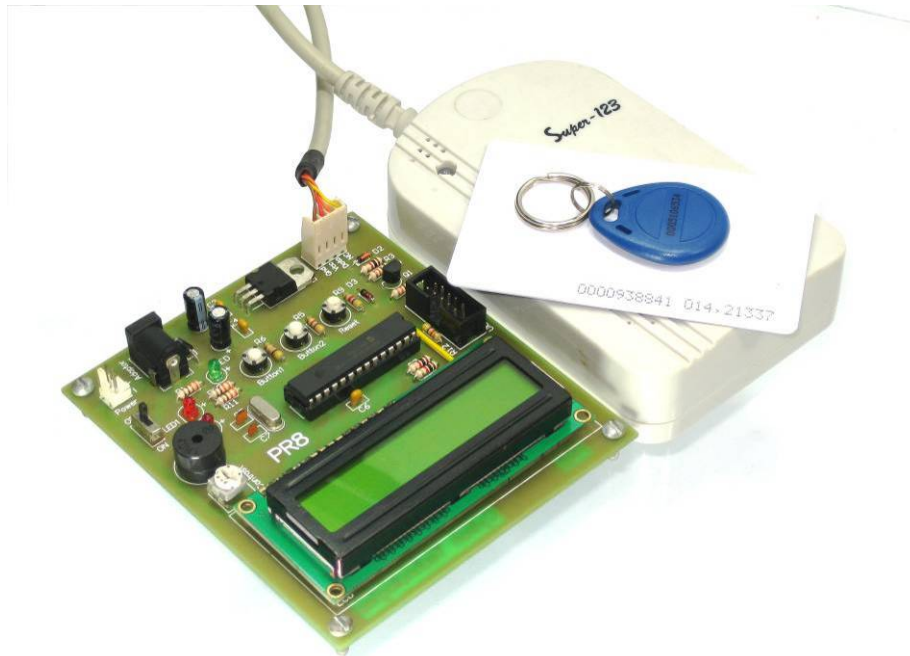


RFID: Read and Display



Version 1.2

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Cytron Technologies Sdn. Bhd.

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OVERVIEW

This document describes the development of Cytron Technologies DIY (Do It Yourself) Project No.8 (PR8). This project will use PIC16F876A and a RFID reader (IDR-232) to control LCD (2x 16 characters), LED and buzzer. Circuit schematic and PIC source code will be provided.

FEATURES

PIC16F876A

- 8-bit microcontroller with 22 I/O
- Operate with 5V supply
- Operating speed 20MHz

