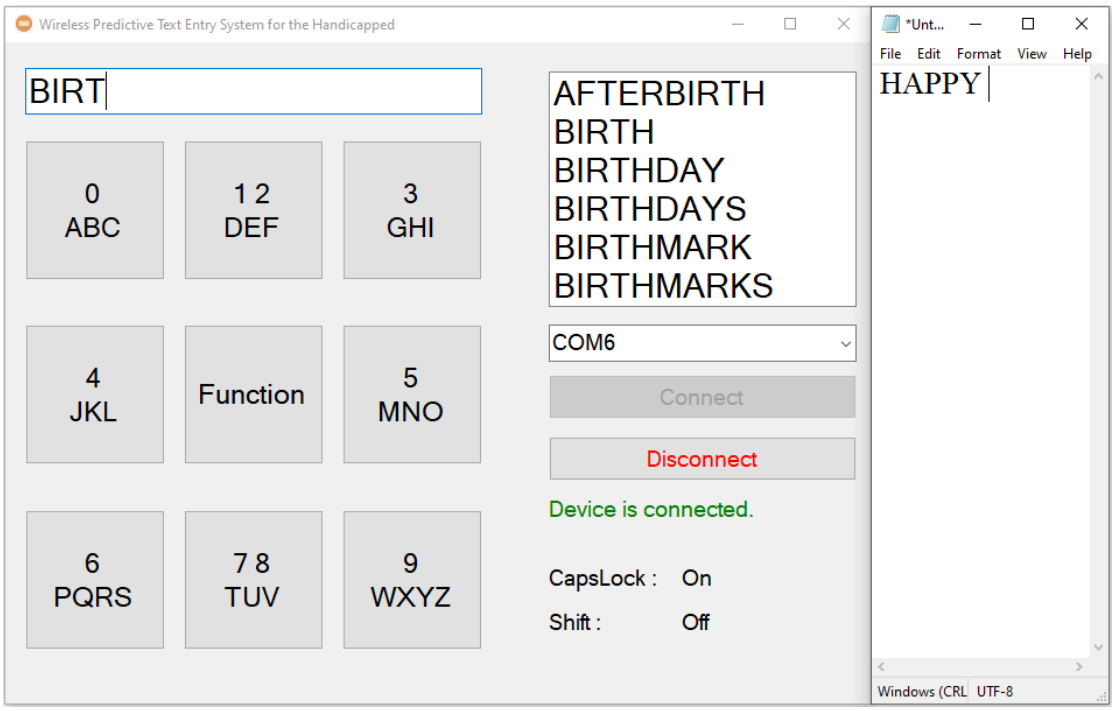

Figure 5.28 Test case when the “Caps Lock” is pressed.

If user only just want the first letter in uppercase, user can press the “Shift” button which located in 2nd key of the program and it is the toggle type button. That mean user just only press the “Shift” one time and the status will change to “On”. After the user enter the letter, the status of “Shift” will change to “Off”. Figure 5.29 show the test case when the “Shift” is pressed.

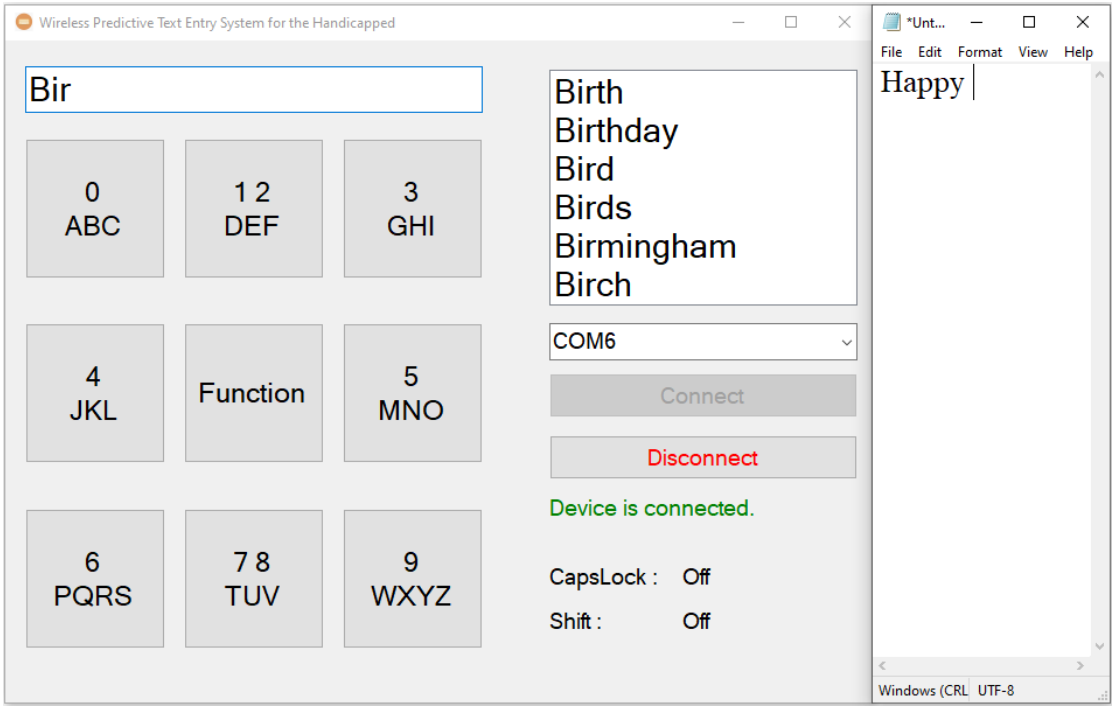

Figure 5.29 Test case when the “Shift” is pressed.

If the “Caps Lock” and “Shift” status is “On”, the letter that user input will be in lower case. For this test case, user need to click “Add” to add the word into user dictionary and print the following word in third application. Figure 5.30 show the test case when the “Caps Lock” and “Shift” is pressed.

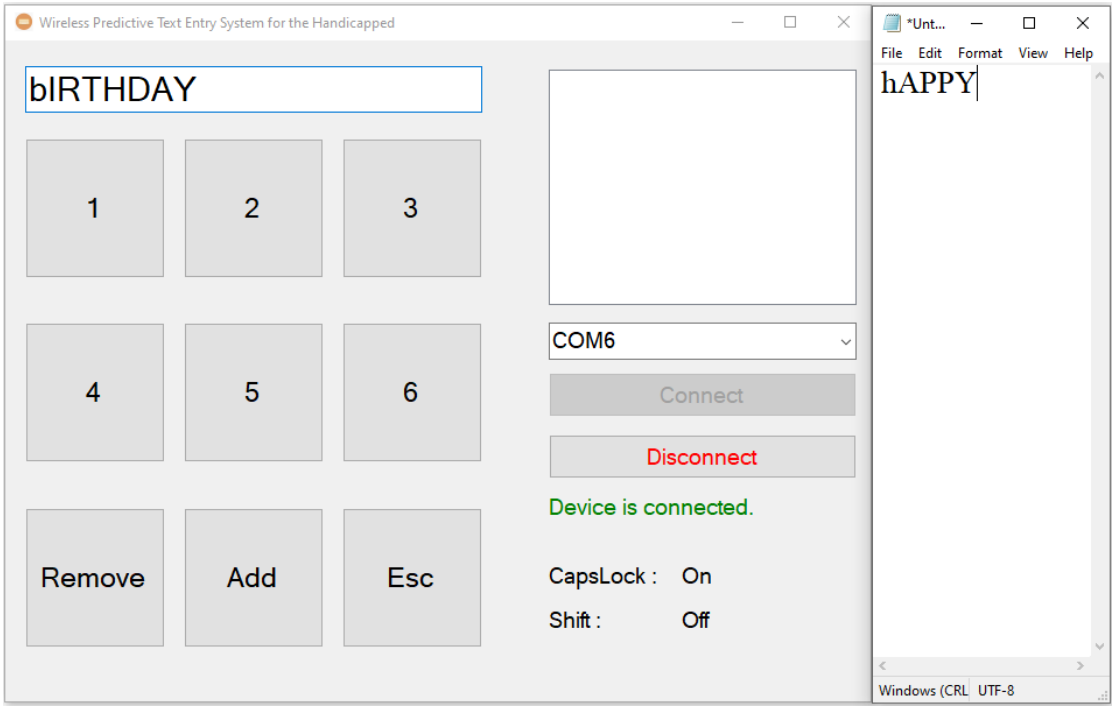

Figure 5.30 Test case when the “Caps Lock” and “Shift” is pressed.

5.4.4 Tab and Enter

For “Tab” and “Enter” function, user need to press the 2nd key after the “Function” button is pressed. To have “Tab” function, user needs to press the 1st key of the program follow by “Enter” in the 2nd key of the program. Figure 5.31 show the interface of the “Tab” and “Enter”.

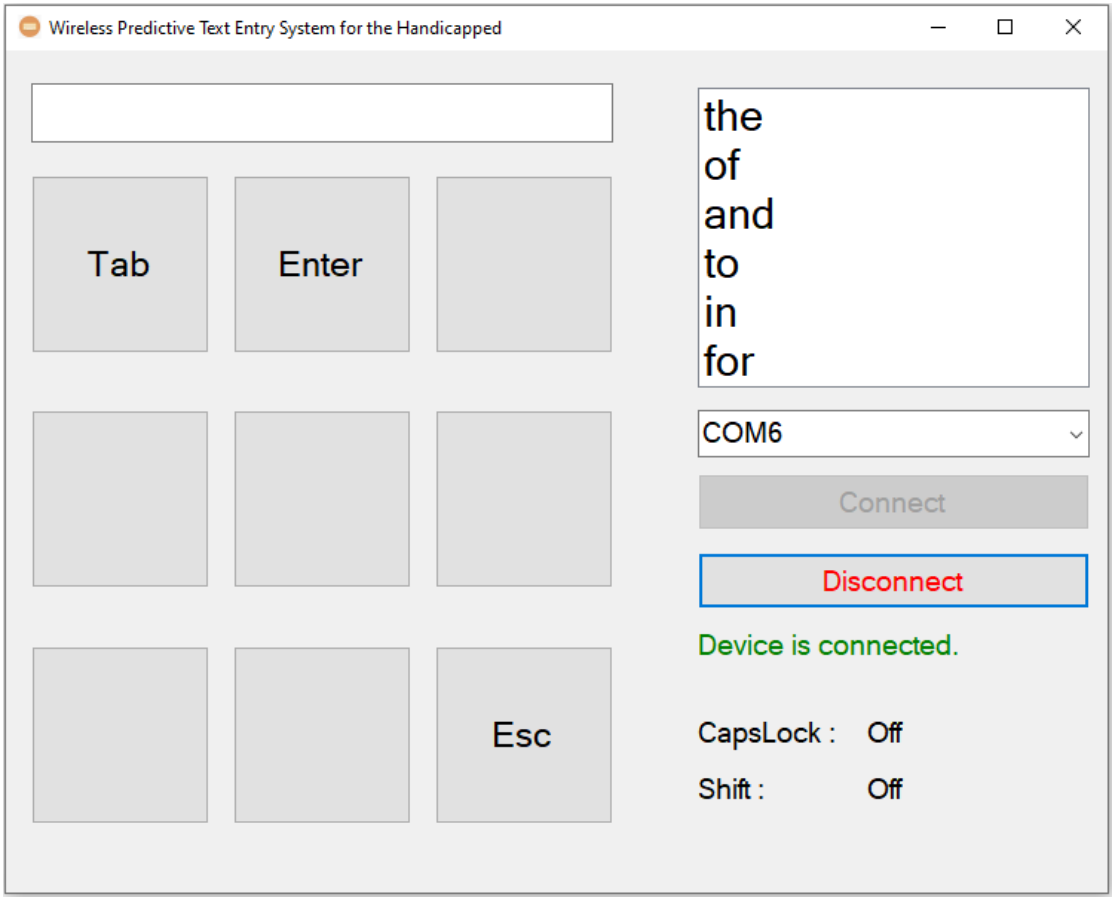

Figure 5.31 Interface of the “Tab” and “Enter”.

5.4.5 Punctuation

If user want to enter the punctuation, user need to press the 3rd key after the "Function" button is pressed. Table 5.2 and Figure 5.32 show the interface of the program after pressed punctuation function.

Key	Function of the button
1	Print (,) on the third application.
2	Print (.) on the third application.
3	Print (?) on the third application.
4	Print (+) on the third application.
5	-
6	Print (-) on the third application.
7	Print (/) on the third application.
8	Print (!) on the third application.
9	Return to the previous page.

Table 5.2 Function of the program after pressed punctuation function.

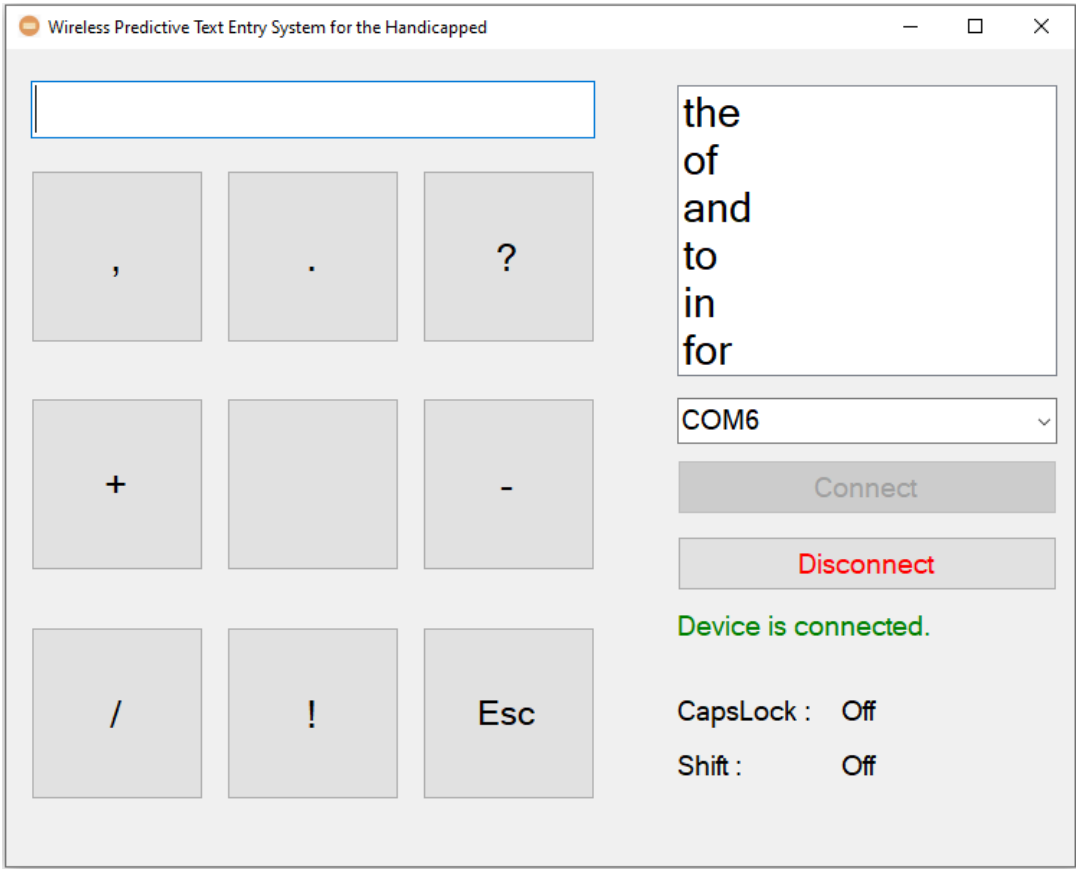

Figure 5.32 Interface of the program after pressed punctuation function.

5.4.6 Backspace

If user want to remove the character that already enter in the third application, user need to press the 4th key after the "Function" button is pressed. Then, the character removes by one. If the search box contains the character, the backspace will remove the search box character until the search box empty then will start to remove the character in third application. Figure 5.33 show the Backspace button location.

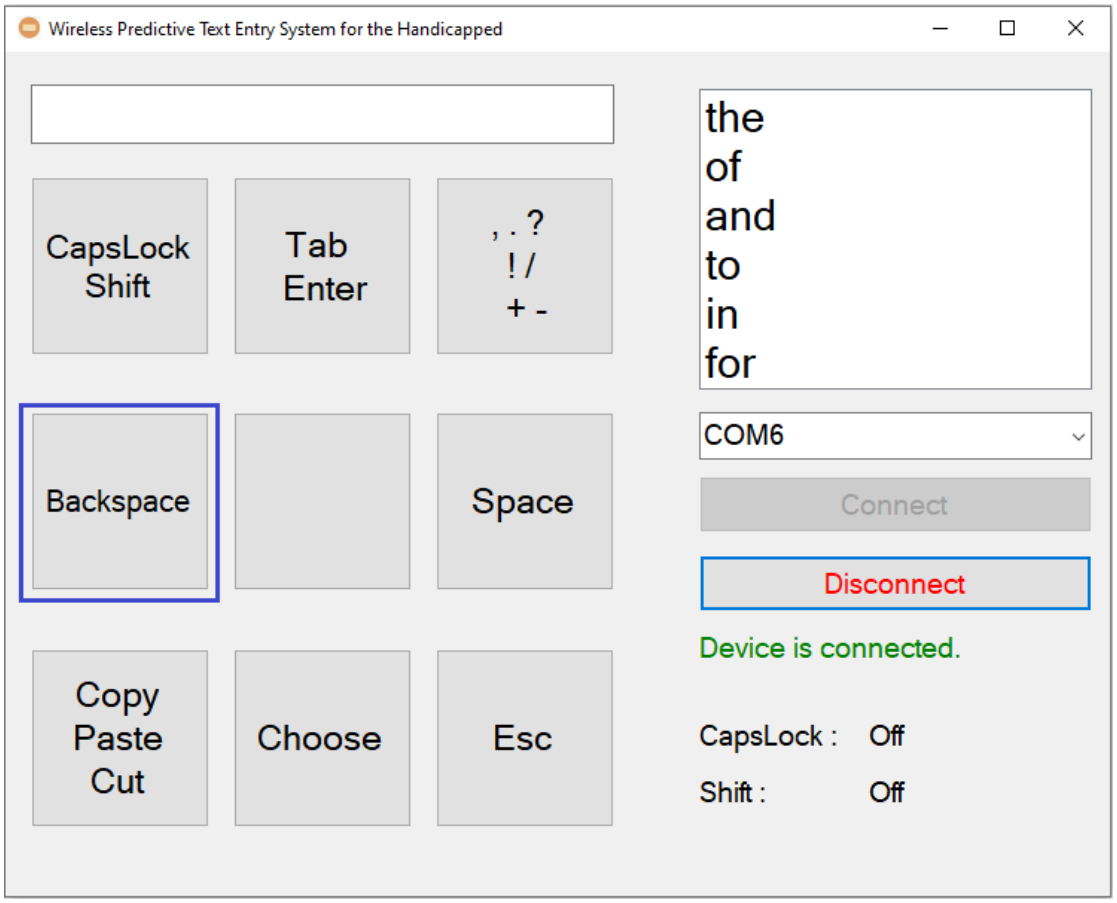

Figure 5.33 Backspace button location.

5.4.7 Space

If user want to enter the space, user need to press the 6th key after the “Function” button is pressed. Then, in the third application will have the one space character added. Figure 5.34 show the Space button location.

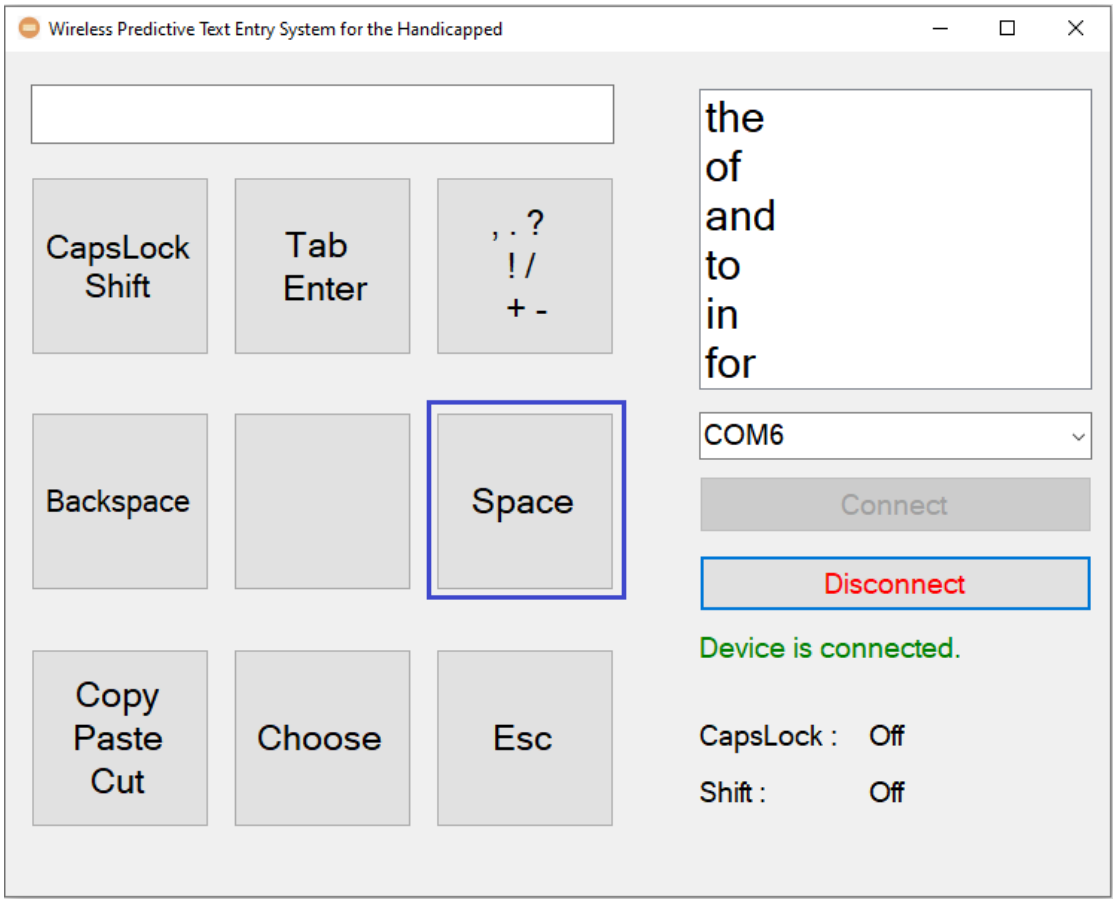

Figure 5.34 Space button location.