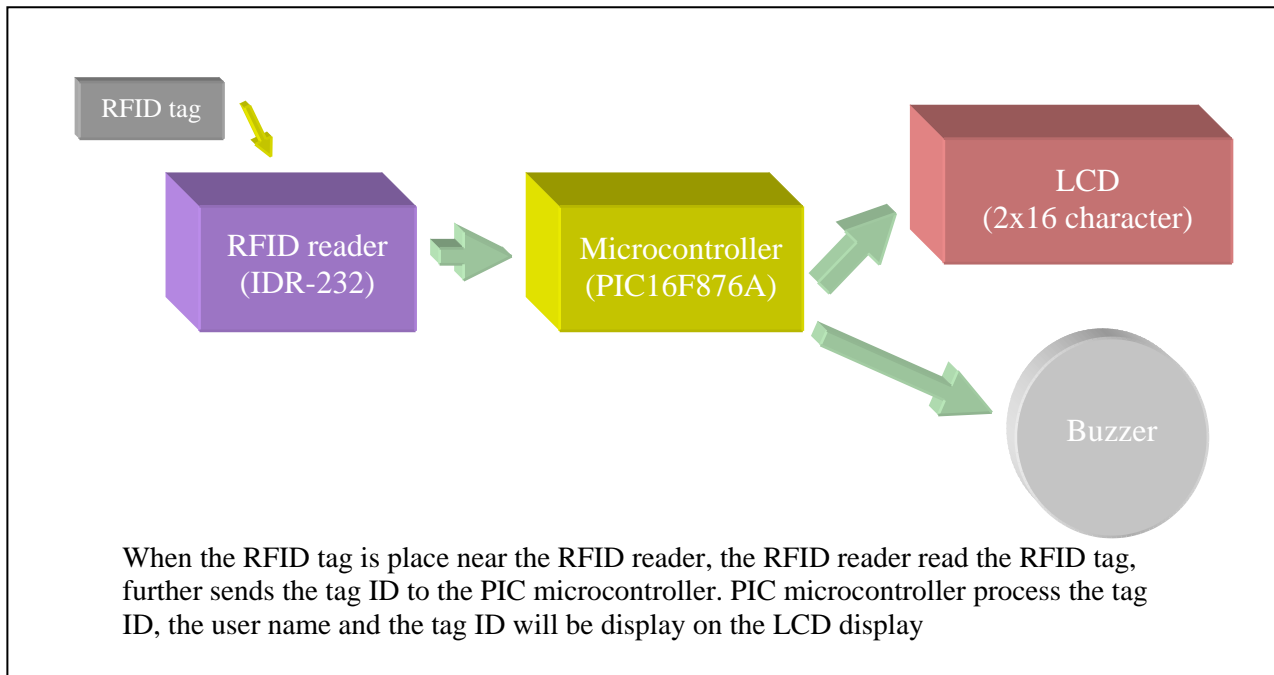
RFID reader IDR-232

- RFID tag reader with serial UART output
- Operate with 5V supply
- Output baud rate 9600bps

LCD (2x 16 characters)

- 2x16 character display
- Operate with 5V supply
- Back light

SYSTEM OVERVIEW



GENERAL DESCRIPTION

Cytron Technologies offers several model of RFID reader. The most common and easy to use reader is IDR-232. It read the RFID passive tag and sends the tag ID to PC or Microcontroller in serial communication.

RFID Reader (IDR-232)



Figure 1

Specification:

IDR-232 is plug and play RFID reader. It has been designed with capabilities and features of:

- Low cost solution for reading passive RFID transponder tags.
- Industrial grade casing for better outlook and protection.
- Integrated RFID reader, antenna, LED, power cable and data cable.
- Every reader has been tested before it being shipped.
- **9600 baud** RS232 serial interface (output only) to PC.
- Fully operation with **5VDC** power supply.
- Buzzer as sound indication of activity.
- Bi-color LED for visual indication of activity.
- Standard RS232 serial cable (female) ready to plug to desktop PC or Laptop.
- PS2 as power source from desktop PC.
- 2cm reading range.
- 0.1s response time.
- Operating frequency: 125 KHz

IDR-232 is fully working RFID tags reader and can be applied in:

- Security system.
- Car parking.
- Office.
- Hypermarket for item pricing.
- Student projects.

IDR-232 can be connected to PC or microcontroller as part of embedded system. In this project the reader will

be interface to a microcontroller. For more information, please refer:

<http://www.cytron.com.my/datasheet/IDR232%20Manual%20v1.pdf>

How RFID works:

RFID also known as Radio-frequency identification is an automatic identification method where the data is stored in the RFID tag. The RFID reader is a device that transmit radio frequency when powered ON. When the RFID tag is place near the RFID reader, the RDIF tag will receive the radio frequency via the antenna inside RFID tag. The radio frequency received will be converted into electrical power that is enough for the RFID tag to transmit the data back to the RFID reader. Further, the RFID reader will transmit the tag ID to PIC or PC via serial communication.

PIC16F876A

This powerful (200 nanosecond instruction execution) yet easy-to-program (only 35 single word instructions) CMOS FLASH-based 8-bit microcontroller packs Microchip's powerful PIC® architecture into an 28-pin package and is upwards compatible with the PIC16C5X, PIC12CXXX and PIC16C7X devices. Feature of the device:

- 256 bytes of EEPROM data memory
- Self programming
- ICD (In Circuit Debugging function)
- 2 Comparators
- 5 channels of 10-bit Analog-to-Digital (A/D) converter
- 2 capture/compare/PWM functions
- The synchronous serial port can be configured as either 3-wire Serial Peripheral Interface (SPI™) or the 2-wire Inter-Integrated Circuit (I2C™) bus
- Universal Asynchronous Receiver Transmitter (UART)

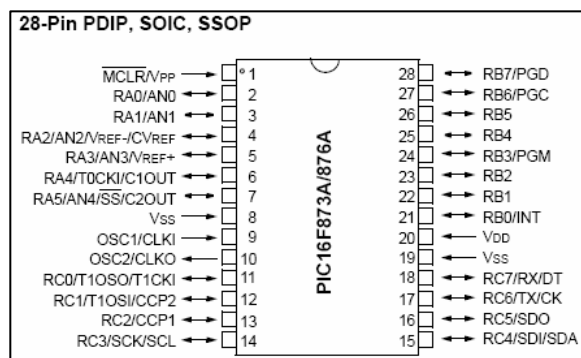


Figure 2

Figure 2 shows the pin diagram for PIC16F876A. For more information about the PIC microcontroller, please refer to the datasheet. The datasheet can be found in microchip web site at: <http://www.microchip.com>

HARDWARE

This project will require following hardware:

- 1 x RFID reader, IDR-232
- 1 x PR8 Printed Circuit Board (PCB)
- 1 x PIC16F876A
- 1 x LCD (2x16 character)
- Related electronic components

Please refer to Appendix A for the PCB layout of PR8. The PCB layout is provided free therefore Cytron Technologies will not be responsible for any further modification or improvement.

Interface RFID reader (IDR-232) with PIC16F876A

The RFID reader comes with a serial port (DB9) for data communication and a PS2 connector to supply 5V for the reader. For this project, user has to cut the wire of the RFID reader and connect the wire to a 2510-04 female connector. Different types of RFID reader sometimes have different color of output wire. There are 5 output wire of RFID reader, only 4 are necessary.

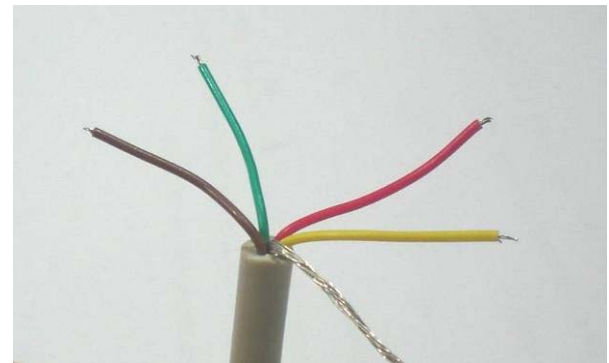


Figure 3

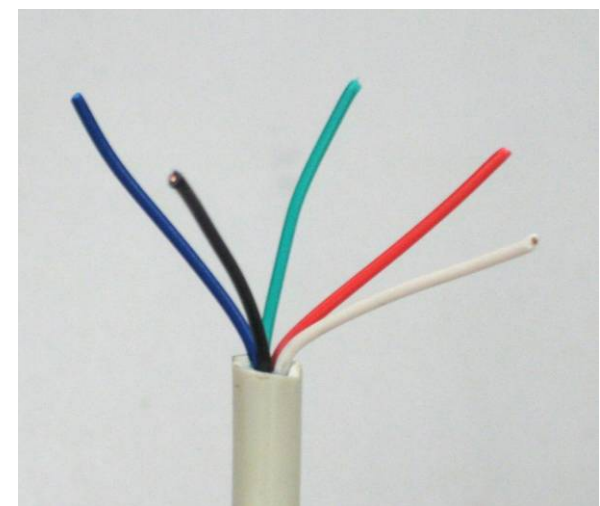


Figure 4

Colour	Pin function	Connection
Yellow	RX	NC
Green	TX	RC7
Red	Vcc (5V)	5V
Brown	Ground	GND
Shielding wire	NC	NC

*NC = not connected

Colour	Pin function	Connection
Green	RX	NC
White	TX	RC7
Red	Vcc (5V)	5V
Black	Ground	GND
Blue	NC	NC

*NC = not connected

Connect only four (yellow, green, red and brown) of the wire to 2510-04 female connector according to the colour of the wire. For more information about how to connect the wire to 2510-04 connector, please refer to getting start section.

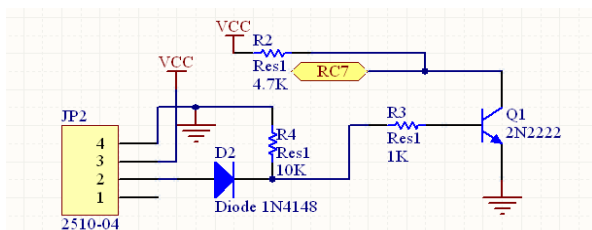


Figure 5

The output of the RFID reader is serial UART in logic +10V/-10V, and the baud rate is 9600bps. The Figure 5 shown is used to convert +10V/-10V logic to +5V/0V logic for PIC microcontroller.

Interface LCD (2x16 character) with PIC16F876A

To use the LCD, user has to solder 16 header pin to the LCD. LCD used in this project is JHD162A, for other type of LCD, please refer to its data sheet.