5.4.8 Copy, Paste, Cut and Select All

User need to press the 7th key in program after the “Function” button is pressed to have the “Copy”, “Paste”, “Cut” and “Select All” function. Table 5.3 and Figure 5.35 show the interface of the “Copy”, “Paste”, “Cut” and “Select All” function.

Key	Function of the button
1	User need to press “Select All” first, then press the “Copy” to perform the copy the text.
2	The “Paste” will perform paste the selected text. If “Copy” or “Cut” is not perform first, the “Paste” will not perform anything.
3	User need to press “Select All” first, then press the “Cut” to perform the cut the text.
4	User press the “Select All” mean selects the whole text.
9	Return to the previous page.

Table 5.3 Function of the “Copy”, “Paste”, “Cut” and “Select All” function.

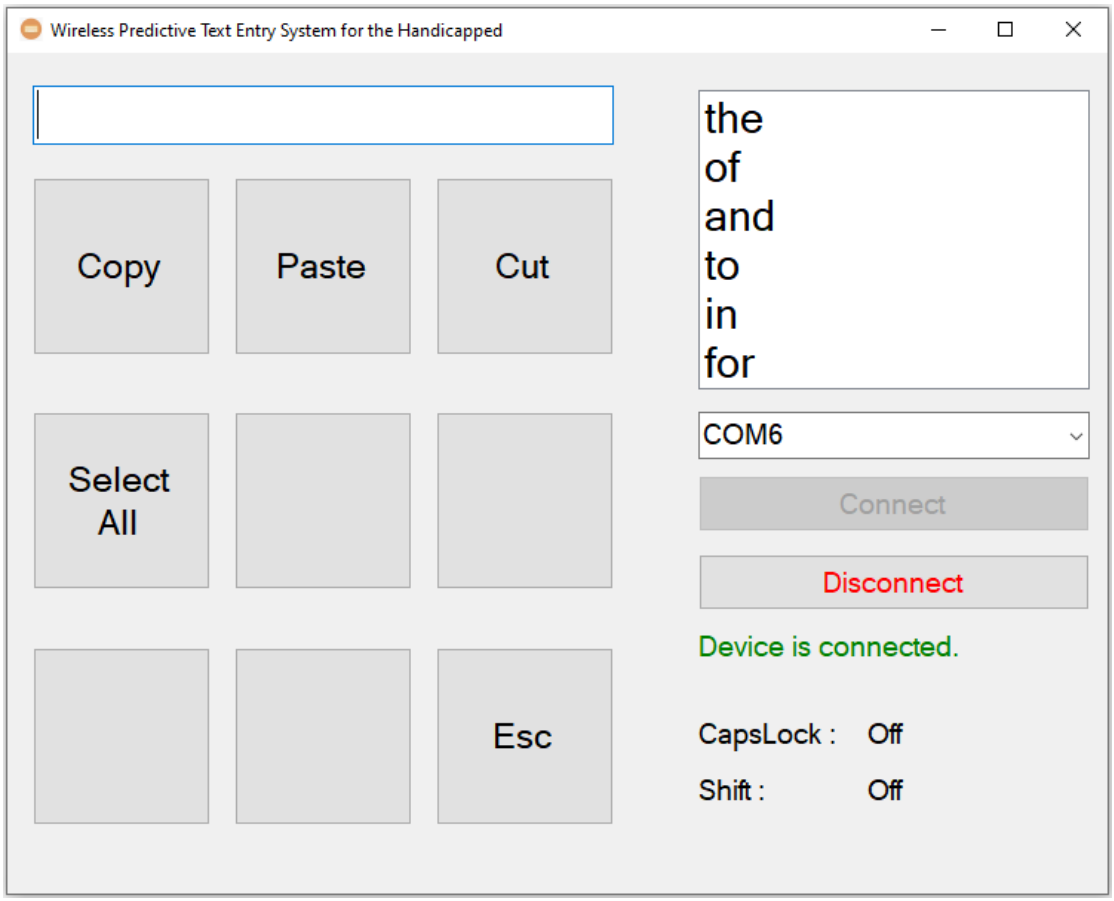

Figure 5.35 Interface of the “Copy”, “Paste”, “Cut” and “Select All” function.

5.4.9 Choose

When user want to select the word from the list box to enter on the third application, User need to press the 8th key in program after the "Function" button is pressed to select the word. Table 5.4 and Figure 5.36 show the interface of the Choose function.

Key	Function of the button
1	Click "1" to select the first word in list box will be printed.
2	Click "2" to select the second word in list box will be printed.
3	Click "3" to select the third word in list box will be printed.
4	Click "4" to select the fourth word in list box will be printed.
5	Click "5" to select the fifth word in list box will be printed.
6	Click "6" to select the sixth word in list box will be printed.
7	Click to remove word from user dictionary.
8	Click to add new word to user dictionary.
9	Return to the previous page.

Table 5.4 Function of Choose.

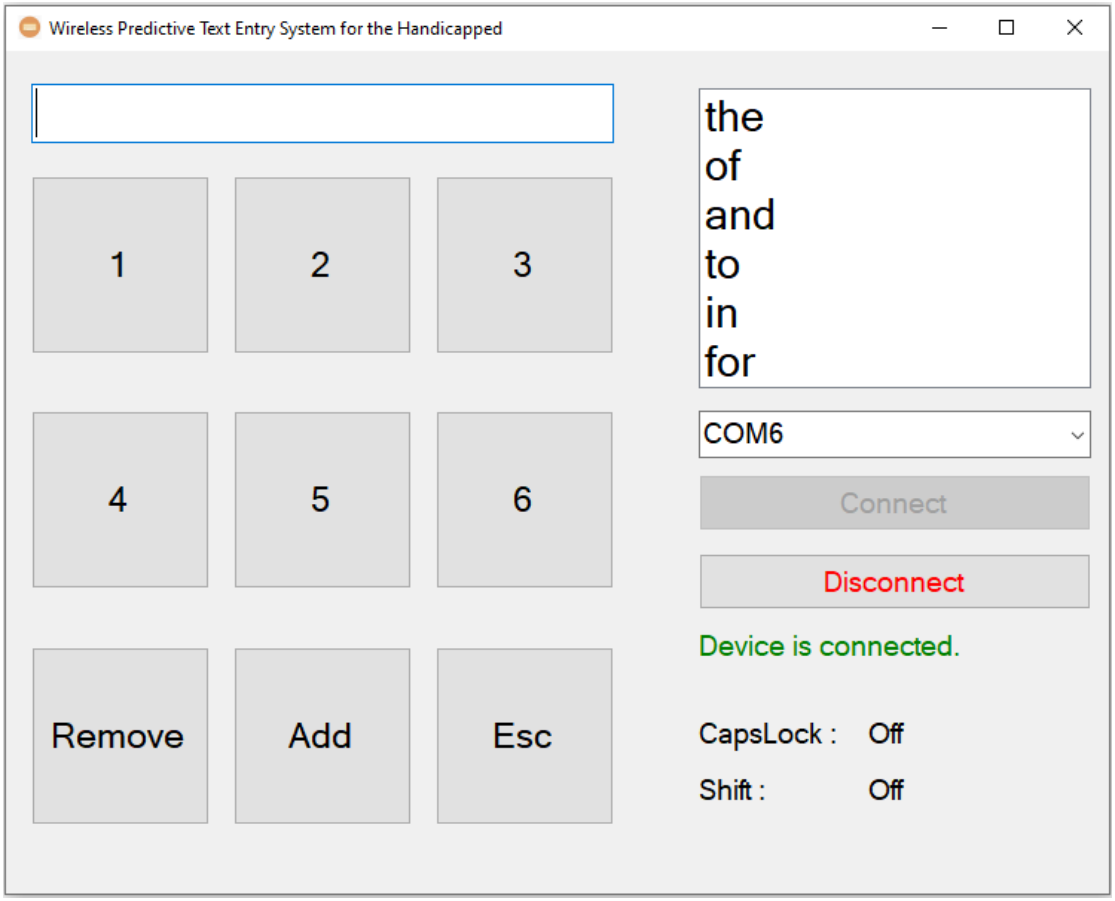

Figure 5.36 Interface of the Choose function.

5.4.10 Remove

When user want to remove the word from user dictionary, User need to press the 7th key in program after the "Choose" button is pressed to select the word. Table 5.5 and Figure 5.37 show the interface of the Remove function.

Key	Function of the button
1	Click "1" to remove the first word in list box from user dictionary.
2	Click "2" to remove the second word in list box from user dictionary.
3	Click "3" to remove the third word in list box from user dictionary.
4	Click "4" to remove the fourth word in list box from user dictionary.
5	Click "5" to remove the fifth word in list box from user dictionary.
6	Click "6" to remove the sixth word in list box printed.
7	Return to the main page.
9	Return to the previous page.

Table 5.5 Function of Remove.

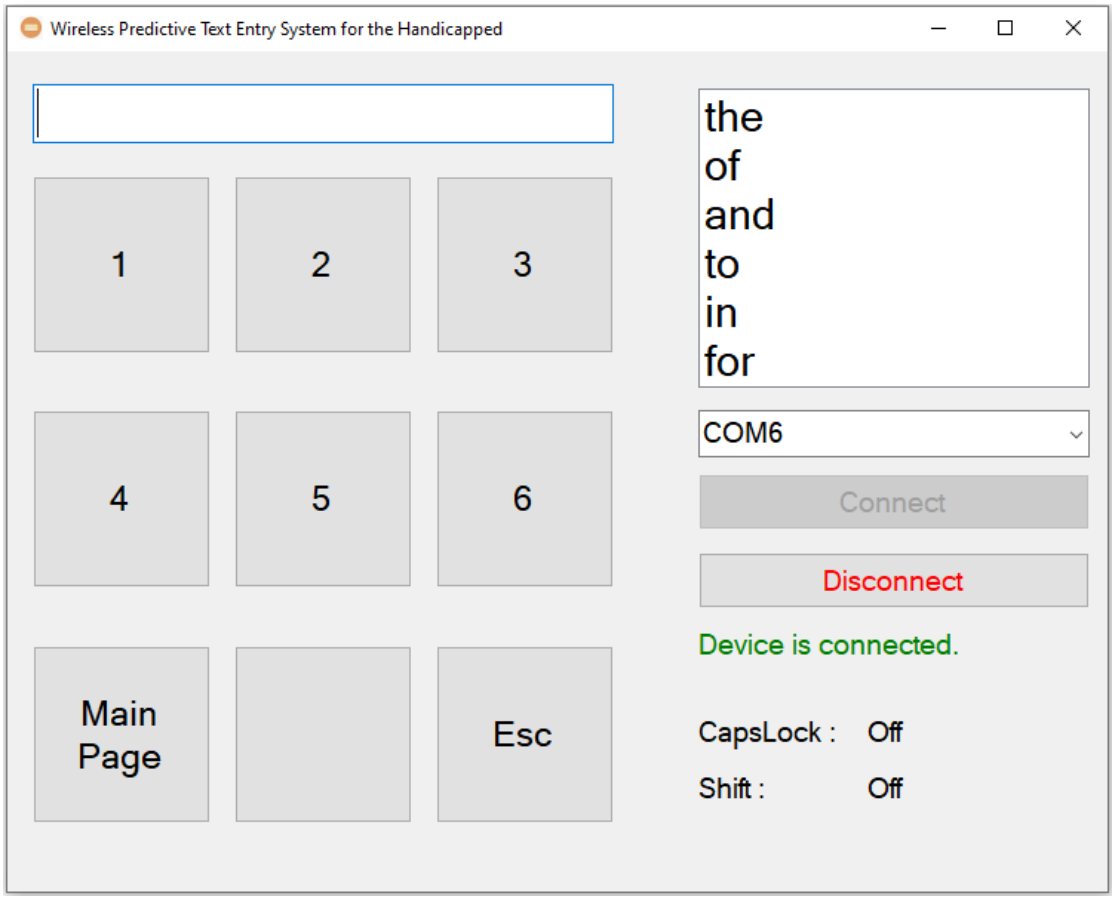

Figure 5.37 Interface of Remove function.

5.5 Concluding Remark

Through this chapter, users can easily understand how to use GUI software and input devices. The user only needs to set up the input device on first use. Users also learn about the function of each button of the GUI software. After understanding how to use input device and GUI software, handicapped can communicate with another people.

Chapter 6: System Evaluation and Discussion

6.1 System Testing and Performance Metrics

After the input device and GUI software were implemented, some test cases were performed to test the functionality of the predictive text input system. A typing speed test case was also conducted to ensure that typing speed has improved. In addition, the power consumption of this input device is also calculated to ensure that the system can work for a long time.

6.1.1 Final Product

Figure 6.1 show the final product top view of the infrared input device and Figure 6.2 show the final product side view of the infrared input device.

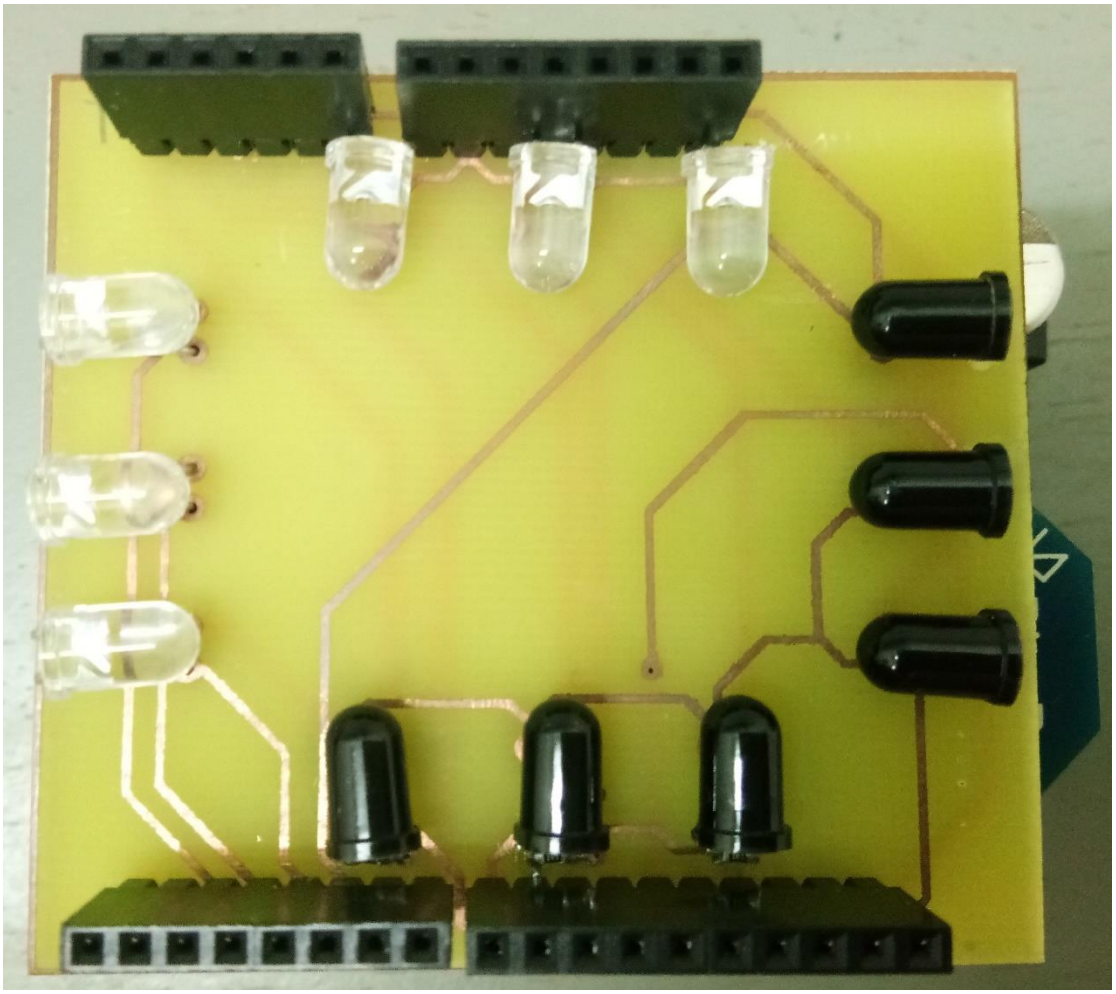

Figure 6.1 Final product top view of the infrared input device.

Figure 6.2 Final product side view of the infrared input device.

Figure 6.3 show the final product of the wireless predictive text entry system.

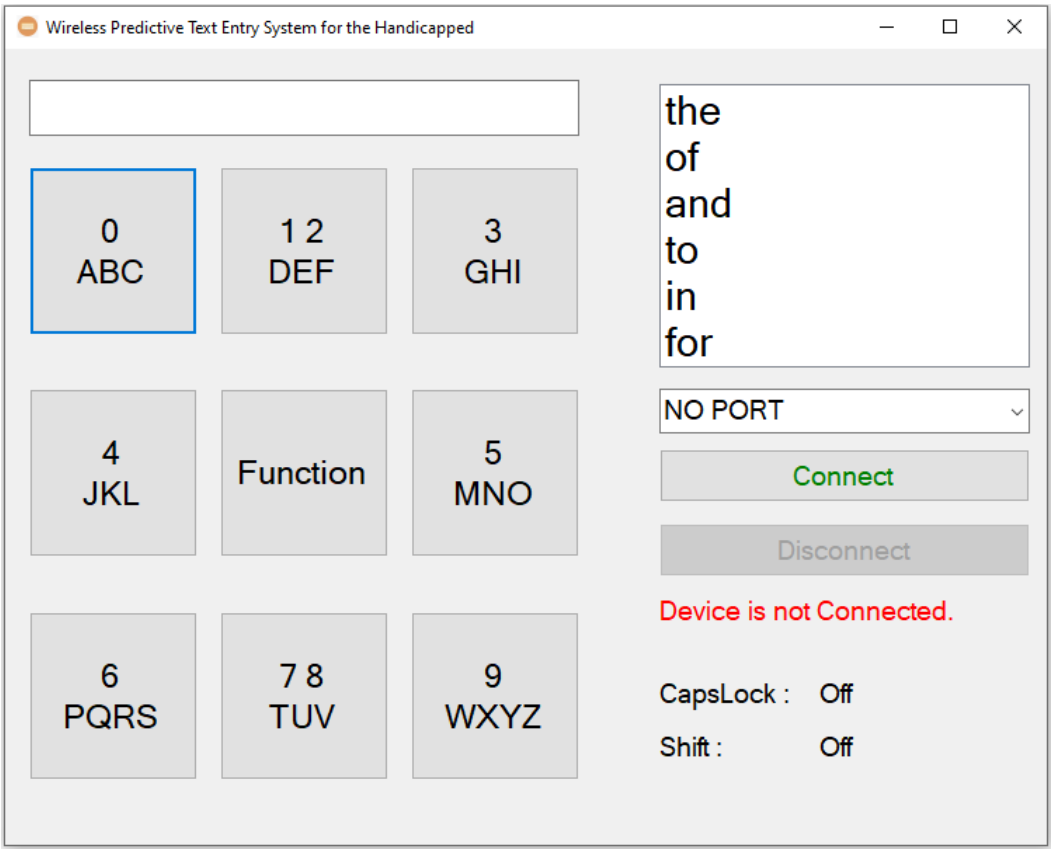

Figure 6.3 Final product of the wireless predictive text entry system.

6.1.2 Test Case of function

To test the functionality of the predictive text input system, each button function will be carried out. Table 6.1 show the test case that will be tested out and expected outcome.

No.	Test Case	Description	Expected outcome
1	Connect the input device with GUI software.	To test the connection between the input device with GUI software.	Indictor in GUI software will change from “Device is not connected” to “Device is connected”.
2	Lowercase word, Choose and space function	To test the lowercase word, and choose word and space printed out in third application.	The word that printed out is in lowercase word and having the spacing. Result: the greatest glory in living lies not in never falling, but in rising every time we fall
3	Uppercase word (Caps Lock function) and Tab function	To test the uppercase word, and tab printed out in third application.	The word that printed out is in uppercase word and having tab. Result: THE GREATEST GLORY IN LIVING LIES NOT IN NEVER FALLING, BUT IN RISING EVERY TIME WE FALL
4	Punctuations, number, shift and enter function	To test the punctuations, number, shift and enter printed out in third application.	First letter is in uppercase, remaining in lowercase and the punctuations, number and enter printed out. Result:

			Hi, you can call 0123456789 to order pizza. Add cheese+hotdog-olive/ham?!
5	Backspace function	To test the alphabets will be remove from the text box or third application.	The word will delete alphabets from the text box first, after text box empty, it will delete alphabets from third application.
6	Copy, Paste, Cut and Select All function	To test the sentence can be copy, paste, cut and select all.	The sentence can be copy, paste, cut and select all.
7	Remove function	To test the user selected word will remove from user dictionary.	The selected word is removed from user dictionary.

Table 6.1 Test case that will be tested out and expected outcome.

6.2 Testing Setup and Result

6.2.1 Test Case 1: Connect the input device with GUI software

To test the connection between the input device with GUI software. Table 6.2 show the expected outcome and result of test case 1. Figure 6.4 show the results details of test case 1.

Test Case	Description	Expected outcome	Result of current test case
Connect the input device with GUI software.	To test the connection between the input device with GUI software.	Indictor in GUI software will change from “Device is not connected” to “Device is connected”.	The test case succeeds and the result is the same as expected.

Table 6.2 Expected outcome and result of test case 1.

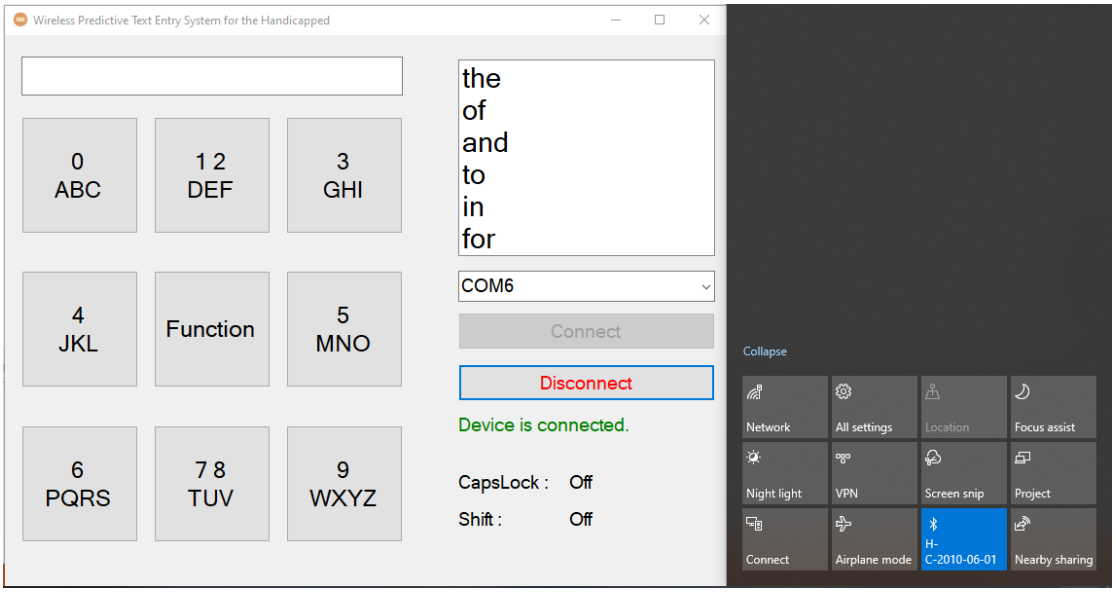

Figure 6.4 Results details of test case 1.

6.2.2 Test Case 2: Lowercase word, Choose and space function

The sentence that will be used for this test case is “the greatest glory in living lies not in never falling, but in rising every time we fall”. To test lowercase of 26 alphabets, choose and space function can work and printed in third application. Table 6.3 show the expected outcome and result of test case 2. Figure 6.5 show the results details of test case 2.

Test Case	Description	Expected outcome	Result of current test case
Lowercase word, Choose and space function	To test the lowercase word, and choose word and space printed out in third application.	The word that printed out is in lowercase word and having the spacing. Result: the greatest glory in living lies not in never falling, but in rising every time we fall	The test case succeeds and the result is the same as expected.

Table 6.3 Expected outcome and result test case of test case 2.

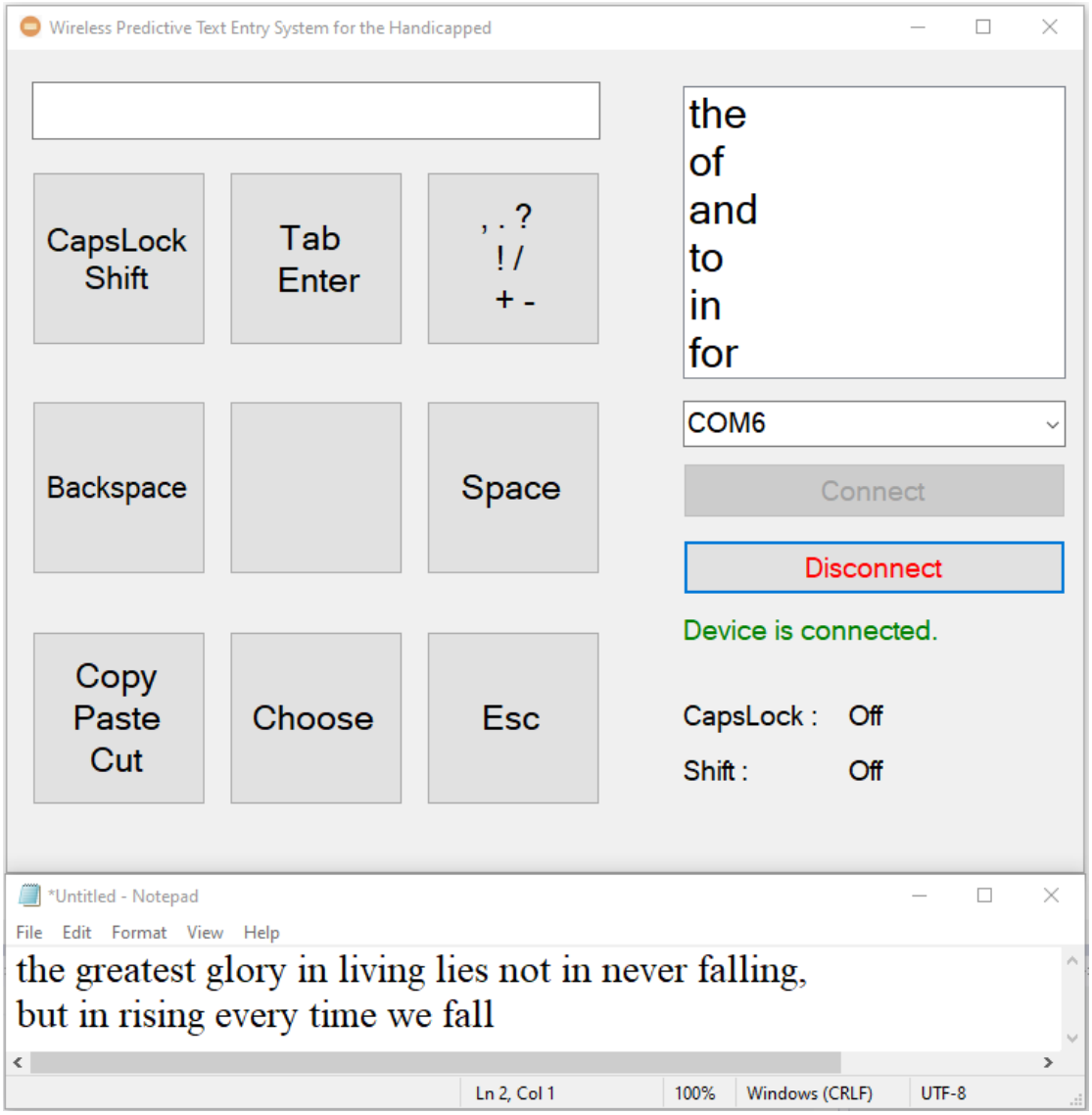

Figure 6.5 Results details of test case 2.

6.2.3 Test Case 3: Uppercase word (Caps Lock function) and Tab function

The sentence that will be used for this test case is “the greatest glory in living lies not in never falling, but in rising every time we fall”. To test uppercase of 26 alphabets by using Caps Lock function and tab function can work and printed in third application. Table 6.4 show the expected outcome and result of test case 3. Figure 6.6 show the results details of test case 3.

Test Case	Description	Expected outcome	Result of current test case
Uppercase word (Caps Lock function) and Tab function	To test the uppercase word, and tab printed out in third application.	The word that printed out is in uppercase word and having tab. Result: THE GREATEST GLORY IN LIVING LIES NOT IN NEVER FALLING, BUT IN RISING EVERY TIME WE FALL	The test case succeeds and the result is the same as expected.

Table 6.4 Expected outcome and result of test case 3.

Figure 6.6 Results details of test case 3.

6.2.4 Test Case 4: Punctuations, number, shift and enter function

The sentence that will be used for this test case is “Hi, you can call 0123456789 to order pizza. Add cheese+hotdog-olive/ham?!”. To test punctuations, number, shift and enter function can work and printed in third application. Table 6.5 show the expected outcome and result of test case 4. Figure 6.7 show the results details of test case 4.

Test Case	Description	Expected outcome	Result of current test case
Punctuations, number, shift and enter function	To test the punctuations, number, shift and enter printed out in third application.	First letter is in uppercase, remaining in lowercase and the punctuations, number and enter printed out. Result: Hi, you can call 0123456789 to order pizza. Add cheese+hotdog-olive/ham?!	The test case succeeds and the result is the same as expected.

Table 6.5 Expected outcome and result of test case 4.

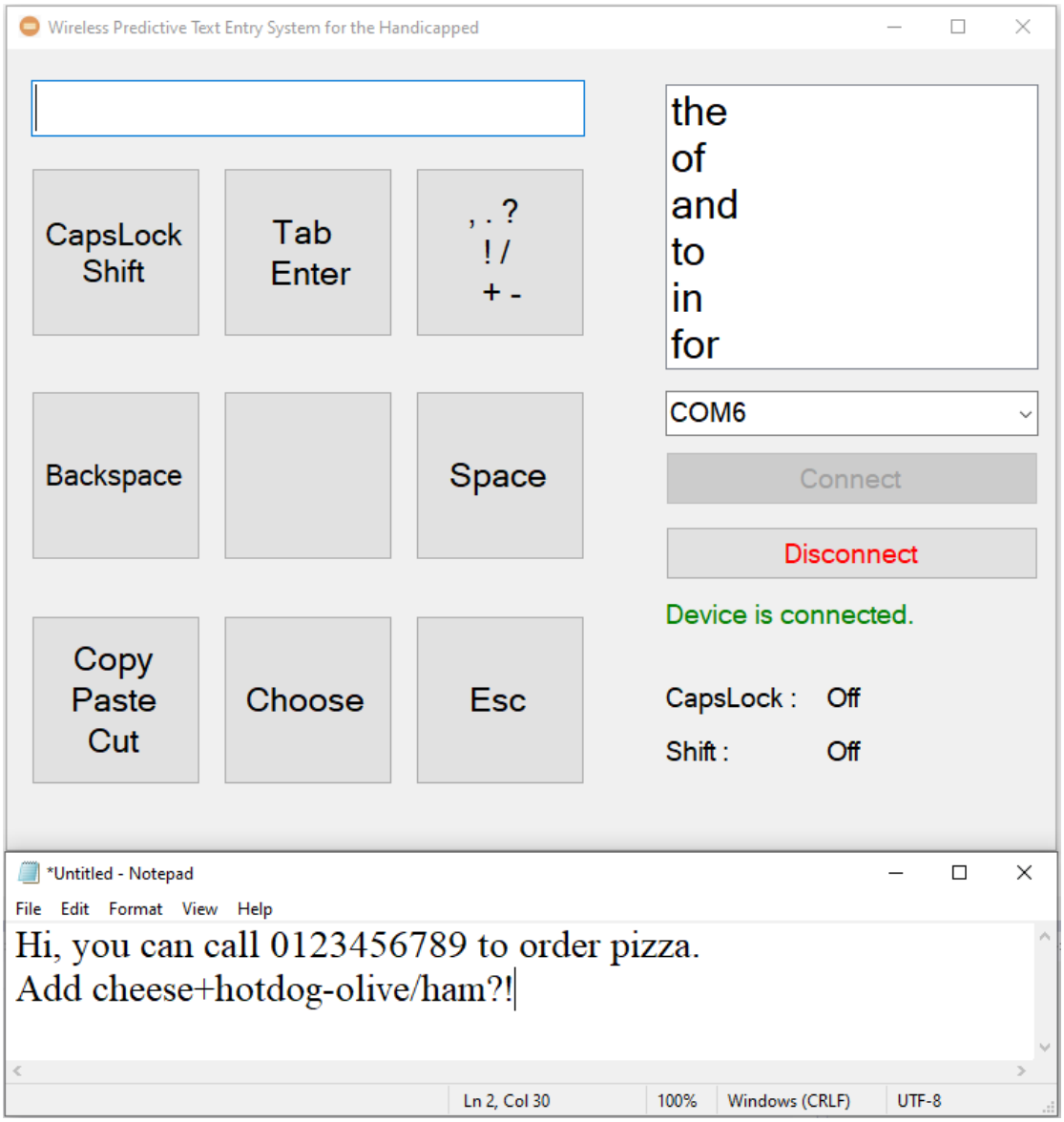

Figure 6.7 Results details of test case 4.

6.2.5 Test Case 5: Backspace function

The sentence that will be used for this test case is “the greatest glory in living lies not in never falling, but in rising every time we fall”. To test the alphabets will be remove from the text box or third application. Table 6.6 show the expected outcome and result of test case 5. Figure 6.8 show the results details of test case 5.

Test Case	Description	Expected outcome	Result of current test case
Backspace function	To test the alphabets will be remove from the text box or third application.	The word will delete alphabets from the text box first, after text box empty, it will delete alphabets from third application.	The test case succeeds and the result is the same as expected.

Table 6.6 Expected outcome and result of test case 5.

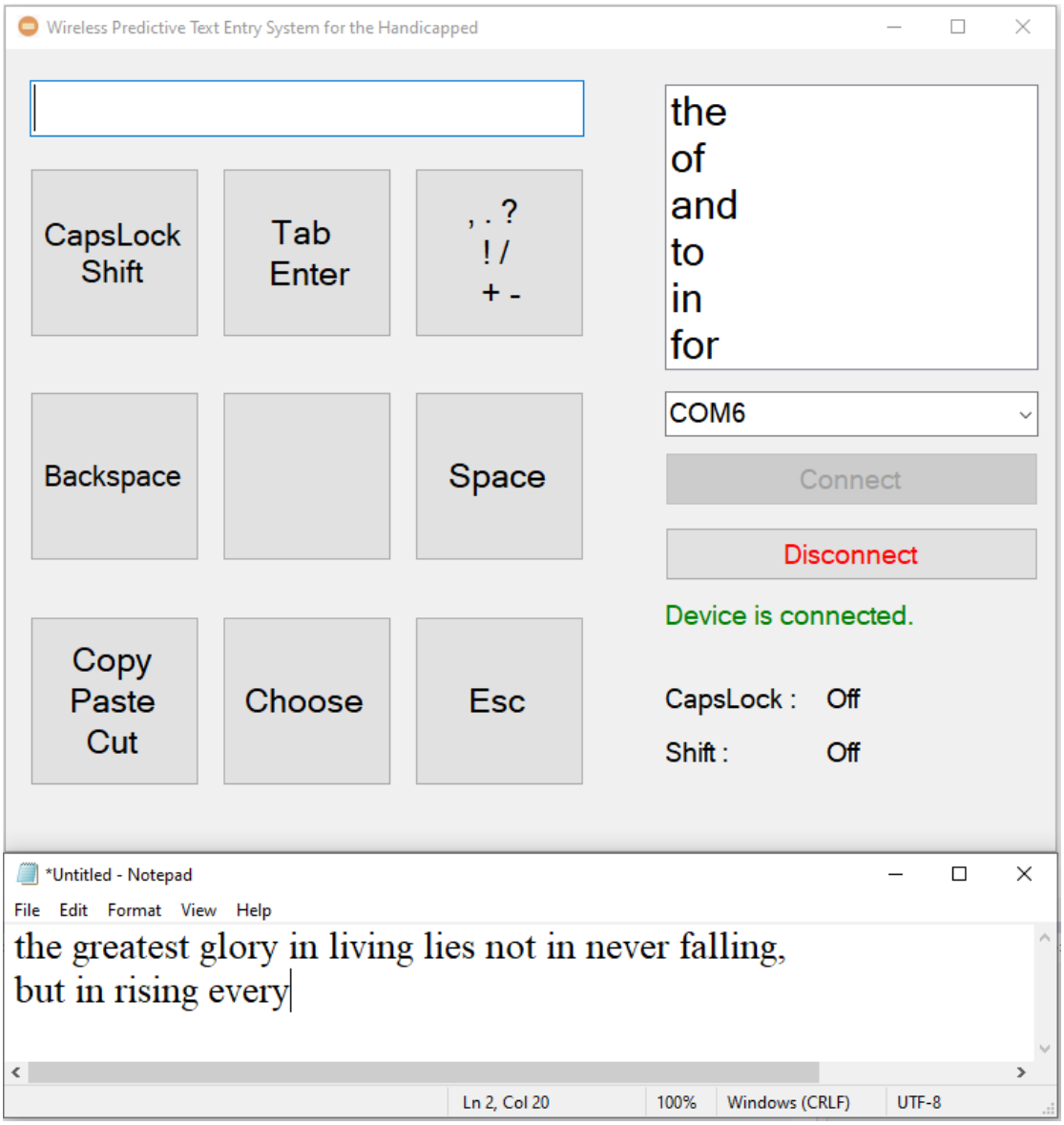

Figure 6.8 Results details of test case 5.

6.2.6 Test Case 6: Copy, Paste, Cut and Select All function

The sentence that will be used for this test case is “the greatest glory in living lies not in never falling, but in rising every time we fall”. To test the sentence can be copy, paste, cut and select all can work and printed in third application. Table 6.7 show the expected outcome and result of test case 6. Figure 6.9 show the results details of select all, copy and paste. Figure 6.10 show the results details of select all, cut and paste.

Test Case	Description	Expected outcome	Result of current test case
Copy, Paste, Cut and Select All function	To test the sentence can be copy, paste, cut and select all.	The sentence can be copy, paste, cut and select all.	The test case succeeds and the result is the same as expected.

Table 6.7 Expected outcome and result of test case 6.

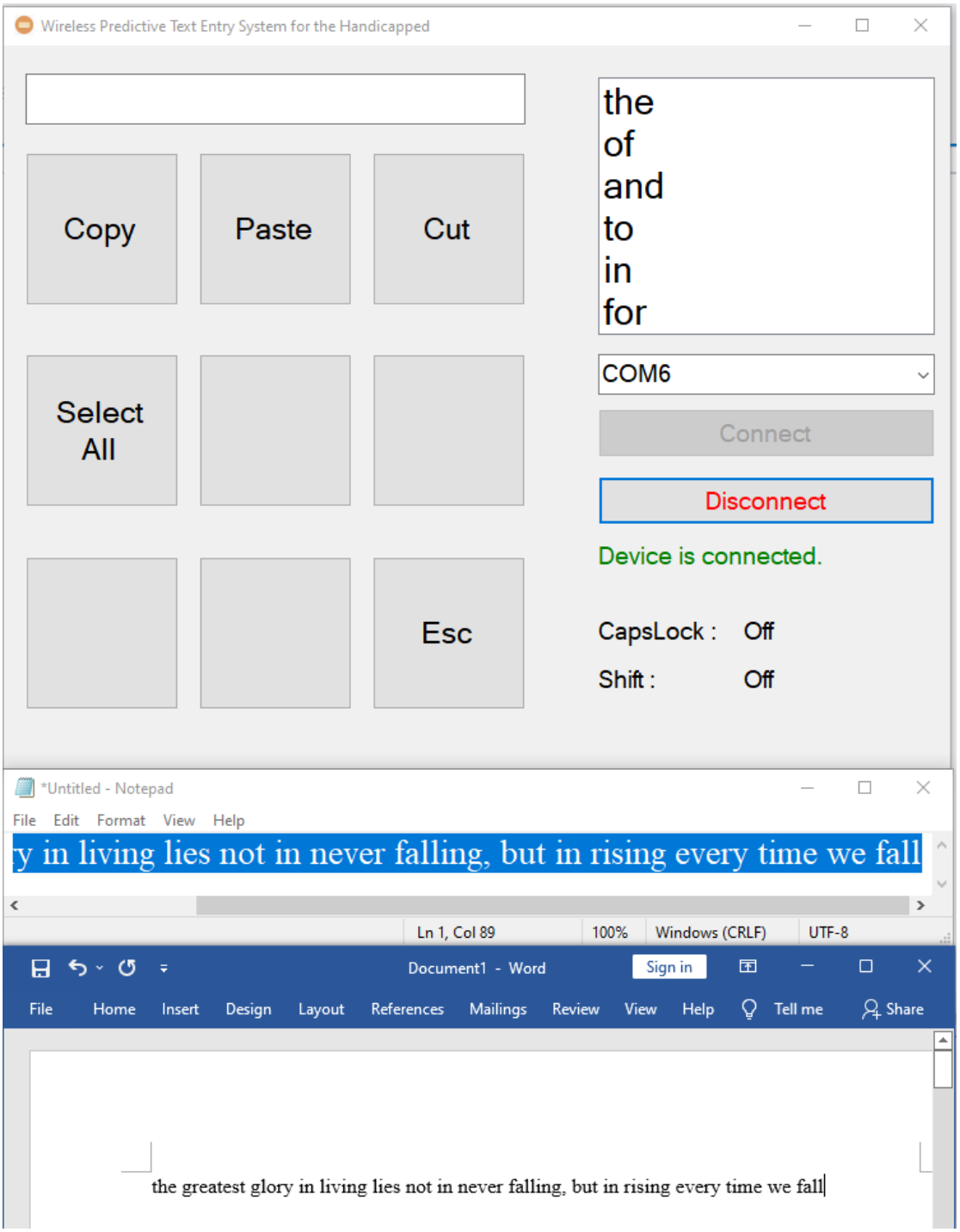

Figure 6.9 Results details of select all, copy and paste.