Figure 6

Figure 6 is a 2x16 character LCD. LCD connection pins and function of each pin:

Pin	Name	Pin function	Connection
1	VSS	Ground	GND
2	VCC	Positive supply for LCD	5V
3	VEE	Brightness adjust	Connected to a preset to adjust brightness
4	RS	Select register, select instruction or data register	RC3
5	R/W	Select read or write	RC2
6	E	Start data read or write	RC4
7	DB0	Data bus pin	RB0
8	DB1	Data bus pin	RB1
9	DB2	Data bus pin	RB2
10	DB3	Data bus pin	RB3
11	DB4	Data bus pin	RB4
12	DB5	Data bus pin	RB5
13	DB6	Data bus pin	RB6
14	DB7	Data bus pin	RB7
15	LED+	Backlight positive input	RC1
16	LED-	Backlight negative input	GND

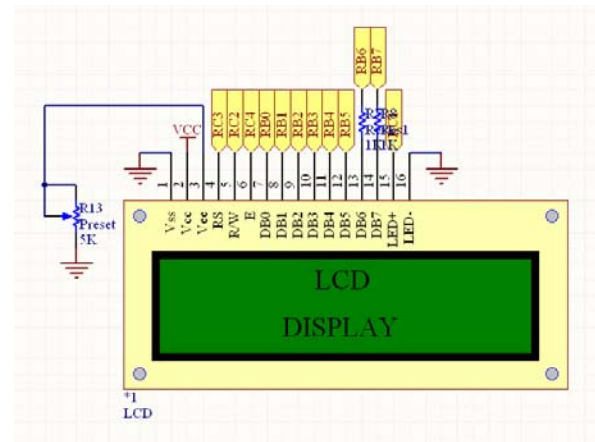


Figure 7

Power supply for the circuit

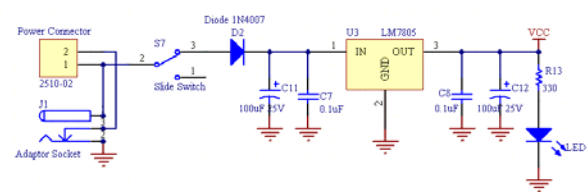


Figure 8

User can choose either AC to DC adaptor (not included in the DIY project set) or 9V-12V battery (not included in the DIY project set) to power up the circuit. Higher input voltage will produce more heat at LM7805

voltage regulator. Typical voltage is 12V. Anyhow, LM7805 will still generate some heat at 12V. There are two types of power connector for the circuit, DC plug (J1) and 2510-02 (Power Connector). Normally AC to DC adaptor can be plugged to J1 type connector.

As Figure 8 shown, the D2 is use to protect the circuit from wrong polarity supply. C7 and C11 is use to stabilize the voltage at the input side of the LM7805 voltage regulator, while the C8 and C12 is use to stabilize the voltage at the output side of the LM7805 voltage supply. The LED is a green LED to indicate the power status of the circuit. R13 is resistor to protect LED from over current that will burn the LED.

Push Button as input for PIC microcontroller

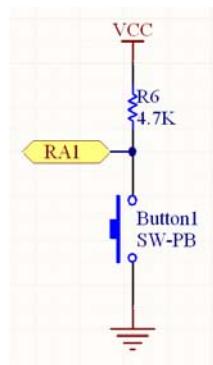


Figure 9

One I/O pin is designated for a push button as input of PIC microcontroller. The connection of the push button to the I/O pin is shown in Figure 9. The I/O pin should be pull up to 5V using a resistor (with value range 1K-10K) and this configuration will result an active-low input. When the button is being pressed, reading of I/O pin will be in logic 0, while when the button is not pressed, reading of that I/O pin will be logic 1.

LED as output for PIC microcontroller

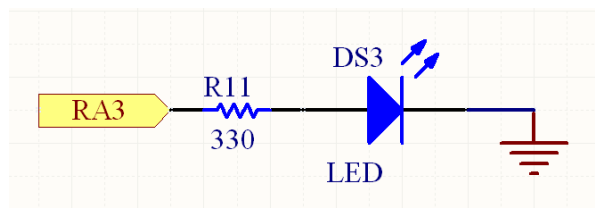


Figure 10

One I/O pin is designated for a LED as output of PIC microcontroller. The connection for a LED to I/O pin is shown in Figure10. The function of R11 is to protect the LED from over current that will burn the LED. When the output is in logic 1, the LED will ON, while when the output is in logic 0, the LED will OFF.

Buzzer as output of PIC microcontroller

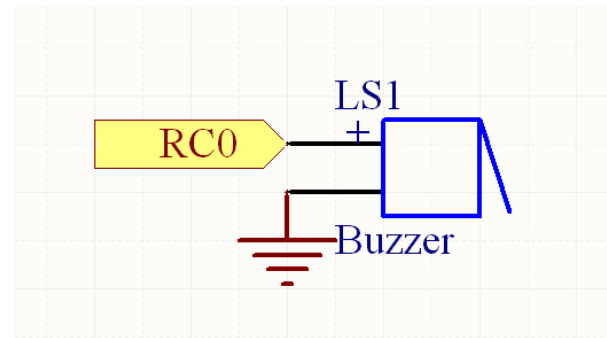


Figure 11

When the output is in logic 1, the buzzer will activate (beep), while when the output is in logic 0, the buzzer will deactivate.