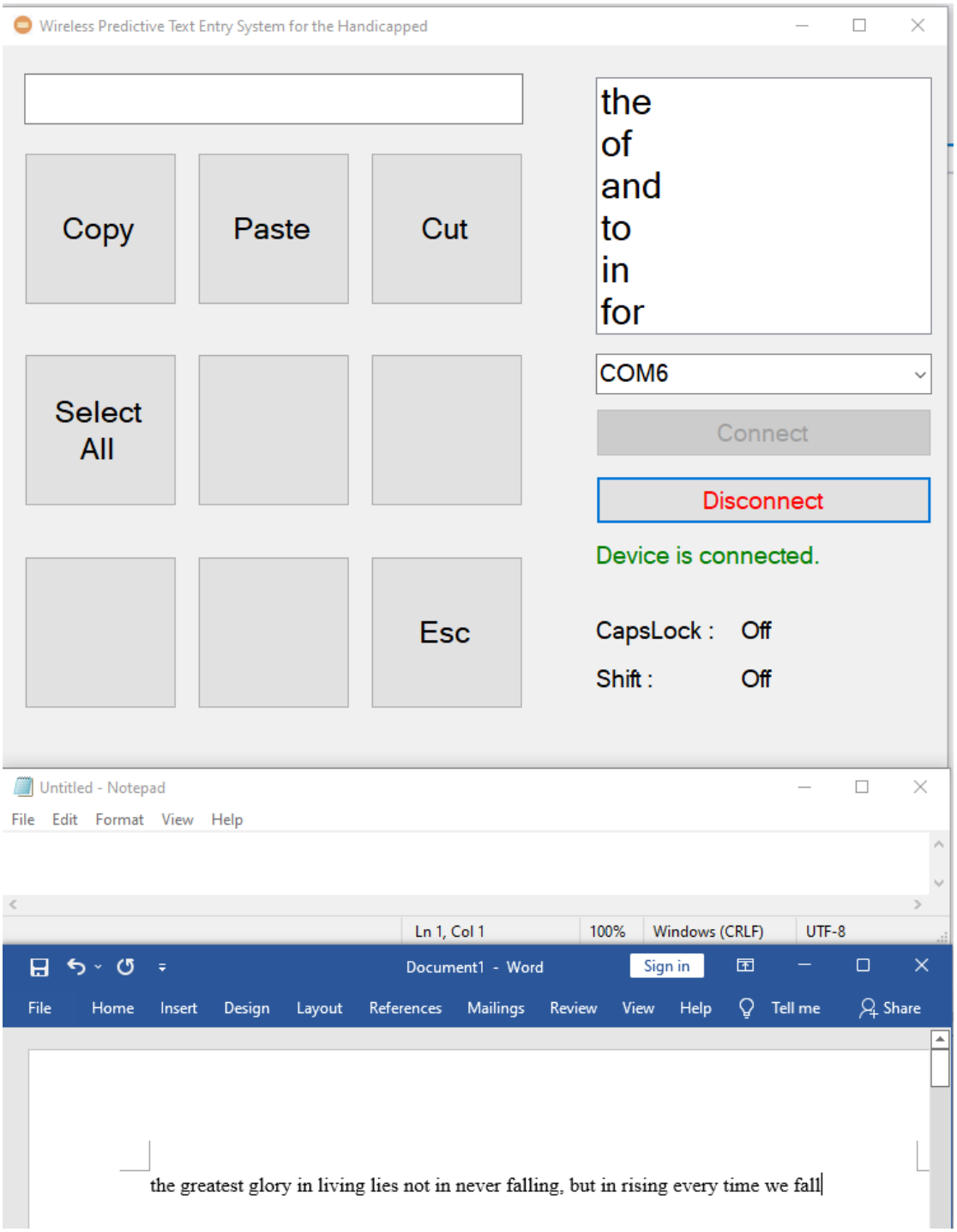

Figure 6.10 Results details of select all, cut and paste.

6.2.7 Test Case 7: Remove function

To test the user selected word will remove from user dictionary. Table 6.8 show the expected outcome and result of test case 7. Figure 6.11 show the results details of test case 7 before remove. Figure 6.12 show the results details of test case 7 after remove.

Test Case	Description	Expected outcome	Result of current test case
Remove function	To test the user selected word will remove from user dictionary.	The selected word is removed from user dictionary.	The test case succeeds and the result is the same as expected.

Table 6.8 Expected outcome and result of test case 7.

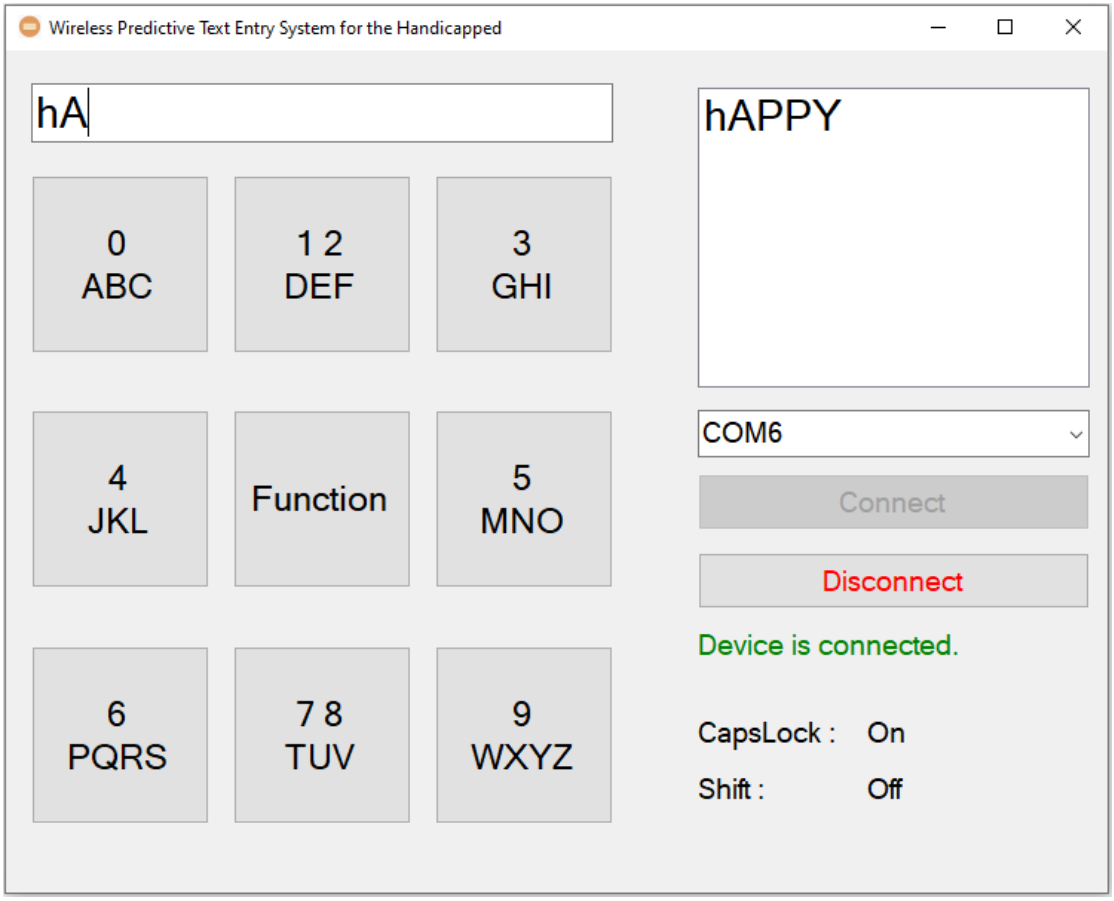

Figure 6.11 Results details of test case 7 before remove.

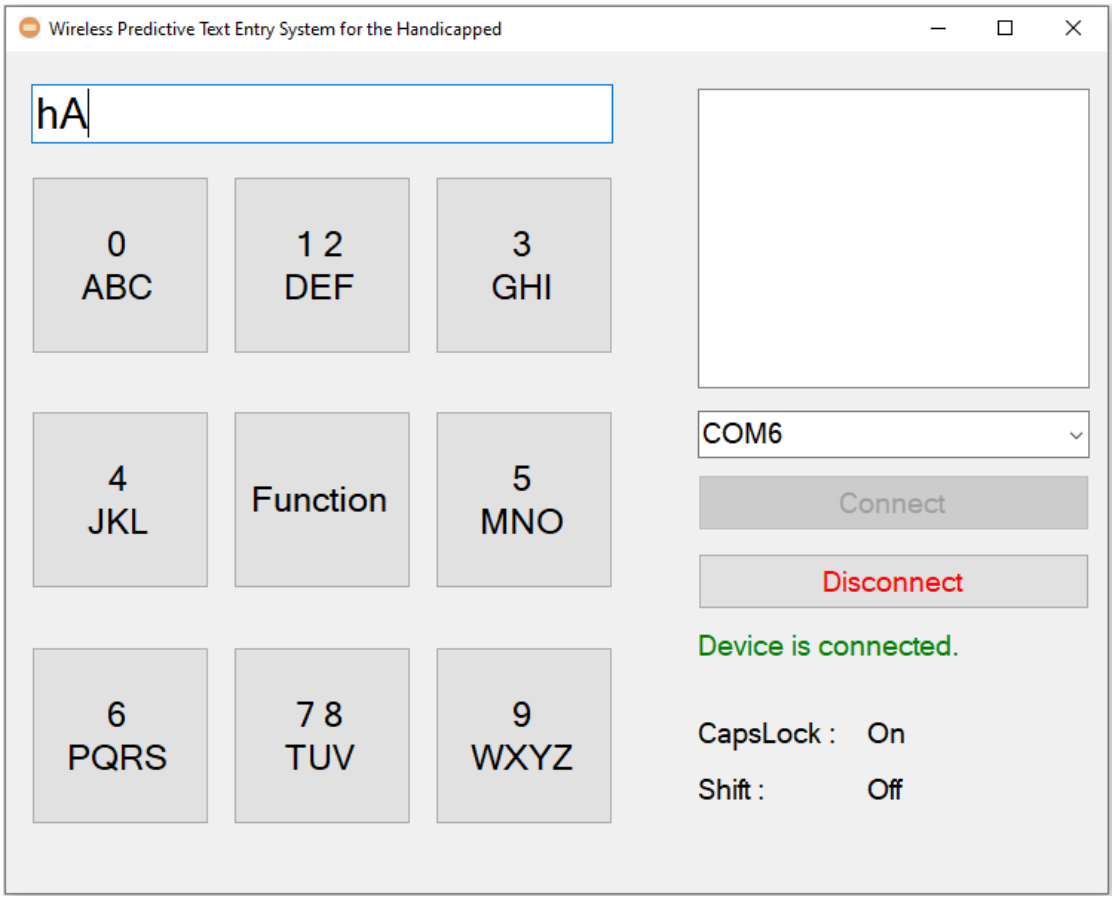

Figure 6.12 Results details of test case 7 after remove.

6.2.8 Typing Speed

To ensure the correctness of typing speed, a special version of the GUI software was created and contains all the features of the original GUI software. What makes this GUI software special is that it records elapsed time, words entered, and words per minute (WPM). WPM method is chosen because it can measure typing speed and most suitable for predictive text entry system. The formula for WPM is as follows.

$$WPM = \frac{Number\ of\ Words\ Typed}{Elapsed\ time\ that\ used} \times 60\ seconds$$

By using this formula, special version of GUI software can easily to count the number of words that typed and WPM. This special version of GUI software will automatically split the spacing of the words and punctuations to ensure the correctness of counting number of words that typed. The sentence that will be used for this test case is “the quick brown fox jump over the lazy dog”. Figure 6.13 show one of the typing speeds results. Table 6.9 show the WPM of the 10 times typing the same sentence.

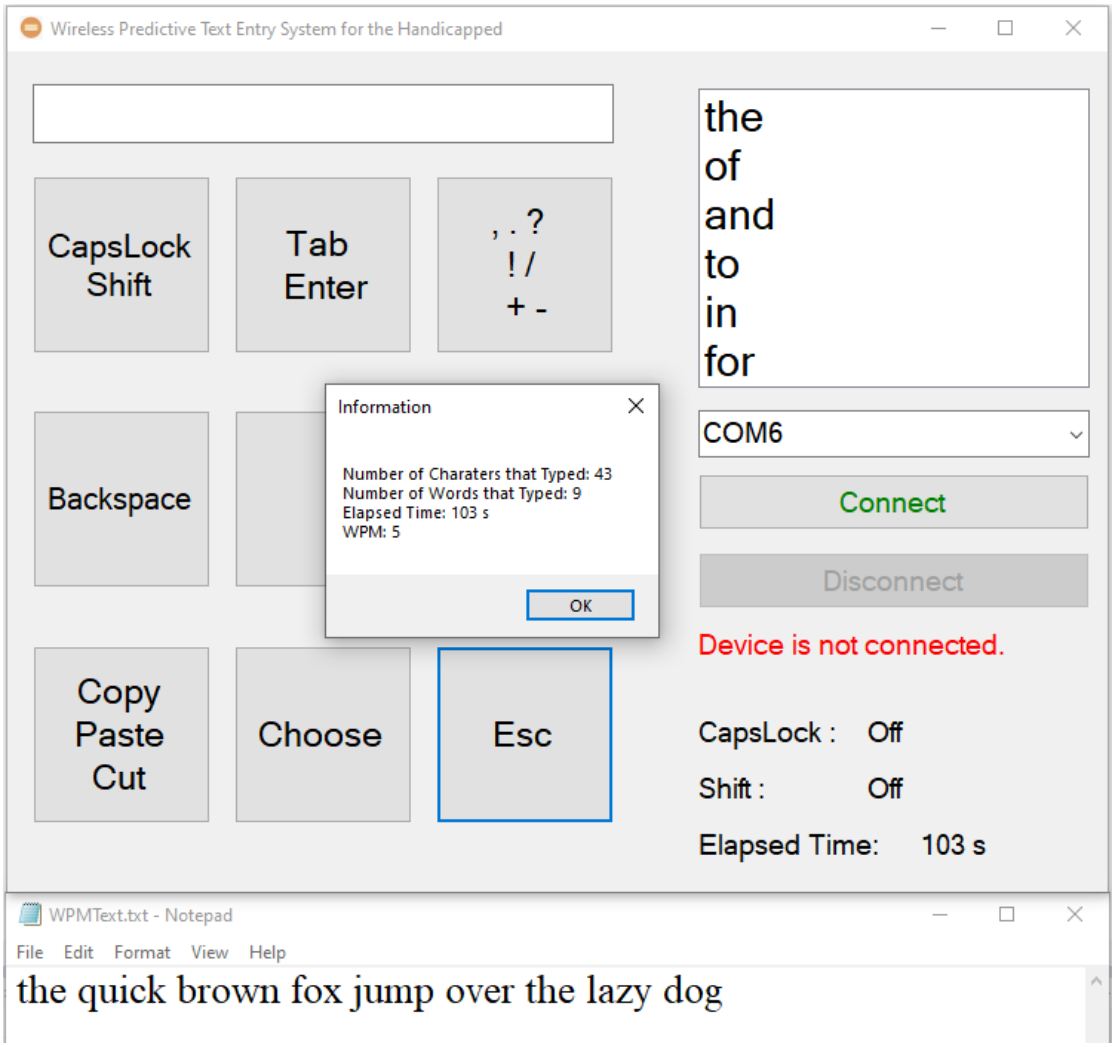

Figure 6.13 One of the typing speeds results.

No. of attempts	WPM
1	5
2	5
3	5
4	5
5	5
6	5
7	5
8	6
9	6
10	6

Table 6.9 WPM of the 10 times typing the same sentence.

Based on research presented by W.L. Chooi [13], the system has an average input rate of 5 WPM, compared to the project's wireless predictive text entry system for handicapped, which has an average input rate of 5.3 WPM. This wireless predictive text entry system is efficient, with an increase of about 0.3 WPM compared to the study proposed by W.L. Chooi [13]. As can be seen from Table 6.9, the increase from 5 WPM to 6 WPM from the 8^{th} attempt to the 10^{th} attempt means that as users become more familiar with the wireless predictive text entry system, their WPM also increases.

6.2.9 Power Consumption of input device

The power consumption of this input device needs to be calculated because one of the goals is to ensure that the device can run for a long time. The materials used to calculate the power consumption of this input device are a power supply, a multimeter, wires or male-to-male jumper wire and a breadboard. First, set the power supply to 5V and connect to multimeter's red probe. Then, connect the ground wire of the power supply to CT-UNO's GND port by using a breadboard and a male-to-male jumper to make the connection. Next, use a breadboard and male-to-male jumper wires to help the multimeter's black probe connect to CT-UNO's Vin port. Finally, switch the multimeter to measure current mode. Figure 6.14 show the setup to measure the current used by input device and Figure 6.15 show the top view of setup to measure the current used by input device.

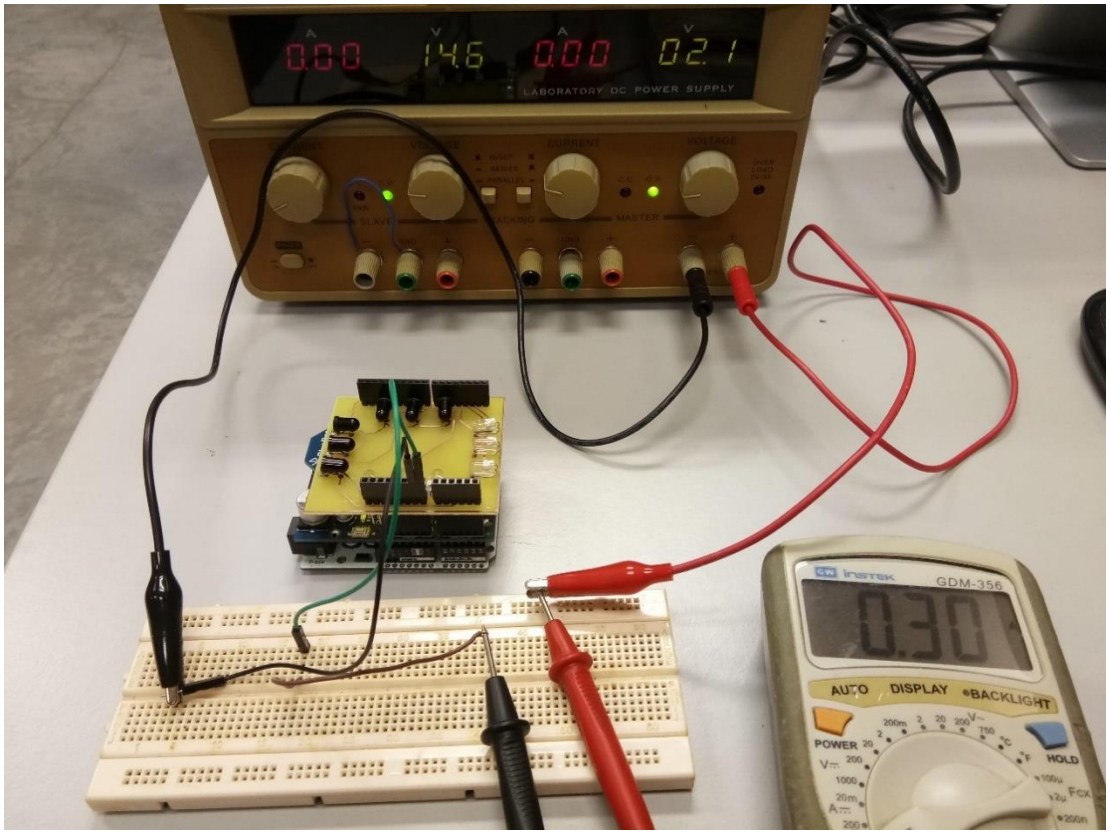

Figure 6.14 Setup to measure the current used by input device.

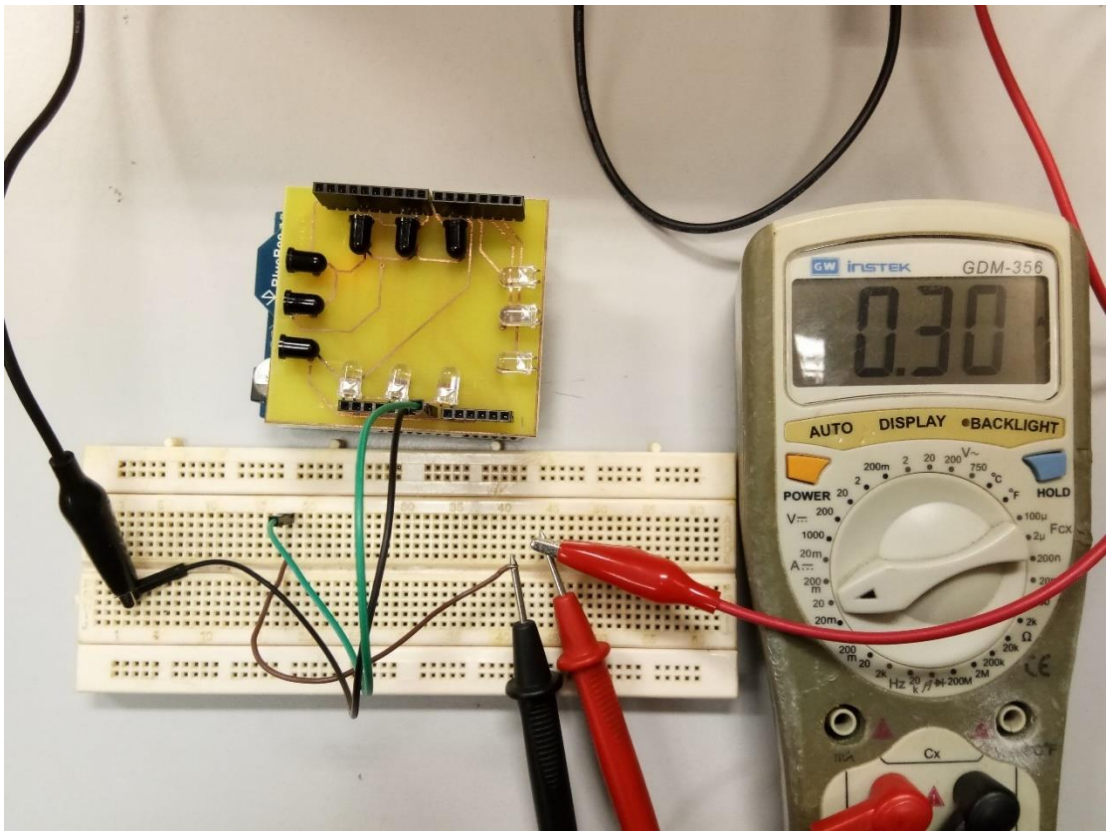

Figure 6.15 Top view of setup to measure the current used by input device.

After multimeter measure the current that used by this input device, 0.30A is used by this input device. The measured current is used to calculate the power consumption of this input device. Power consumption is calculated by using this formula. Formula at below show the power consumption formula.

$$Power\ (P) = Current\ (I) \times Voltage\ (V)$$

$Voltage\ (V) = 5V$

$Current\ (I) = 0.30A$

$Power\ (P) = 0.30A\ \times 5V = 1.5\ W$

After calculate the power consumption, power consumption that used by this input device is 1.5 W. Then, the maximum operating hour also needs to be calculated by using this formula.

$$Maximum\ Operating\ Hour\ = \frac{Power\ that\ provide\ by\ user}{Power\ that\ used\ by\ input\ device}$$

If user use 10000mAh power bank.

$$Maximum\ Operating\ Hour\ = \frac{10000mAh}{300mAh}\ \approx 33\ hours$$

Maximum operating hours of this predictive text entry system is 33 hours if user use 10000mAh power bank.

6.3 Project Challenges

Challenges faced while creating the PCB for this project. With zero knowledge of designing PCB boards and EAGLE software, spend extra time learning about designing PCB boards and EAGLE software. After the PCB board design is completed, the second problem and challenge also come, that is, it does not meet the PCB manufacturing conditions. Differential PCB manufacturing has the differential capability of the PCB board therefore the first design is rejected. Fortunately, the design doesn't have problem and just need to change the capability of the PCB board. After done change the capability of the PCB board, the design is fulfilling the condition and created.

In addition to this, soldering the components to the PCB is one of the challenges. Due to the small size of components such as SMD resistors, it is difficult to solder to a PCB board. It just takes extra time and effort to solder it.

During create the GUI program for this project, the challenges is faced. The issues were faced when creating a dictionary file for the prediction GUI program. It is easy to look up dictionaries on the Internet, but almost all websites that provide dictionaries are different. After searching the dictionary on the Internet, how to arrange the dictionary will face the second problem. When arranging the dictionary, 5 files will be created, which are commonly used words by users and are used less frequently, and the user dictionary contains 2 types of words containing capital letters. In this process, it takes a lot of time to make arrangements of dictionary.

Besides that, the GUI program is lagging after read the 5 dictionary files also one of the challenges. This program lagging and take time to load the words in the list because the words contain in these 5 files is more than 100000 words [17]. Although encountered many difficulties and challenges in the development process. Fortunately, this project can solve and overcome these problems and challenges.

6.4 Objectives Evaluation

The main objective of this project is to create a wireless predictive text entry system that suitable for handicapped with low-cost material, so that handicapped can affordable to have this device and communicate with others at the same time without making them feel abandoned and reduce their typing errors. This objective is achieved because the input device of this system is created by using low-cost materials and have a list box to select the word. The several sub-objectives also achieved.

1) Device is portable.
    - The device is created in small size and can start up just using power bank or another power supply with USB Micro-B wire.
2) Device is lightweight.
    - The device is created in small size so the user can hold and use by one hand.
3) The device can use for long operating hour.
    - After calculated the power consumption, maximum operating hour of this system is 33 hours if used 10000mAh power bank.

4) Device used wireless connection
    - This device is created by using Bluetooth module and PCB board.
5) Device is user-friendly.
    - User just need to connect the Bluetooth Module with computer via Bluetooth for first time and choose correct COM port to connect the device with GUI software.

6.5 Concluding Remark

Through this chapter, all test cases and objectives of this project have been achieved. This predictive text entry system and device is fulfilling the objective that set for this project and have tested, so that handicapped can communicate with others without feeling abandoned, improve their productivity in work and working more efficiently and reduce their typing errors. The power consumption that used by this input device is 1.5 W and maximum operating hour of this system is 33 hours if used 10000mAh power bank.

Chapter 7: Conclusion and Recommendation

7.1 Conclusion

The project concluded that the problem that needed to be solved was to enhance handicapped to enter text more easily and effectively. When using a "QWERTY" keyboard, handicapped may encounter difficulties. It takes some time for the handicaps to reach the "QWERTY" keyboard, because this type of keyboard has 101 or 104 keys. If handicaps only allow them to move their fingers limitedly, it will become more difficult. Although there is a text entry device for handicaps, it can be expensive, and not all handicaps can buy the device.

Fortunately, the problem of this project is solved and the objectives of this project is also achieved, so handicapped to enter text more easily and effectively. The main objective of this project is achieved because a wireless predictive text entry system is created to solve the problem and low-cost material is used in this wireless predictive text entry system. Besides that, the device created by W.L. Chooi [13] was using resistor, but in this project, it was replaced by the SMD resistor to make the input device look neater.

One of the objectives is device must be wireless connection, this system is a wireless based system by using Bluetooth module to make it portable and easier to use. The remaining objective also achieved which is device must be portable, lightweight, user friendly and long operating time. The size of the device also fit to small size to make handicapped easier to hold the device and use finger to press the intersection point. User friendly is achieved by user just need to learn and memorization each button function to use this system. For long operating time, user can use power bank start up this system and by using power bank this system can operate more than 10 hours and it depending on how much mAh power bank the user uses.

7.2 Recommendation

Replacing the microcontroller is recommended because the price of the CT-UNO and Cytron XBee Shield has increased compared to the research was proposed by W.L. Chooi [13]. Besides that, the Bluetooth module produced by Cytron has been discontinued. Therefore, it is recommended to replace the microcontroller to reduce the cost of the input device.

In addition, replacing the size of components also recommended because this input device will be used by difference user. The categories of users can be male, female and children and different users will have different finger sizes. Therefore, replacing the size of components such as the size of IR Transmitter and IR receiver is 5mm, it can be replaced to 3mm size. By replace the size of components, the area of the PCB board that user can touch the intersection point also increase. Besides that, it also can make the device look neater.

Besides that, make a cover for the input device to protect the input device from irresistible damage and protect the user from overheating the input device to prevent some unwanted accidents.

This GUI software could do with some improvements to make it usable in different operating systems because this wireless predictive text entry system is written in Windows Form Application format and only working in Windows platform. Additionally, the system's word selection is limited to 6. This list box of the prediction system can add more word choices for the user to select or add a second page to the list box to reduce the number of characters the user needs to enter.

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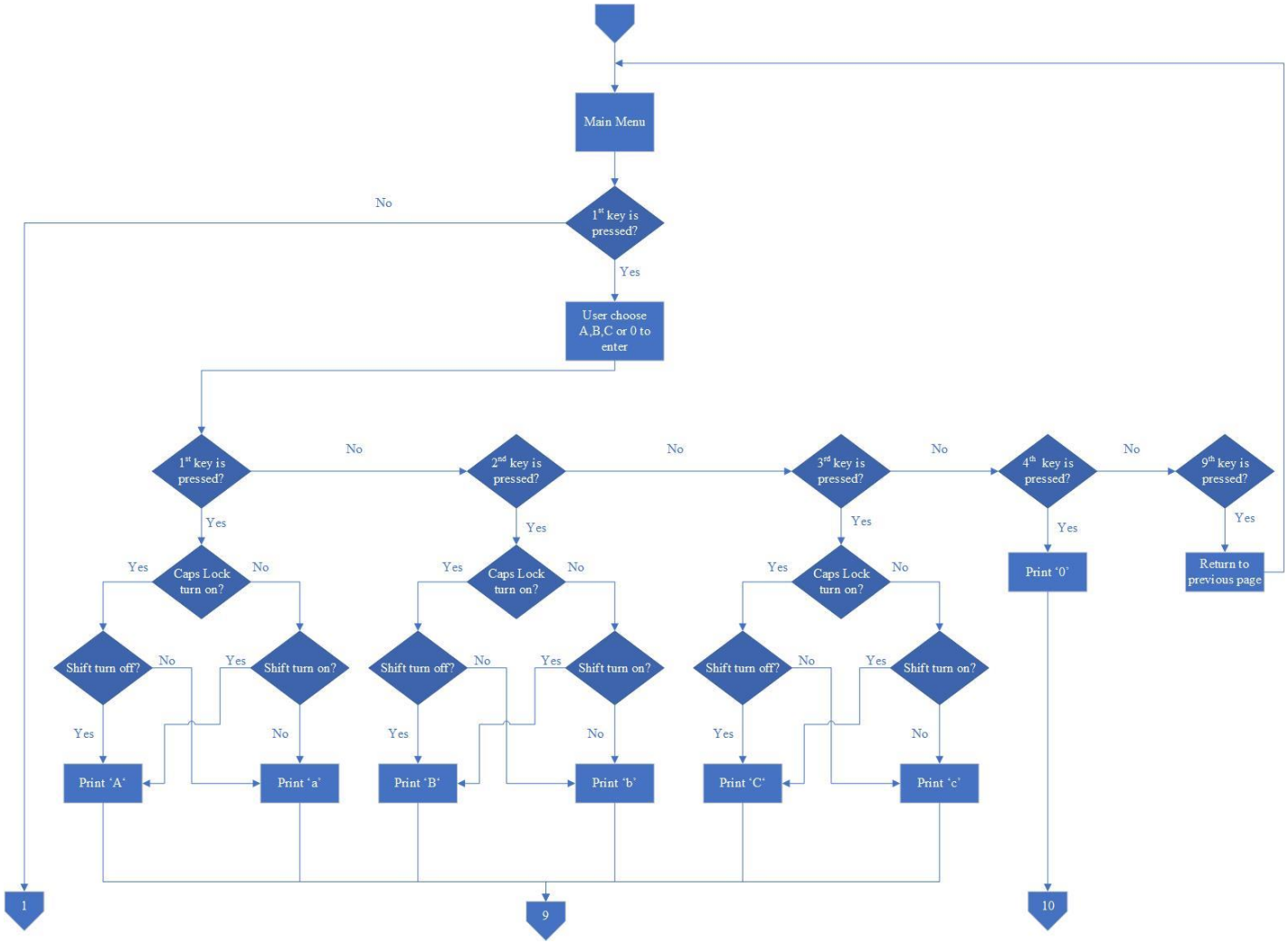
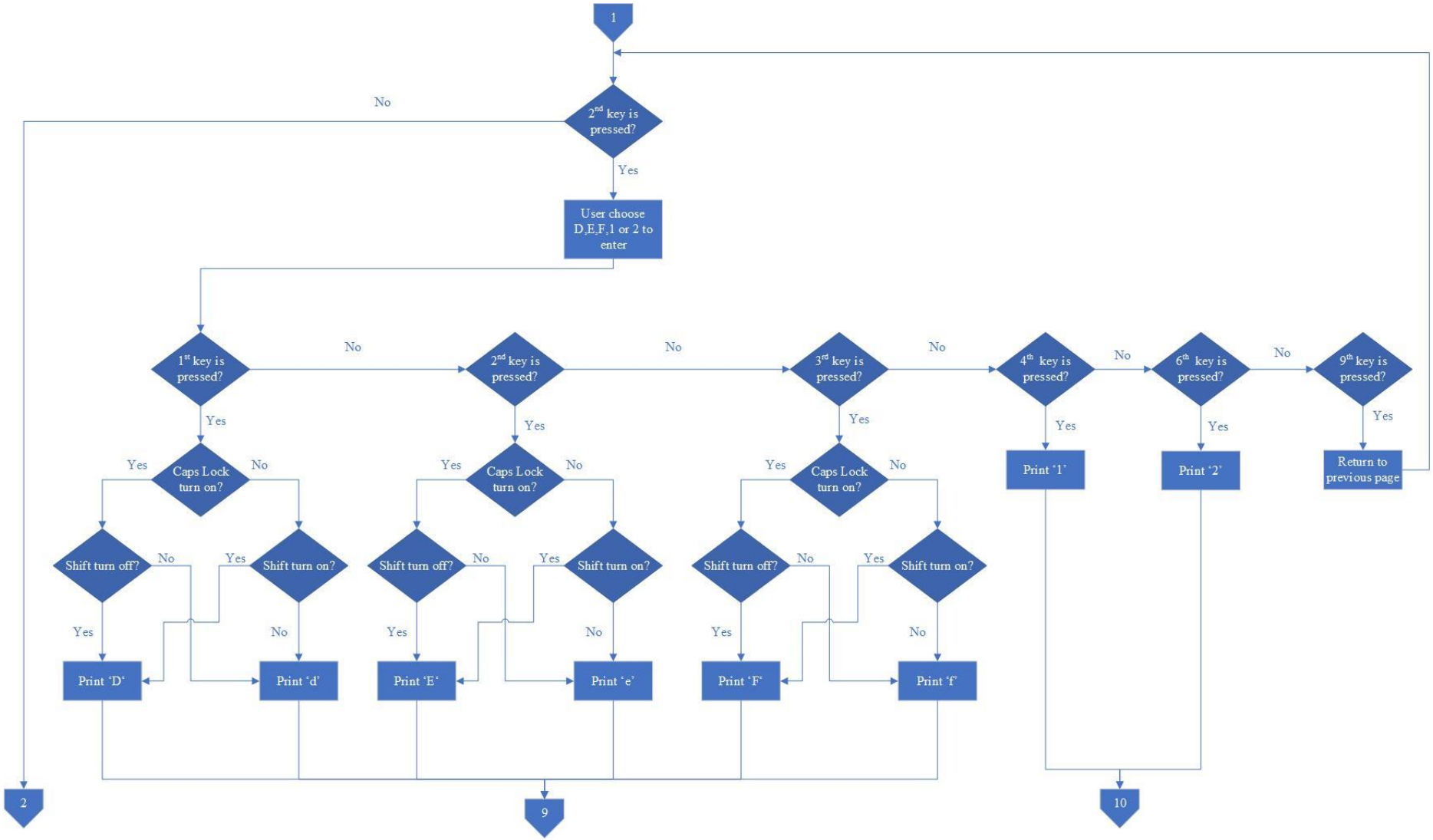
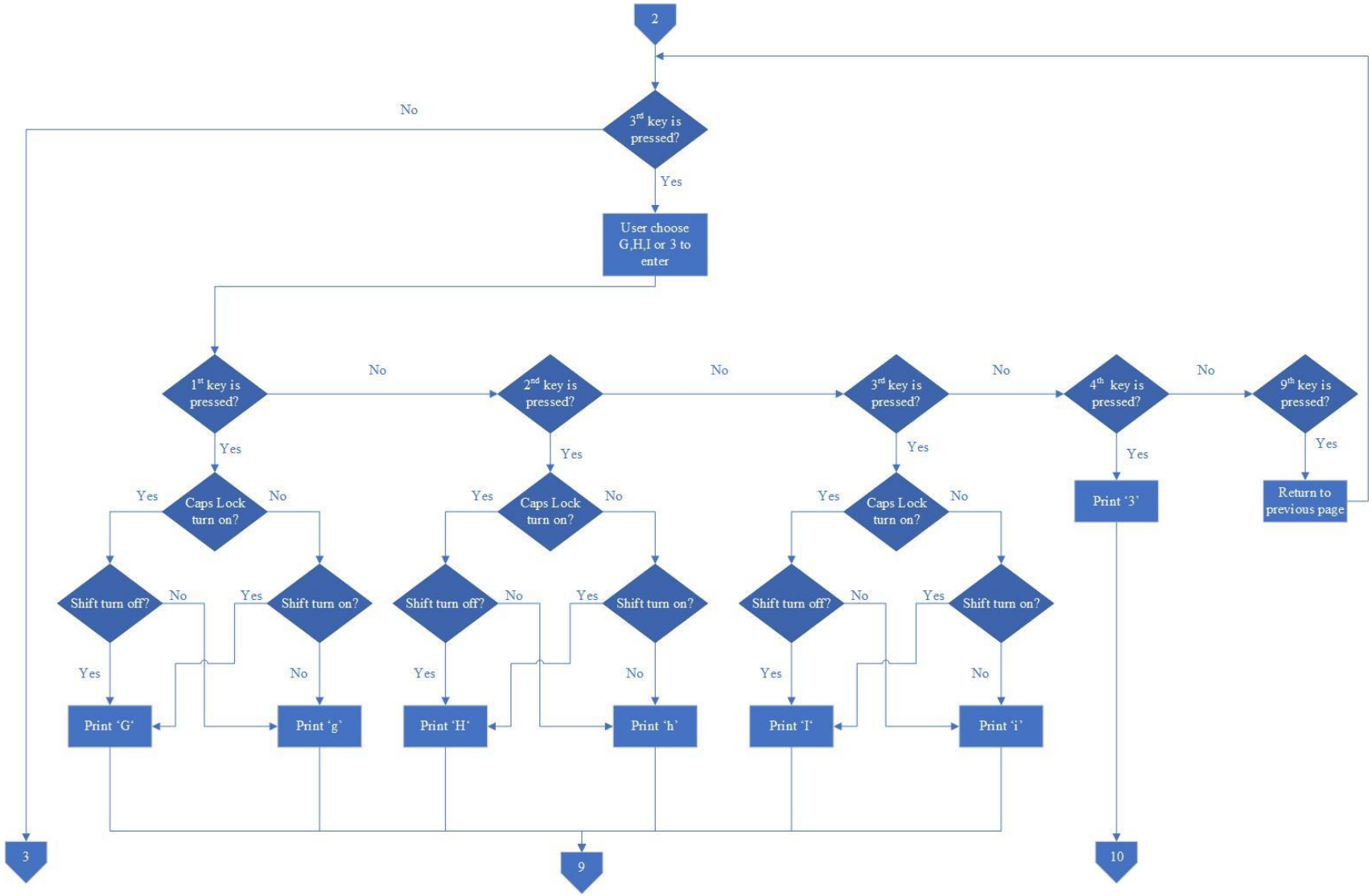
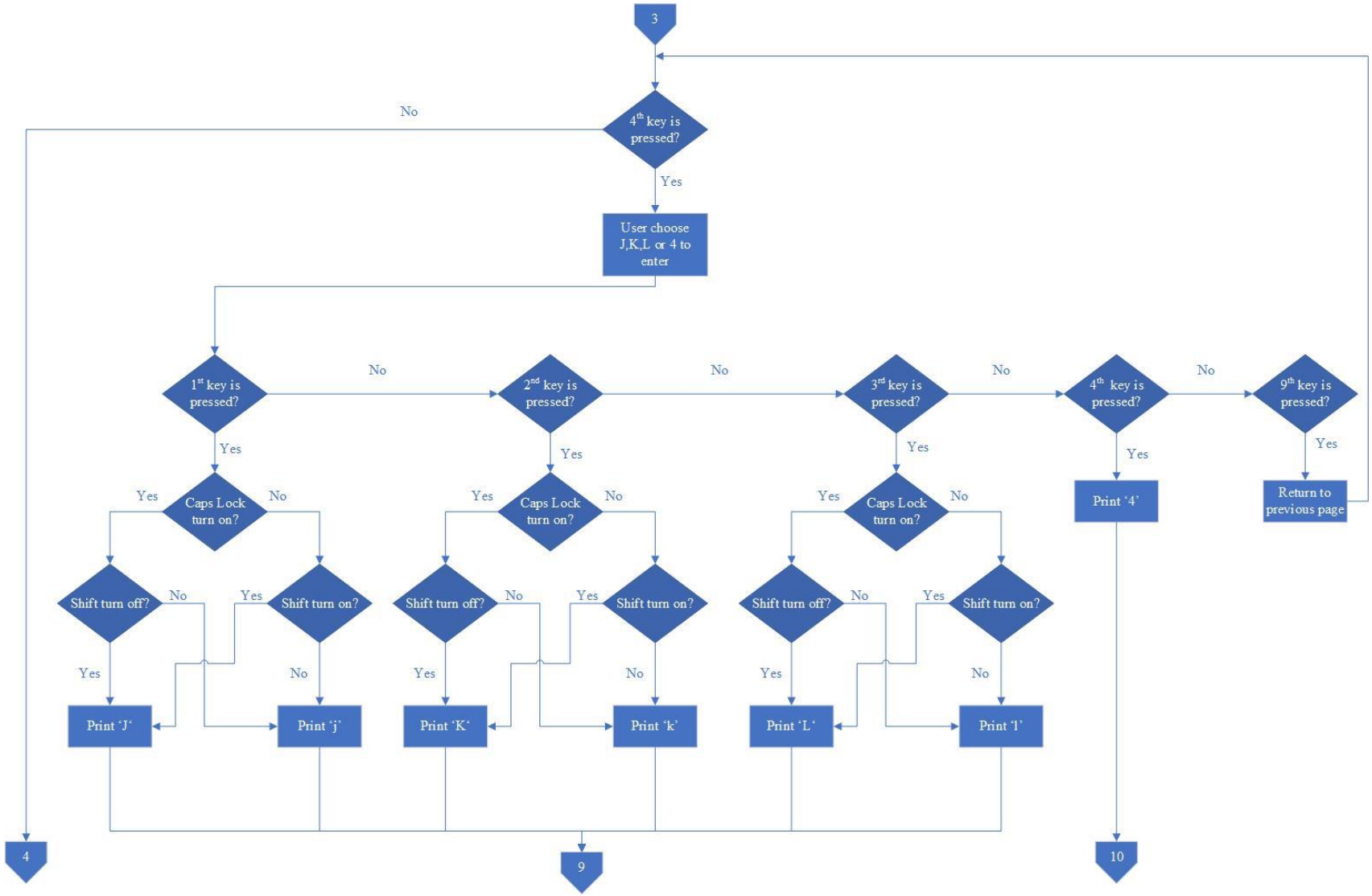
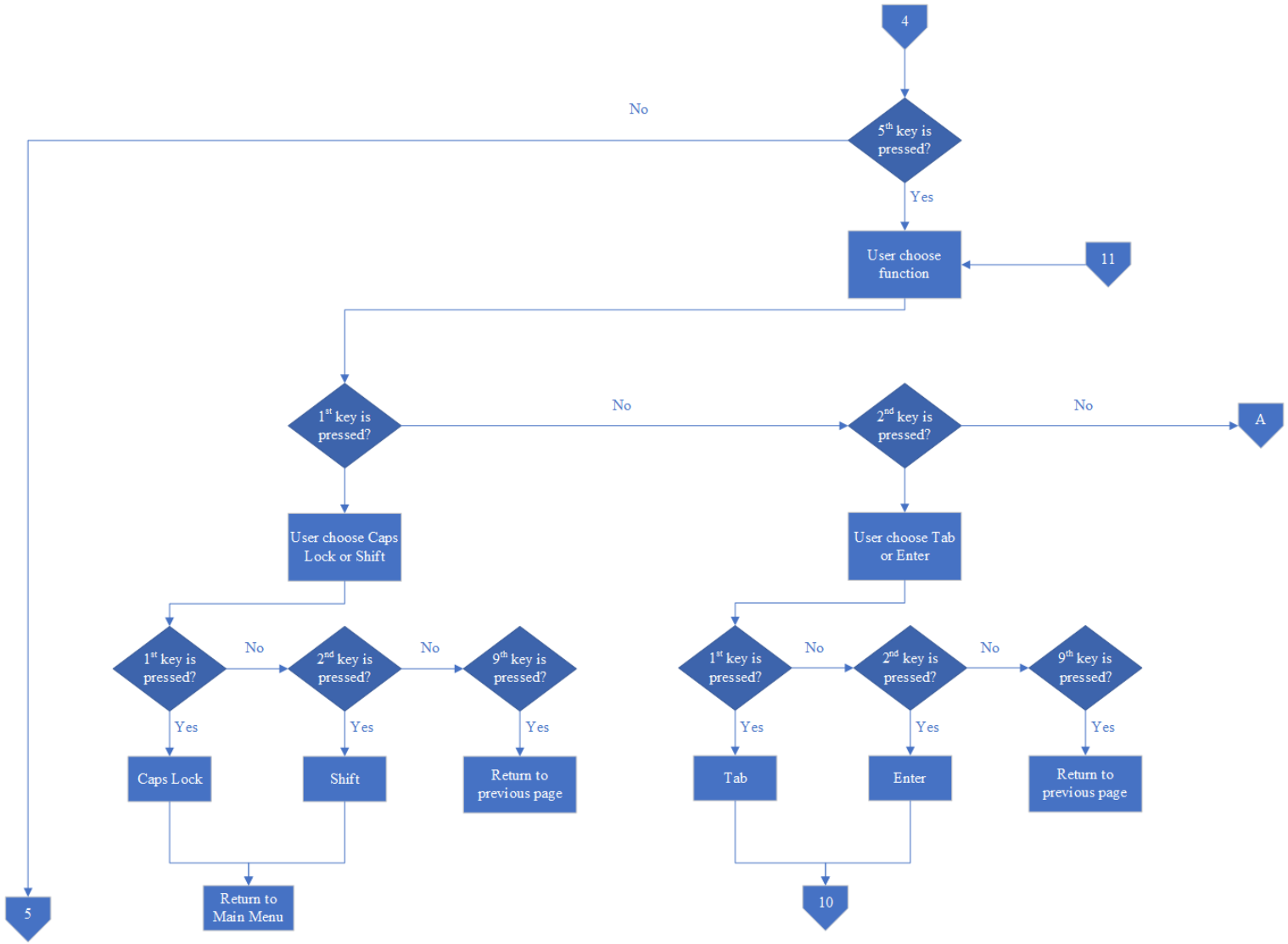
Subroutine to analyze the key signal of the device