ICSP for programming PIC microcontroller

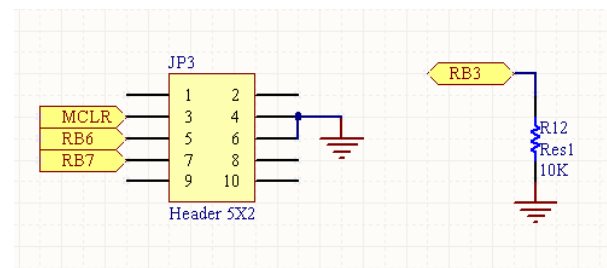


Figure 12

MCLR, RB6 and RB7 need to be connected to the USB In Circuit Programmer (UIC00A) to program the PIC microcontroller. At the same time, RB3 need to be pull low to 0V to disable low voltage programming, because the programmer is using high voltage programming. The programmer (UIC00A) is not included in DIY project set since it can be used several time for different project set. User can also choose other type of PIC programmer to load the program.

For the instruction of using PIC programmer, please refer to the particular PIC programmer user's manual.

PCB circuit board

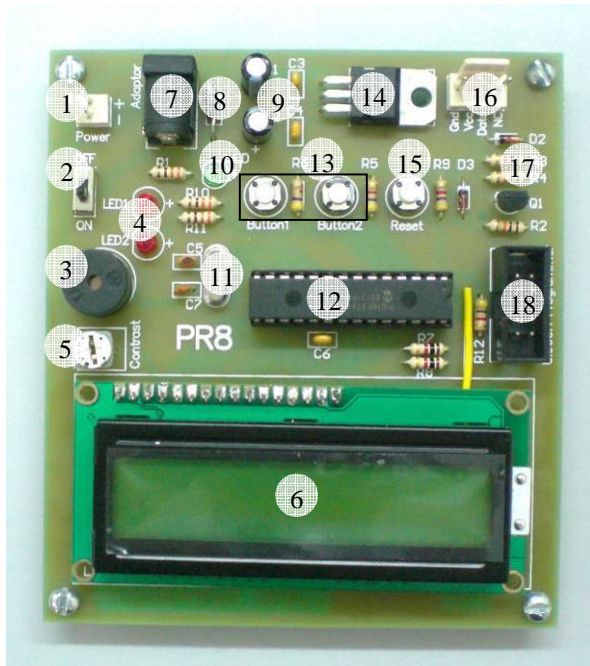


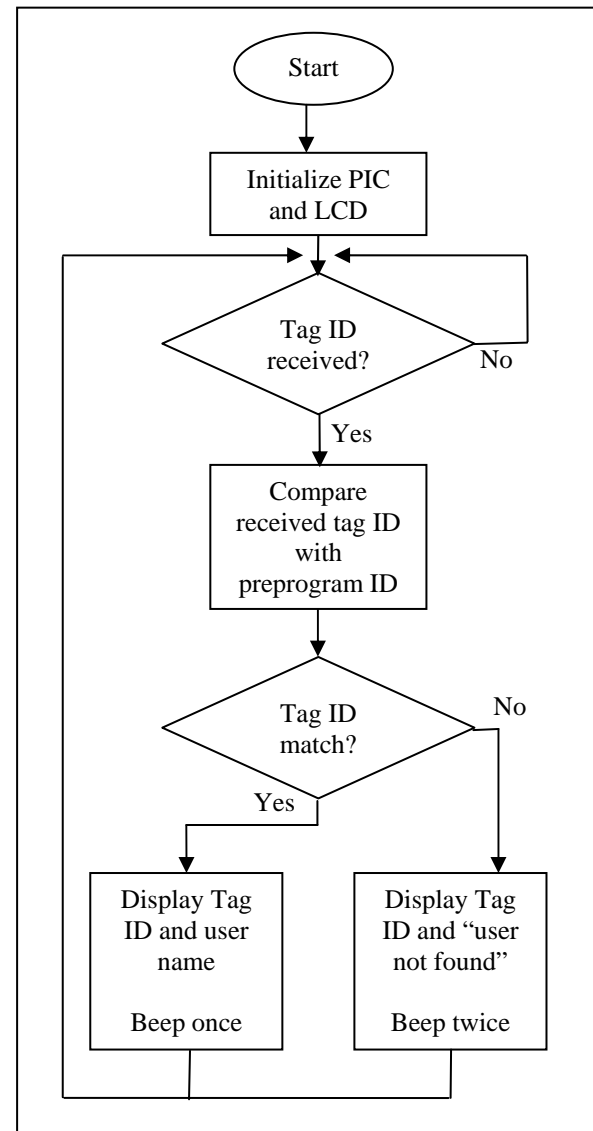
Figure 13

Component:

1. 2510-02 connector, (to use either 9V battery or 12V battery to power up the circuit).
2. Slide switch (to ON or OFF the circuit).
3. Buzzer.
4. LED.
5. Preset (to adjust the brightness of the LCD).
6. LCD.
7. AC-DC adaptor socket (to use power supply from AC-DC adaptor).
8. Diode (to protect the circuit from wrong polarity power input).
9. Capacitor (to stabilize the output voltage of the LM7805 voltage regulator).
10. Power indicator LED (to indicate the power status of the circuit).
11. Crystal (20MHz).
12. PIC 16F876A (the main brain of the system).
13. Push button.
14. LM7805 (voltage regulator, supply 5V for PIC).
15. Reset button (to reset the microcontroller).
16. 2510-04 connector for RFID reader.
17. RFID reader support component.
18. ICSP box header (to connect to PIC programmer for loading program).

SOFTWARE

Flow Chart:



For more information about the software of this system, please refer to the source code provided. The explanation of each instruction is provided in the source code as the comment of each line.

The source code is provided free and Cytron Technologies will not be responsible for any further modification or improvement.

GETTING START

User can obtain the hardware set for this project (PR8) either by online purchasing (www.cytron.com.my) or purchase it in Cytron Technologies Shop.

1. Once user has the hardware set, soldering process can be started. Please solder the electronic components one by one according the symbols or overlays on the Printed Circuit Board (PCB). Ensure the component value

and polarity is correctly soldered. Please refer to PCB Layout in Appendix A.

Caution: Make sure all the connectors (2510) are soldered in proper side. Those electronic components have polarity such as capacitor, diode, PIC, LM7805 and LED should be soldered in right polarity or it may cause the circuit board fail to work.

Warning: Before the battery (Power) is plugged in, make sure the polarity is correct to prevent the explosion. Wrong polarity of capacitor also may cause explosion.

2. Connect the RFID reader to 2510-04 connector.

Connect the wire to 2510-04 connector:

The heat shrink tube can be used to tie the wire together to make it look nicer. The wire have to be soldered to the 2510 iron pin and plug the soldered iron pin into 2510-04 connector according to the colour shown in Figure 15 and Figure 16.

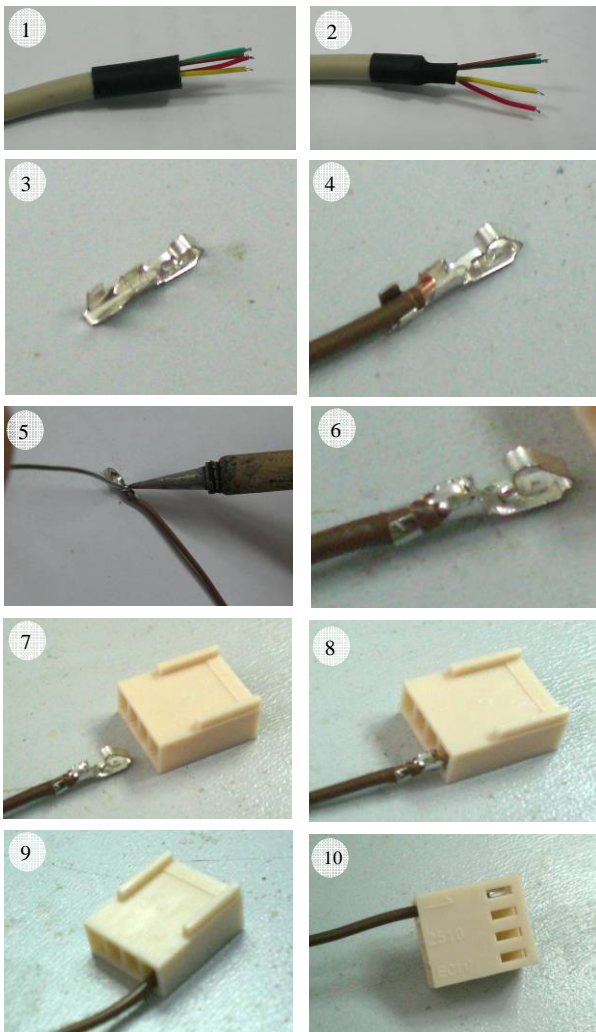


Figure 14

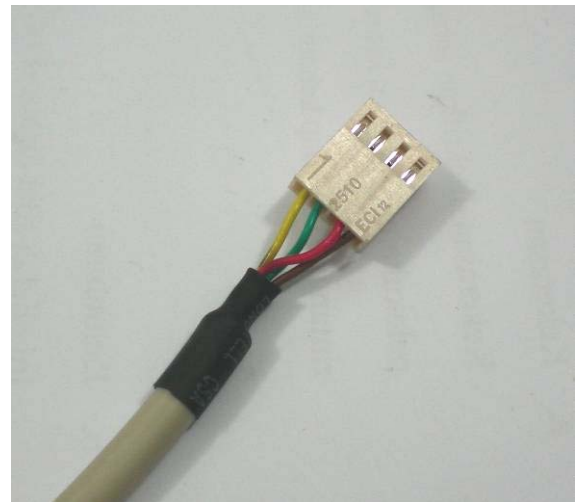


Figure 15

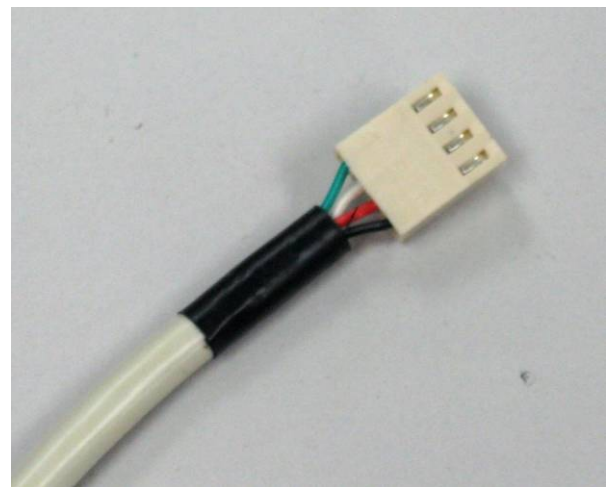


Figure 16

3. Please download the necessary files and document from Cytron Technologies website. These included documentation, sample source code, schematic, component list and software.
4. The next step is to install MPLAB IDE and HI-TECH C PRO into a computer. The MPLAB IDE software can be downloaded from www.cytron.com.my . Please refer MPLAB IDE installation step document to install the software. The documents can be used to any version of MPLAB IDE software.
5. After the installation complete, open the project file provided using MPLAB IDE. Please refer MPLAB Open Project document to open the sample program.
6. **Please modify the tag ID in the program same as the tag ID that you want to read.** This step is to allow the system to remember the ID.

7. Plug in power supply for the circuit. User can choose to use battery or AD to DC adaptor.

AC to DC adaptor:



Figure 17 (Not included in DIY project set)

9V battery connector:

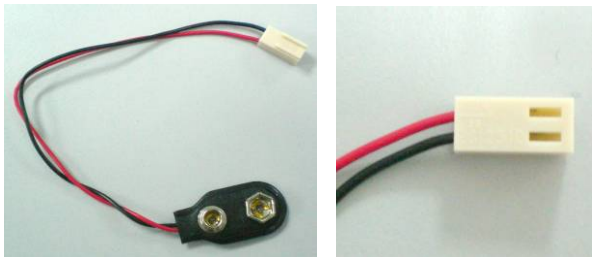


Figure 18 (not included in DIY project set)

Connection to the PCB board:

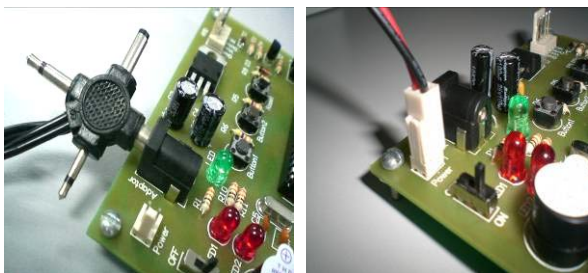


Figure 19

8. Build the project and load the hex file into the PIC microcontroller using the USB In Circuit Programmer (UIC00A). When user build the project, MPLAB IDE will generate hex file. The hex file generated from MPLAB IDE will be named according to project name, not C file name. Cytron Technologies also provide hex file for user. Do not forget to switch ON the power. The programmer is not included in the hardware set but it can be found at Cytron website. (User manual is provided at website).
9. Test the functionality of the PCB board.
10. Modify the program.