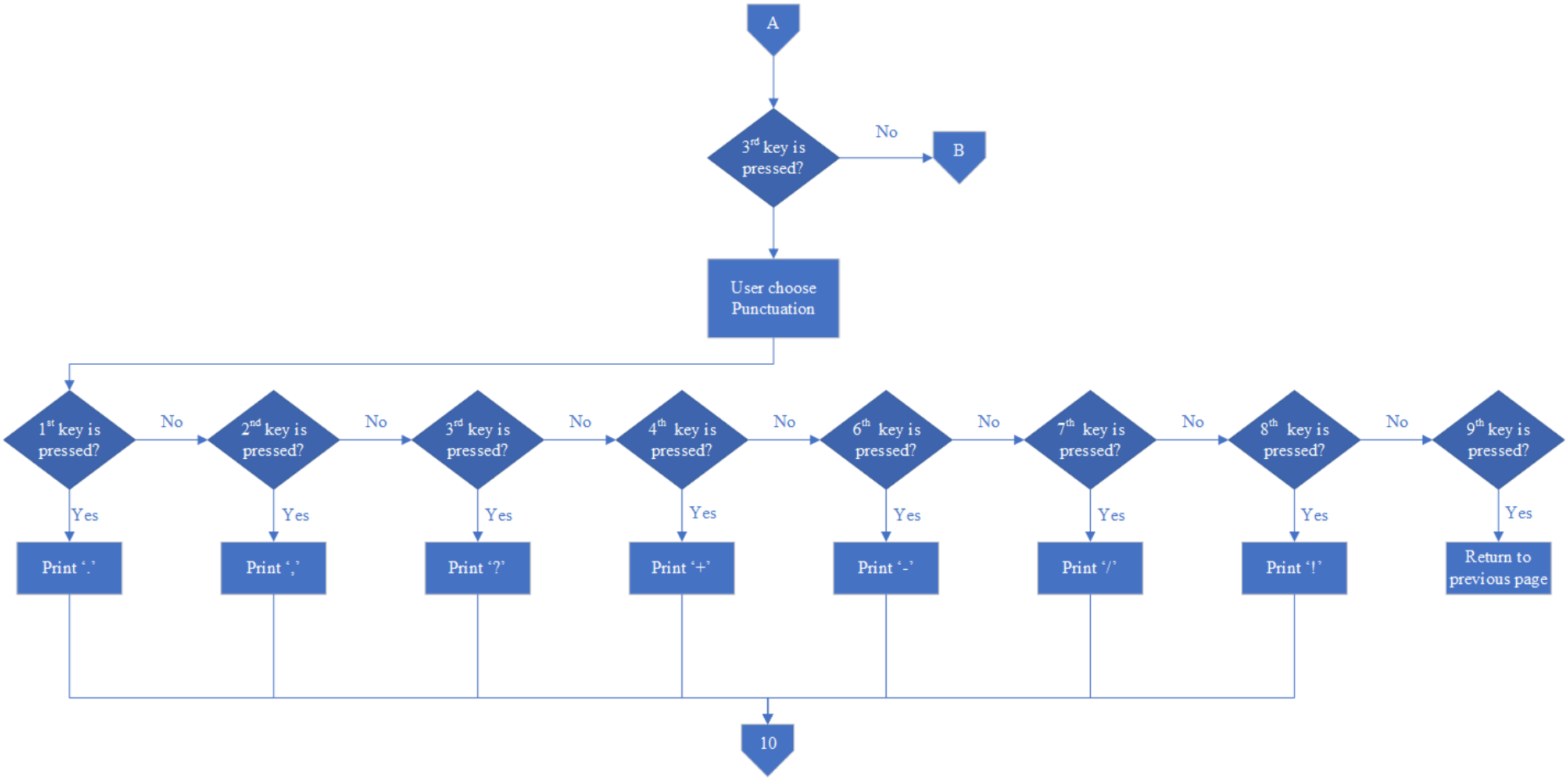


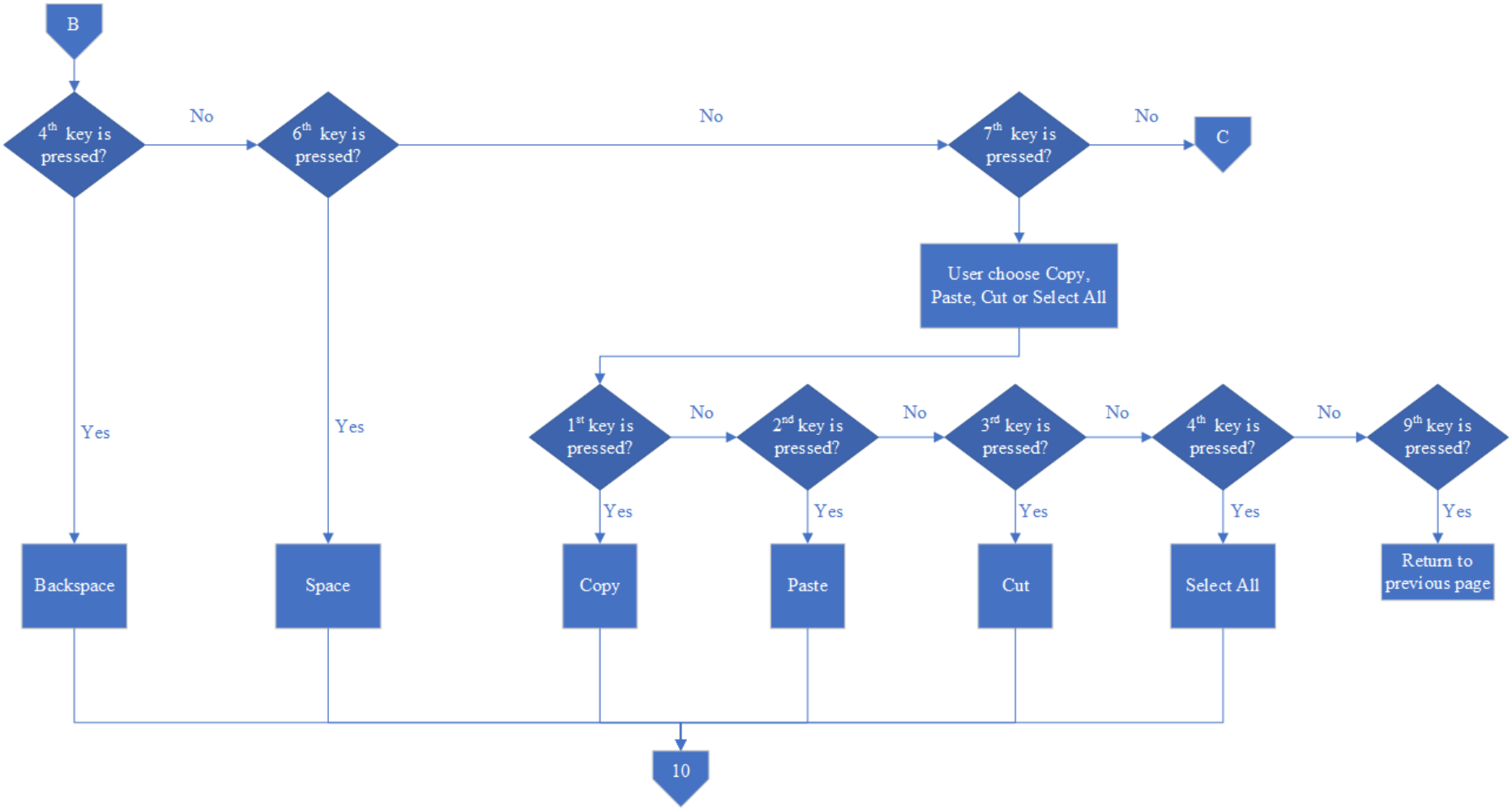

1
2nd key is pressed?
No
Yes
User choose D,E,F,1 or 2 to enter
1st key is pressed?
2nd key is pressed?
3rd key is pressed?
4th key is pressed?
6th key is pressed?
9th key is pressed?
Caps Lock turn on?
Shift turn off?
Shift turn on?
Print 'D'
Print 'd'
Print 'E'
Print 'e'
Print 'F'
Print 'f'
Print '1'
Print '2'
Return to previous page
2
9
10

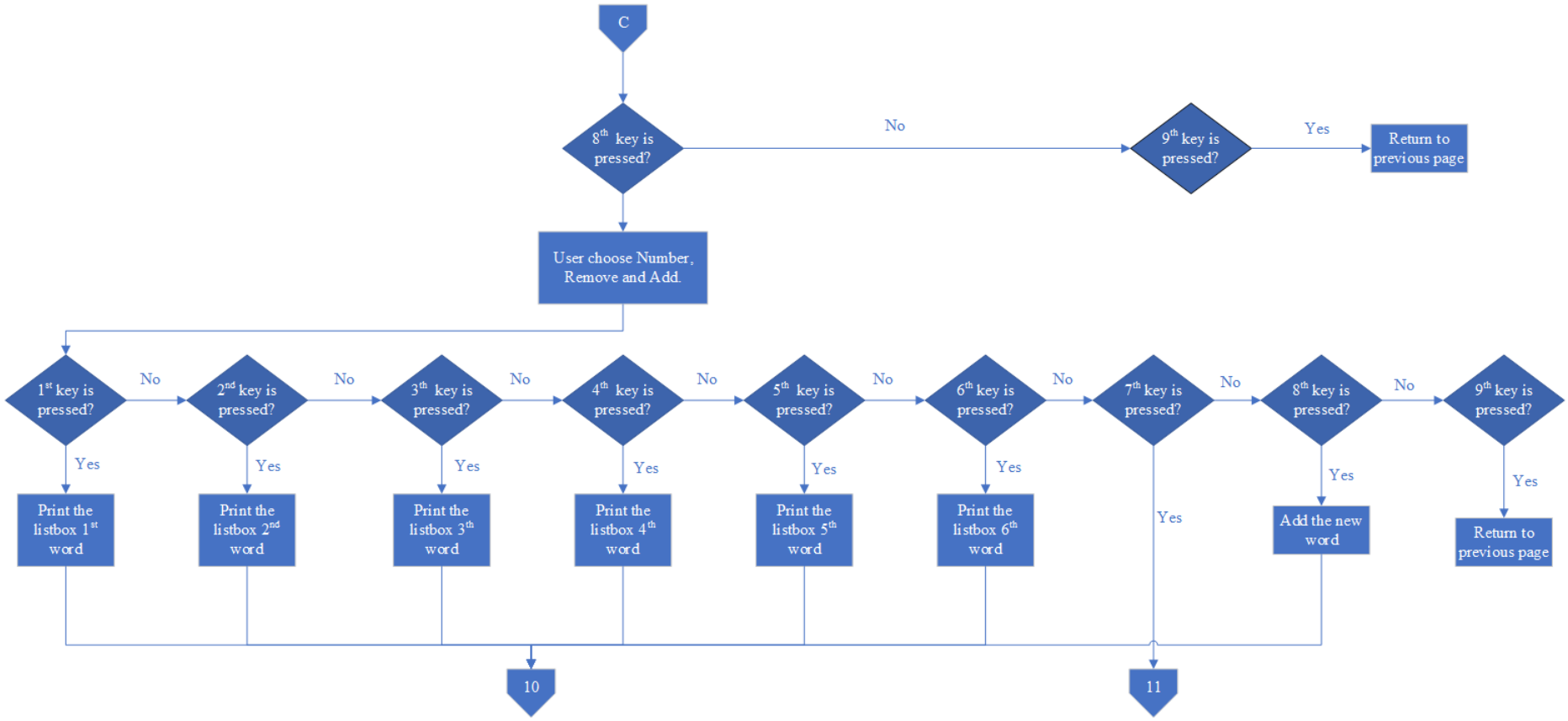

2
3rd key is pressed?
No
Yes
User choose G,H,I or 3 to enter
1st key is pressed?
2nd key is pressed?
3rd key is pressed?
4th key is pressed?
9th key is pressed?
Caps Lock turn on?
Shift turn off?
Shift turn on?
Print 'G'
Print 'g'
Print 'H'
Print 'h'
Print 'I'
Print 'i'
Print '3'
Return to previous page
3
9
10

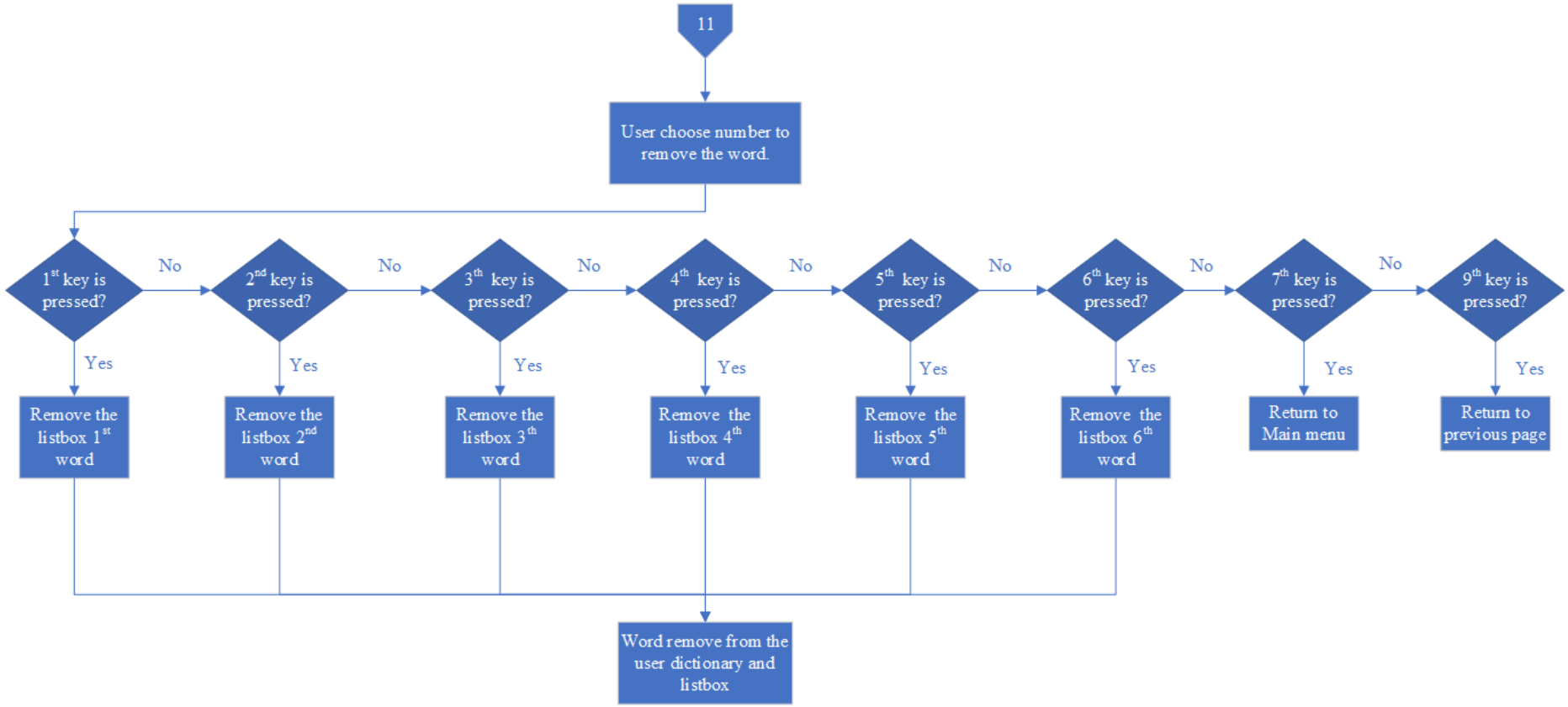

3
4th key is pressed?
No
Yes
User choose J,K,L or 4 to enter
1st key is pressed?
2nd key is pressed?
3rd key is pressed?
4th key is pressed?
9th key is pressed?
Caps Lock turn on?
Shift turn off?
Shift turn on?
Print 'J'
Print 'j'
Print 'K'
Print 'k'
Print 'L'
Print 'l'
Print '4'
Return to previous page
4
9
10

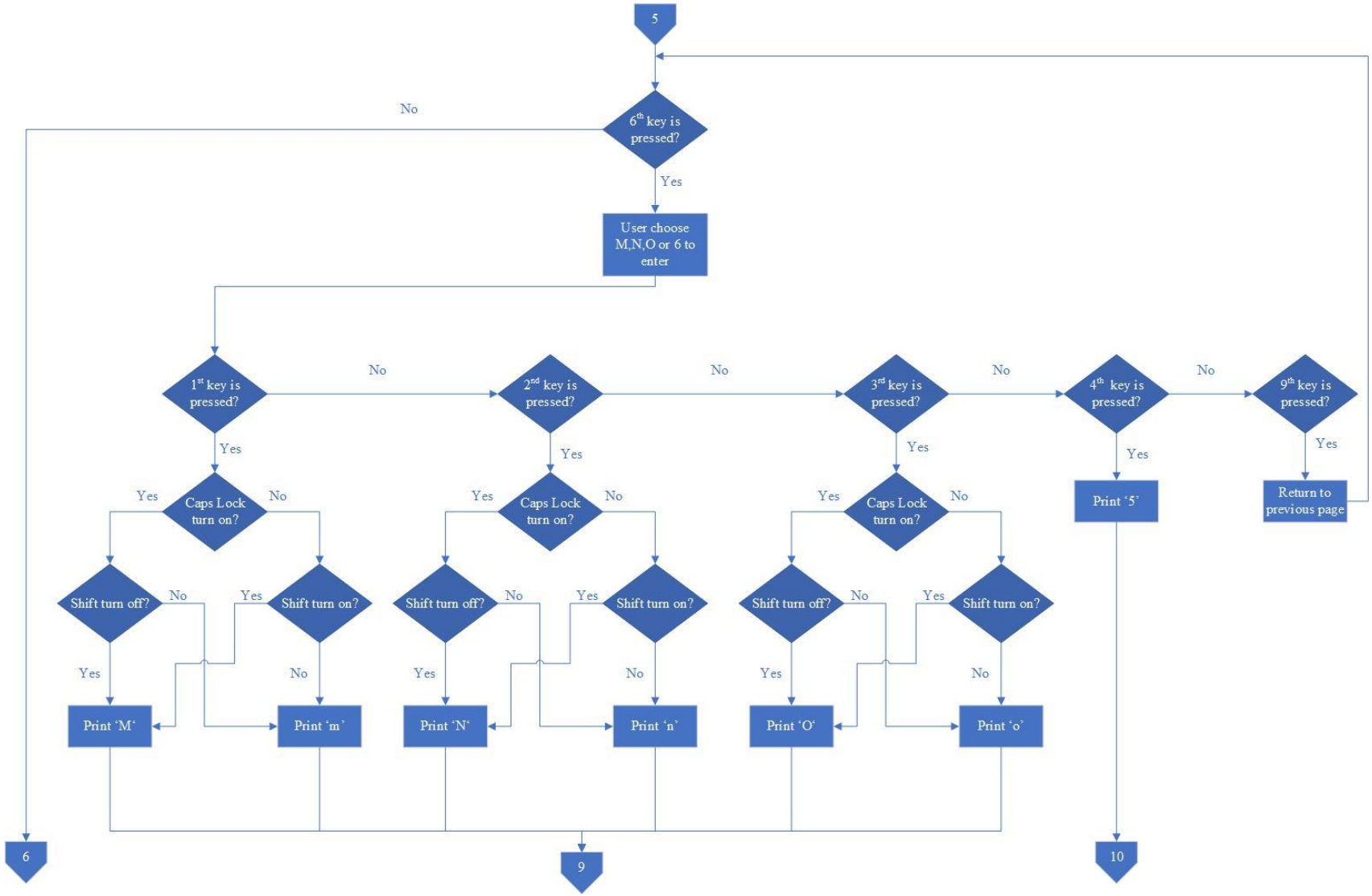

4
No
5th key is pressed?
Yes
User choose function
11
1st key is pressed?
No
2nd key is pressed?
No
A
User choose Caps Lock or Shift
User choose Tab or Enter
1st key is pressed?
No
2nd key is pressed?
No
9th key is pressed?
Yes
Yes
Yes
Caps Lock
Shift
Return to previous page
1st key is pressed?
No
2nd key is pressed?
No
9th key is pressed?
Yes
Yes
Yes
Tab
Enter
Return to previous page
5
Return to Main Menu
10

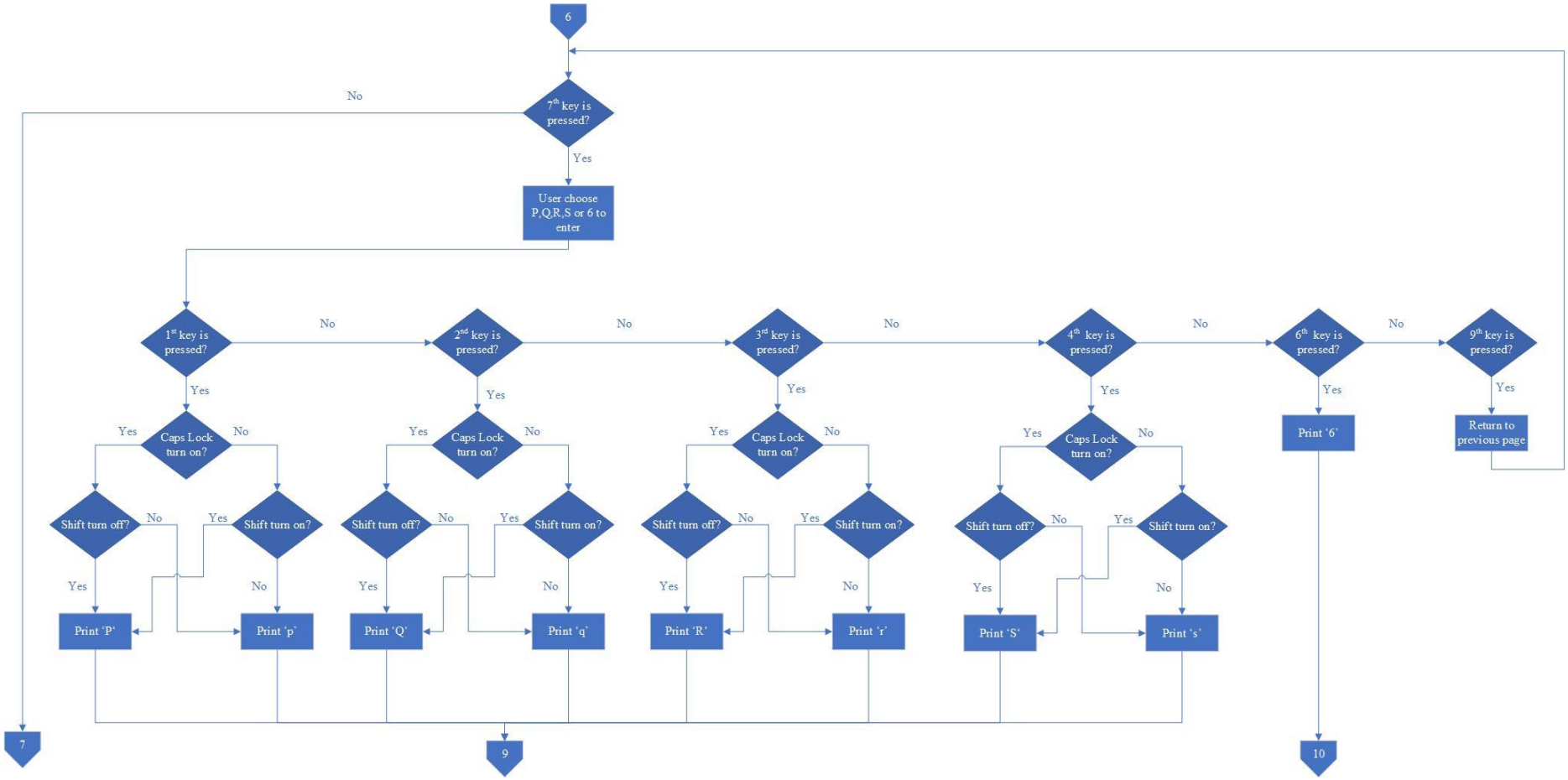

A
3rd key is pressed?
No
B
User choose Punctuation
1st key is pressed?
No
2nd key is pressed?
No
3rd key is pressed?
No
4th key is pressed?
No
6th key is pressed?
No
7th key is pressed?
No
8th key is pressed?
No
9th key is pressed?
Yes
Print '.'
Print ','
Print '?'
Print '+'
Print '-'
Print '/'
Print '!'
Return to previous page
10

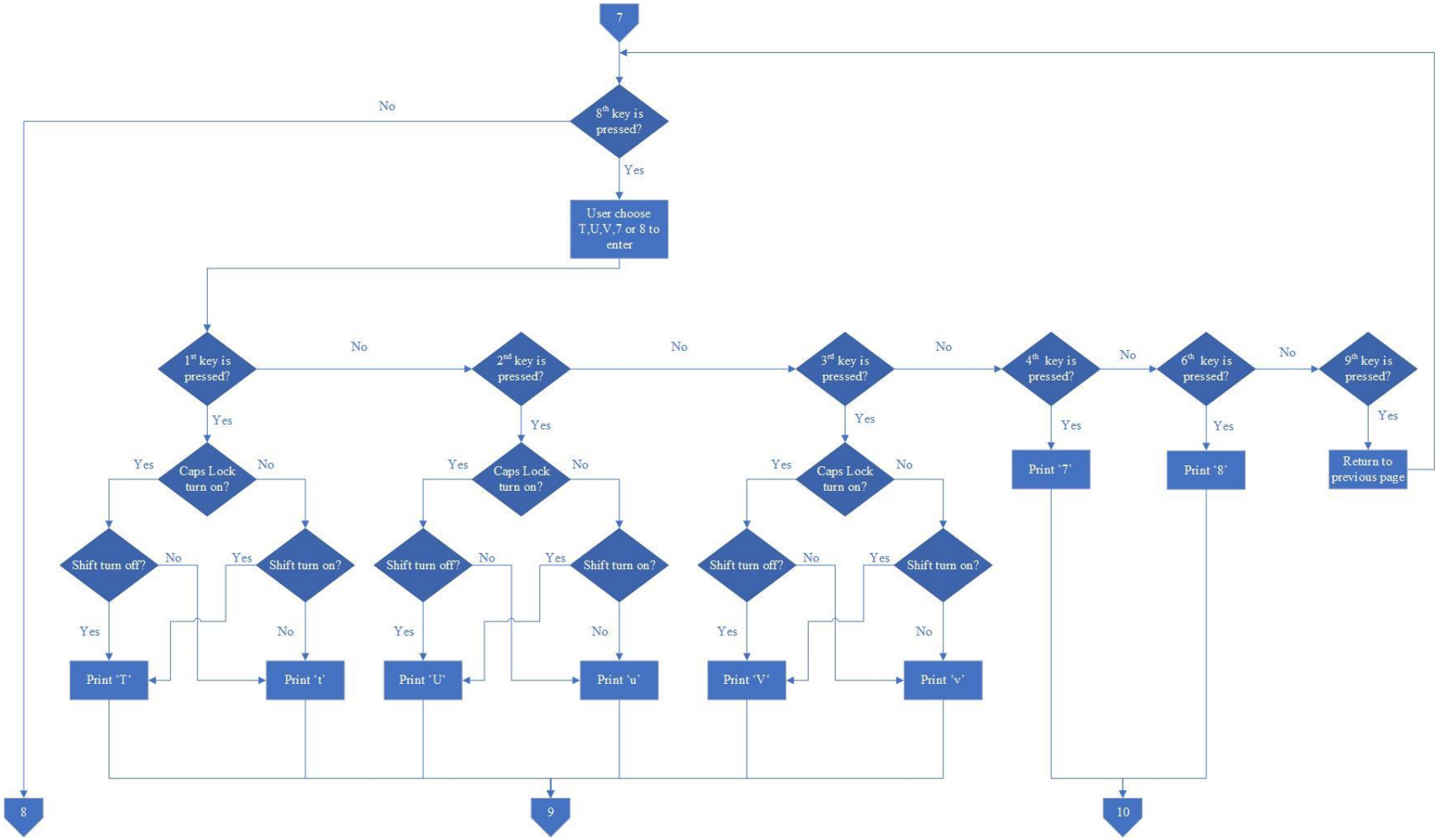

B
4th key is pressed?
No
6th key is pressed?
No
7th key is pressed?
No
C
User choose Copy, Paste, Cut or Select All
Yes
Yes
1st key is pressed?
No
2nd key is pressed?
No
3rd key is pressed?
No
4th key is pressed?
No
9th key is pressed?
Yes
Yes
Yes
Yes
Yes
Backspace
Space
Copy
Paste
Cut
Select All
Return to previous page
10

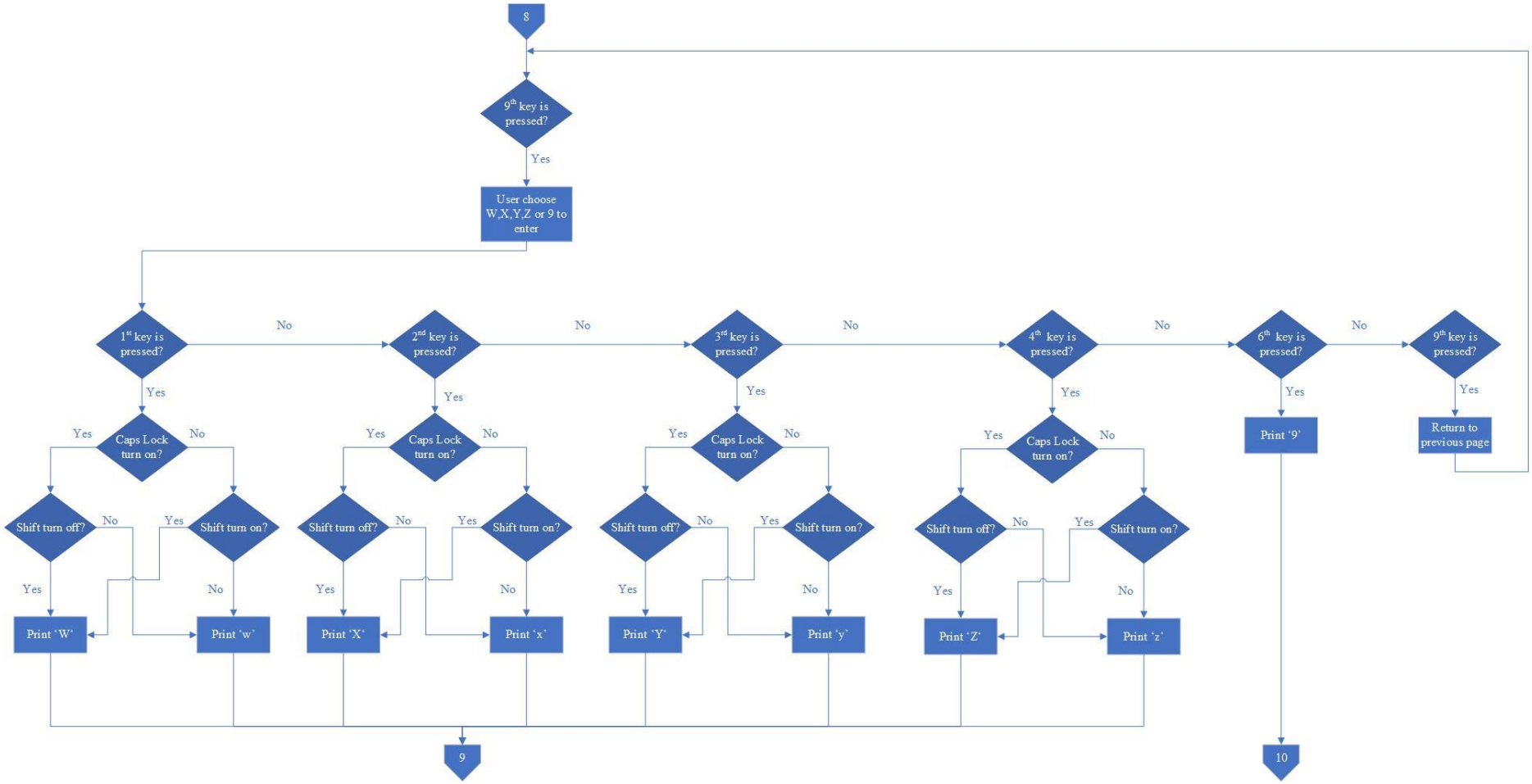

C
8th key is pressed?
No
9th key is pressed?
Yes
Return to previous page
User choose Number, Remove and Add.
1st key is pressed?
No
2nd key is pressed?
No
3th key is pressed?
No
4th key is pressed?
No
5th key is pressed?
No
6th key is pressed?
No
7th key is pressed?
No
8th key is pressed?
No
9th key is pressed?
Yes
Print the listbox 1st word
Print the listbox 2nd word
Print the listbox 3th word
Print the listbox 4th word
Print the listbox 5th word
Print the listbox 6th word
Add the new word
Return to previous page
10
11

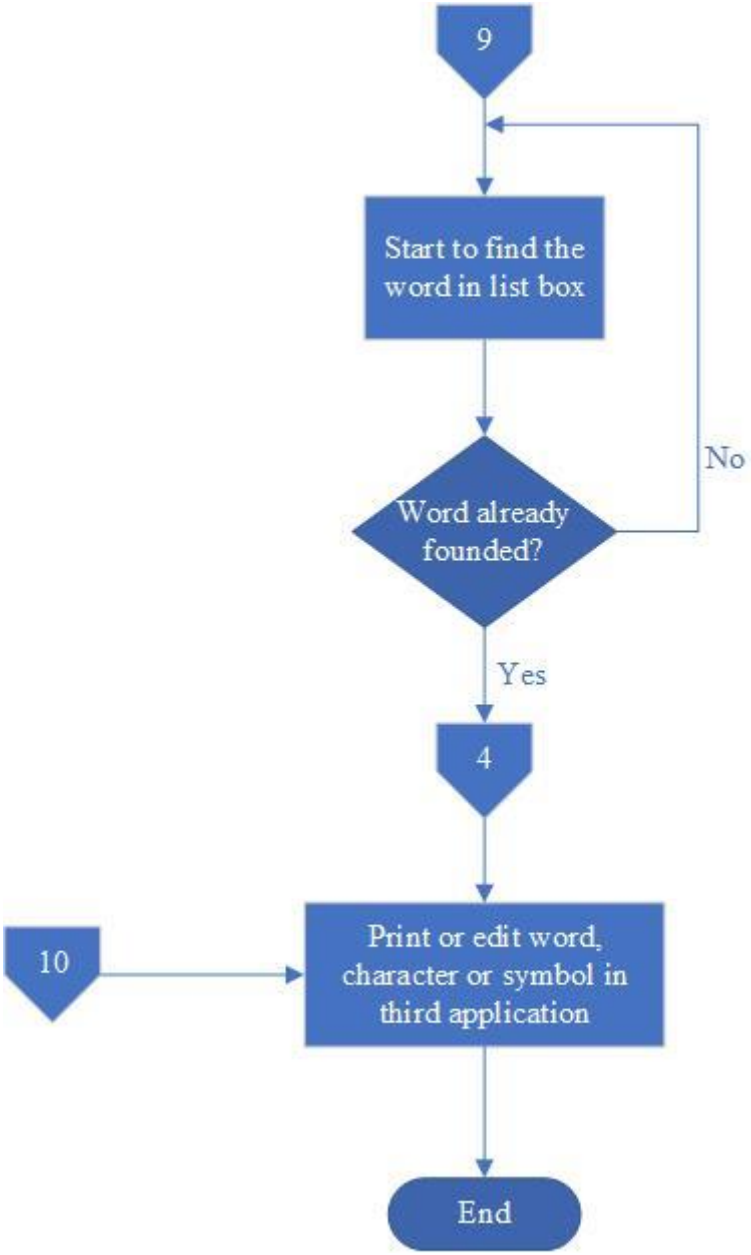

11
User choose number to remove the word.
1st key is pressed?
No
2nd key is pressed?
No
3th key is pressed?
No
4th key is pressed?
No
5th key is pressed?
No
6th key is pressed?
No
7th key is pressed?
No
9th key is pressed?
Yes
Remove the listbox 1st word
Remove the listbox 2nd word
Remove the listbox 3th word
Remove the listbox 4th word
Remove the listbox 5th word
Remove the listbox 6th word
Return to Main menu
Return to previous page
Word remove from the user dictionary and listbox