11. Have fun!

TEST METHOD

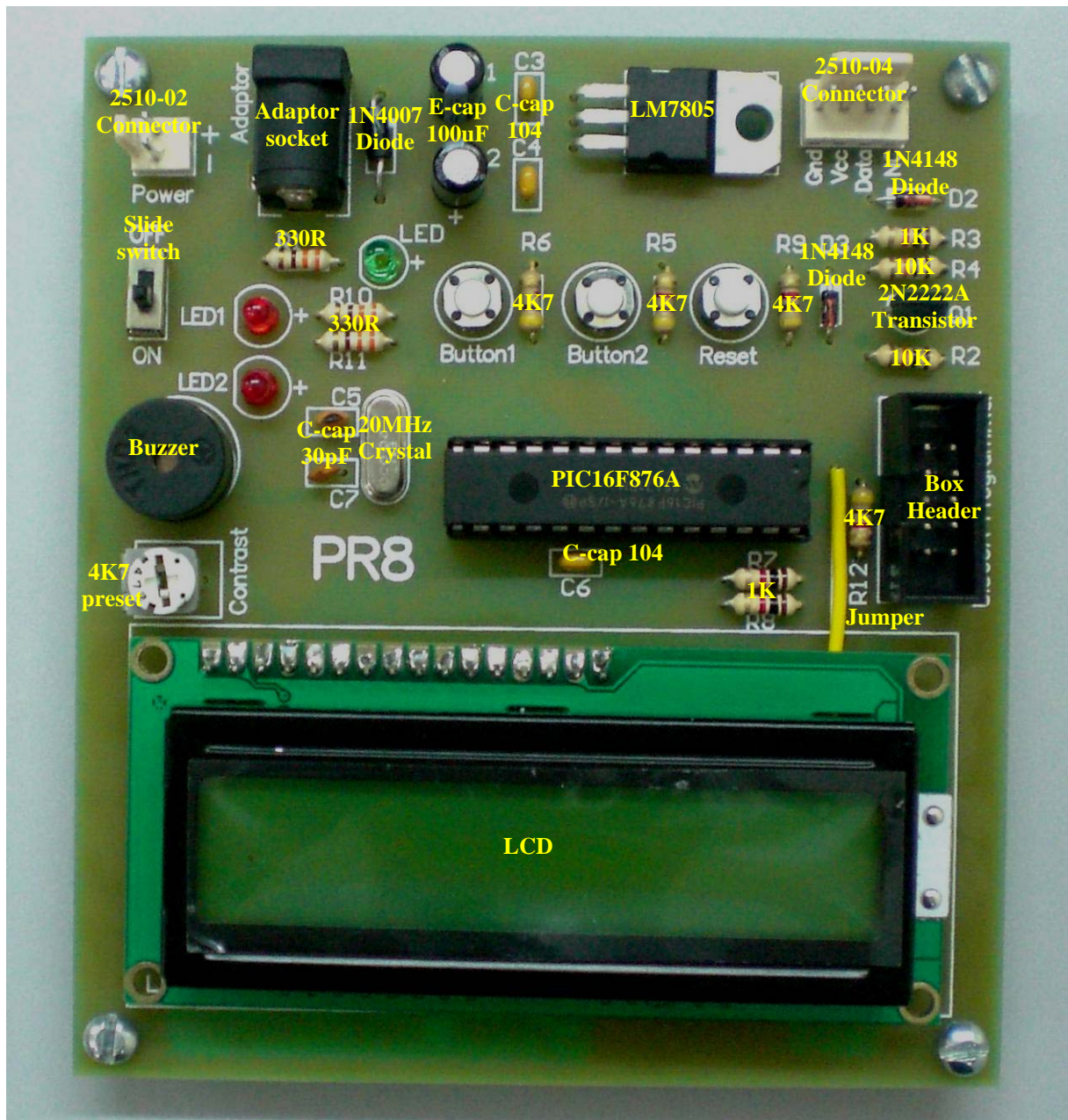
1. Switch ON the power
 - Power Led (Green) will turn ON.
 - LCD will show “RFID door security”
 - After a few second it will change to “Place your ID on the reader”
2. Place the card on RFID
 - LCD will show “ID : _ _ _ _ _ user not found”
 - After a few second it will change again to “Place your ID on the reader”
3. If all steps mention above can be executed, your project is done successfully. Congratulations!!

WARRANTY

No warranty will be provided as this is DIY project. Thus, user is advice to check the polarity of each electronic component before soldering it to board.

Appendix

PCB Layout:



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