5
6th key is pressed?
No
Yes
User choose M,N,O or 6 to enter
1st key is pressed?
2nd key is pressed?
3rd key is pressed?
4th key is pressed?
9th key is pressed?
Caps Lock turn on?
Shift turn off?
Shift turn on?
Print 'M'
Print 'm'
Print 'N'
Print 'n'
Print 'O'
Print 'o'
Print '5'
Return to previous page
6
9
10


6
7th key is pressed?
No
Yes
User choose P,Q,R,S or 6 to enter
1st key is pressed?
2nd key is pressed?
3rd key is pressed?
4th key is pressed?
6th key is pressed?
9th key is pressed?
Caps Lock turn on?
Shift turn off?
Shift turn on?
Print 'P'
Print 'p'
Print 'Q'
Print 'q'
Print 'R'
Print 'r'
Print 'S'
Print 's'
Print '6'
Return to previous page
7
9
10


7
8th key is pressed?
No
Yes
User choose T,U,V,7 or 8 to enter
1st key is pressed?
2nd key is pressed?
3rd key is pressed?
4th key is pressed?
6th key is pressed?
9th key is pressed?
Caps Lock turn on?
Shift turn off?
Shift turn on?
Print 'T'
Print 't'
Print 'U'
Print 'u'
Print 'V'
Print 'v'
Print '7'
Print '8'
Return to previous page
8
9
10


8
9th key is pressed?
Yes
User choose W,X,Y,Z or 9 to enter
1st key is pressed?
No
2nd key is pressed?
No
3rd key is pressed?
No
4th key is pressed?
No
6th key is pressed?
No
9th key is pressed?
Yes
Caps Lock turn on?
Shift turn off?
Shift turn on?
Print 'W'
Print 'w'
Print 'X'
Print 'x'
Print 'Y'
Print 'y'
Print 'Z'
Print 'z'
Print '9'
Return to previous page
9
10


9
Start to find the word in list box
Word already founded?
No
Yes
4
10
Print or edit word, character or symbol in third application
End

FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: Trimester 2, Year 5	**Study week no.: Week 1**
Student Name & ID: Seah Ni Xuan 17ACB05751	
Supervisor: Mr. Teoh Shen Khang	
Project Title: Wireless Predictive Text Entry System for the Handicapped	

1. WORK DONE

[Please write the details of the work done in the last fortnight.]

Discuss the PCB board design with supervisor.
Send the PCB board design to fabrication.

2. WORK TO BE DONE

Design the PCB board with EAGLE software.
Repair the GUI program bug.

3. PROBLEMS ENCOUNTERED

Not familiar with EAGLE software need a lot of time to learn.

4. SELF EVALUATION OF THE PROGRESS

Do more research about the predictive text entry.

TEOH

Supervisor's signature

Xuan!

Student's signature

FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: Trimester 2, Year 5	**Study week no.: Week 2**
Student Name & ID: Seah Ni Xuan 17ACB05751	
Supervisor: Mr. Teoh Shen Khang	
Project Title: Wireless Predictive Text Entry System for the Handicapped	

1. WORK DONE

[Please write the details of the work done in the last fortnight.]

GUI program is done adding some new function.

2. WORK TO BE DONE

Repair the GUI program bug.

3. PROBLEMS ENCOUNTERED

No problems are encountered.

4. SELF EVALUATION OF THE PROGRESS

Do more research about the predictive text entry.

TEOH

Supervisor's signature

Xuan!

Student's signature

FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: Trimester 2, Year 5	**Study week no.: Week 3**
Student Name & ID: Seah Ni Xuan 17ACB05751	
Supervisor: Mr. Teoh Shen Khang	
Project Title: Wireless Predictive Text Entry System for the Handicapped	

1. WORK DONE

[Please write the details of the work done in the last fortnight.]

Discuss and redo the PCB board design with supervisor because the design is not fulfilling the fabrication capability.

2. WORK TO BE DONE

Redesign the infrared board with EAGLE software.

3. PROBLEMS ENCOUNTERED

Not familiar with EAGLE software need a lot of time to learn.

4. SELF EVALUATION OF THE PROGRESS

Do more research about the predictive text entry.

TEOH

Supervisor's signature

Xuan!

Student's signature

FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: Trimester 2, Year 5	**Study week no.: Week 4**
Student Name & ID: Seah Ni Xuan 17ACB05751	
Supervisor: Mr. Teoh Shen Khang	
Project Title: Wireless Predictive Text Entry System for the Handicapped	

1. WORK DONE

[Please write the details of the work done in the last fortnight.]

Discuss the components for hardware and buy it.

2. WORK TO BE DONE

Order the components.

3. PROBLEMS ENCOUNTERED

No problems are encountered.

4. SELF EVALUATION OF THE PROGRESS

Do more research about the predictive text entry.

TEOH

Supervisor's signature

Xuan!

Student's signature

FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: Trimester 2, Year 5	**Study week no.: Week 5**
Student Name & ID: Seah Ni Xuan 17ACB05751	
Supervisor: Mr. Teoh Shen Khang	
Project Title: Wireless Predictive Text Entry System for the Handicapped	

1. WORK DONE

[Please write the details of the work done in the last fortnight.]

PCB board is done fabrication.
Having discussion about the FYP report.

2. WORK TO BE DONE

Soldering the components on PCB board.

3. PROBLEMS ENCOUNTERED

No problems are encountered.

4. SELF EVALUATION OF THE PROGRESS

Do more research about the predictive text entry.

TEOH

Supervisor's signature

Xuan!

Student's signature

FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: Trimester 2, Year 5	**Study week no.: Week 6**
Student Name & ID: Seah Ni Xuan 17ACB05751	
Supervisor: Mr. Teoh Shen Khang	
Project Title: Wireless Predictive Text Entry System for the Handicapped	

1. WORK DONE

[Please write the details of the work done in the last fortnight.]

Soldering the components on PCB board.
Checking each component is working fine.
Having discussion about the FYP report and the PCB board with supervisor.

2. WORK TO BE DONE

Continue soldering the components on PCB board.

3. PROBLEMS ENCOUNTERED

No problems are encountered.

4. SELF EVALUATION OF THE PROGRESS

Do more research about the predictive text entry.

TEOH

Supervisor's signature

Xuan!

Student's signature

FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: Trimester 2, Year 5	**Study week no.: Week 7**
Student Name & ID: Seah Ni Xuan 17ACB05751	
Supervisor: Mr. Teoh Shen Khang	
Project Title: Wireless Predictive Text Entry System for the Handicapped	

1. WORK DONE

[Please write the details of the work done in the last fortnight.]

Done soldering the components on PCB board.
Writing the code for Arduino and upload to ensure the infrared board is working.

2. WORK TO BE DONE

Writing the code to ensure the GUI program can receive the analog signal from Arduino.

3. PROBLEMS ENCOUNTERED

No problems are encountered.

4. SELF EVALUATION OF THE PROGRESS

Do more research about the predictive text entry.

TEOH

Supervisor's signature

Xuan!

Student's signature

FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: Trimester 2, Year 5	**Study week no.: Week 8**
Student Name & ID: Seah Ni Xuan 17ACB05751	
Supervisor: Mr. Teoh Shen Khang	
Project Title: Wireless Predictive Text Entry System for the Handicapped	

1. WORK DONE

[Please write the details of the work done in the last fortnight.]

Having discussion about the FYP report and the GUI program with supervisor.
GUI program can receive the analog signal from Arduino.

2. WORK TO BE DONE

Writing the code to ensure when the intersection point of infrared board is pressed, the GUI program will response which button is clicked.

3. PROBLEMS ENCOUNTERED

No problems are encountered.

4. SELF EVALUATION OF THE PROGRESS

Do more research about the predictive text entry.

TEOH

Supervisor's signature

Xuan!

Student's signature

FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: Trimester 2, Year 5	**Study week no.: Week 9**
Student Name & ID: Seah Ni Xuan 17ACB05751	
Supervisor: Mr. Teoh Shen Khang	
Project Title: Wireless Predictive Text Entry System for the Handicapped	

1. WORK DONE

[Please write the details of the work done in the last fortnight.]

Continue do the improvement on GUI program.

2. WORK TO BE DONE

Continue do the improvement on GUI program.
Repair the system delay problem.
Write report.

3. PROBLEMS ENCOUNTERED

Change the background color of the button have some delay.

4. SELF EVALUATION OF THE PROGRESS

Do more research about the predictive text entry.

TEOH

Supervisor's signature

Xuan!

Student's signature

FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: Trimester 2, Year 5	**Study week no.: Week 10**
Student Name & ID: Seah Ni Xuan 17ACB05751	
Supervisor: Mr. Teoh Shen Khang	
Project Title: Wireless Predictive Text Entry System for the Handicapped	

1. WORK DONE

[Please write the details of the work done in the last fortnight.]

Continue do the improvement on GUI program.

2. WORK TO BE DONE

Continue do the improvement on GUI program.
Write report.

3. PROBLEMS ENCOUNTERED

Having a delay problem in system.

4. SELF EVALUATION OF THE PROGRESS

Do more research about the predictive text entry.

TEOH

Supervisor's signature

Xuan!

Student's signature

FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: Trimester 2, Year 5	**Study week no.: Week 11**
Student Name & ID: Seah Ni Xuan 17ACB05751	
Supervisor: Mr. Teoh Shen Khang	
Project Title: Wireless Predictive Text Entry System for the Handicapped	

1. WORK DONE

[Please write the details of the work done in the last fortnight.]

Show the final product to supervisor.

2. WORK TO BE DONE

Continue do the improvement on GUI program.
Write report.

3. PROBLEMS ENCOUNTERED

No problems are encountered.

4. SELF EVALUATION OF THE PROGRESS

Do more research about the predictive text entry.

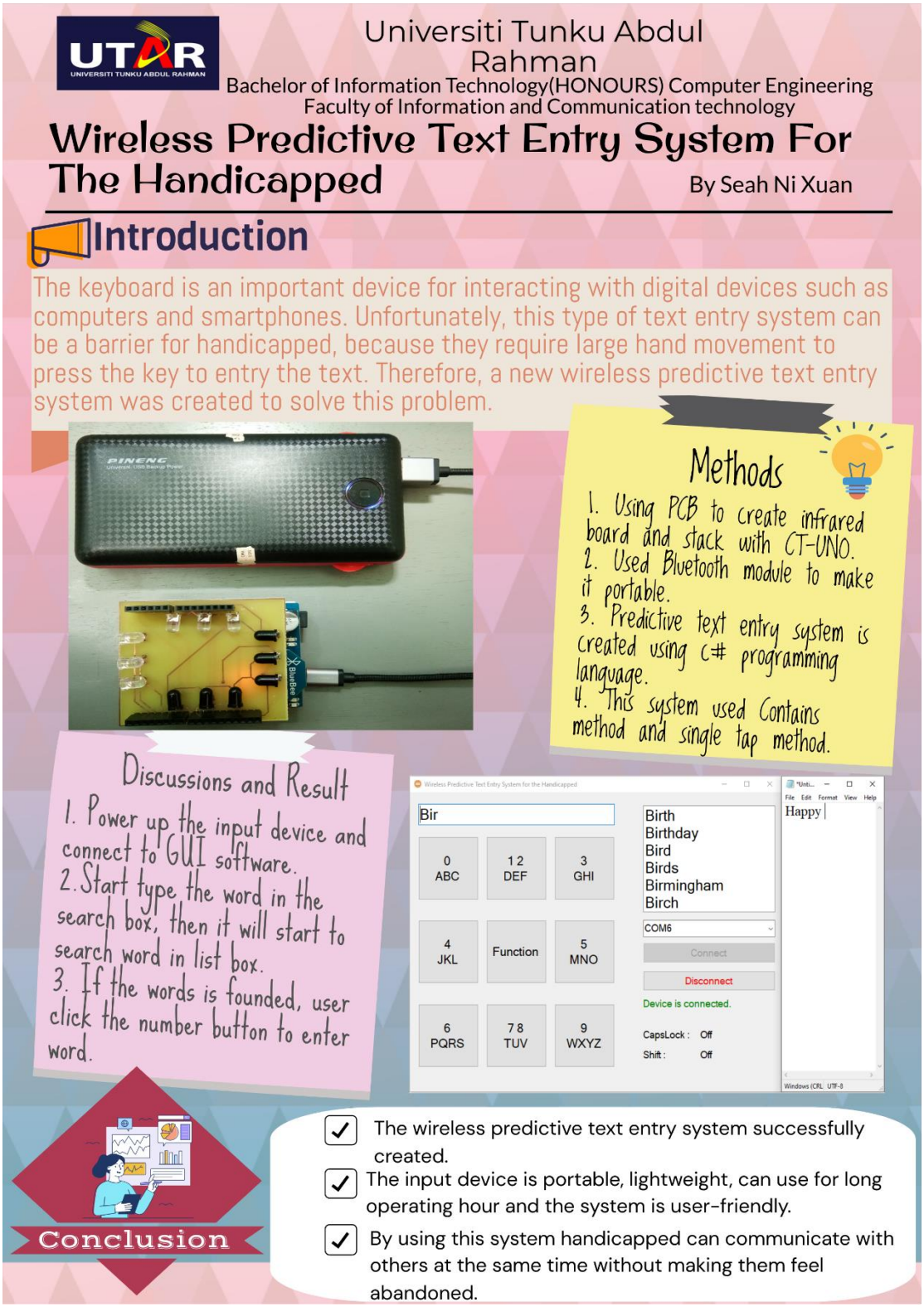
TEOH

Supervisor's signature

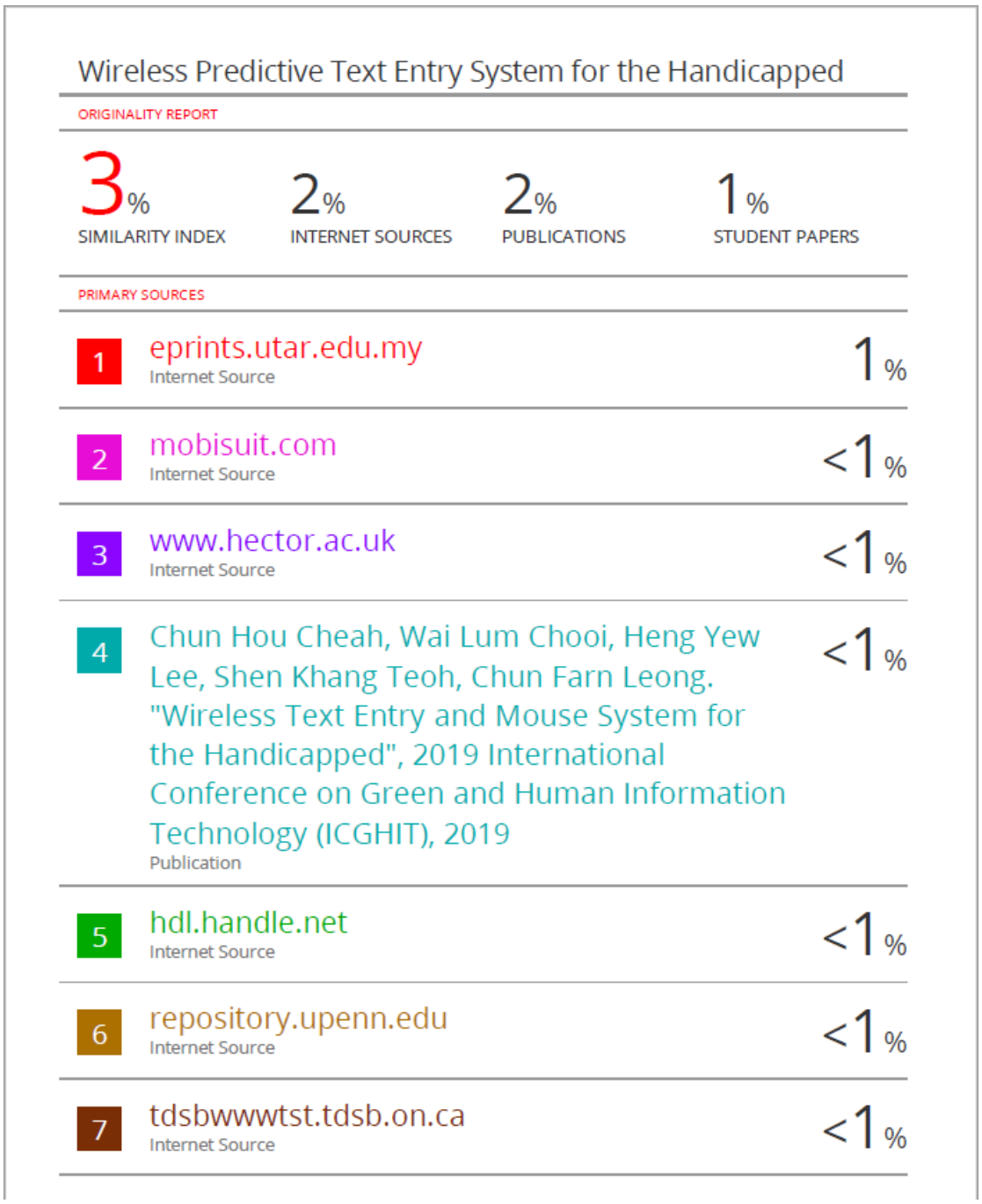
Xuan!

Student's signature

Poster


Universiti Tunku Abdul Rahman
Bachelor of Information Technology(HONOURS) Computer Engineering
Faculty of Information and Communication technology
Wireless Predictive Text Entry System For The Handicapped
By Seah Ni Xuan
Introduction
The keyboard is an important device for interacting with digital devices such as computers and smartphones. Unfortunately, this type of text entry system can be a barrier for handicapped, because they require large hand movement to press the key to entry the text. Therefore, a new wireless predictive text entry system was created to solve this problem.
Methods
1. Using PCB to create infrared board and stack with CT-UNO.
2. Used Bluetooth module to make it portable.
3. Predictive text entry system is created using c# programming language.
4. This system used Contains method and single tap method.
Discussions and Result
1. Power up the input device and connect to GUI software.
2. Start type the word in the search box, then it will start to search word in list box.
3. If the words is founded, user click the number button to enter word.
Bir
Birth
Birthday
Bird
Birds
Birmingham
Birch
COM6
Connect
Disconnect
Device is connected.
CapsLock : Off
Shift : Off
Happy
Conclusion
The wireless predictive text entry system successfully created.
The input device is portable, lightweight, can use for long operating hour and the system is user-friendly.
By using this system handicapped can communicate with others at the same time without making them feel abandoned.

Plagiarism Check Result



Wireless Predictive Text Entry System for the Handicapped

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FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY

Full Name(s) of Candidate(s)	Seah Ni Xuan
ID Number(s)	17ACB05751
Programme / Course	Bachelor of Information Technology (Honours) Computer Engineering
Title of Final Year Project	Wireless Predictive Text Entry System for the Handicapped

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Based on the above results, I hereby declare that I am satisfied with the originality of the Final Year Project Report submitted by my student(s) as named above.

TEOH

Signature of Supervisor

Name: Mr. Teoh Shen Khang

Date: 18 April 2022

Signature of Co-Supervisor

Name: _____

Date: _____

UNIVERSITI TUNKU ABDUL RAHMAN

FACULTY OF INFORMATION & COMMUNICATION TECHNOLOGY (KAMPAR CAMPUS)

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Student Id	17ACB05751
Student Name	Seah Ni Xuan
Supervisor Name	Mr. Teoh Shen Khang

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I, the author, have checked and confirmed all the items listed in the table are included in my report.

_____

(Signature of Student)

Date: 16 April 2022