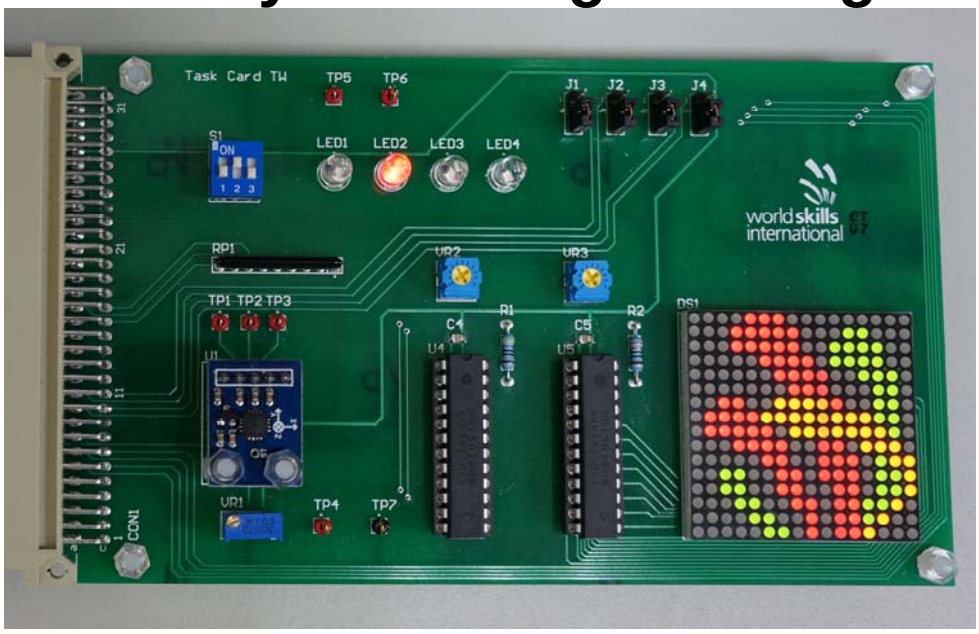
Test Project Document

WSC2013_TP16_TW_software_full _actual_EN

Embedded System Programming Project



Submitted by:
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Member Country: Chinese Taipei

Contents

This Test Project consists of the following documentation/files:

1. WSC2013_TP16_TW_software_full_actual_EN.docx
2. Test.hex
3. Example.c
4. Datasheets folder
5. Video folder

This test project proposal consists of the following boards:

1. PIC-kit board
2. Task board

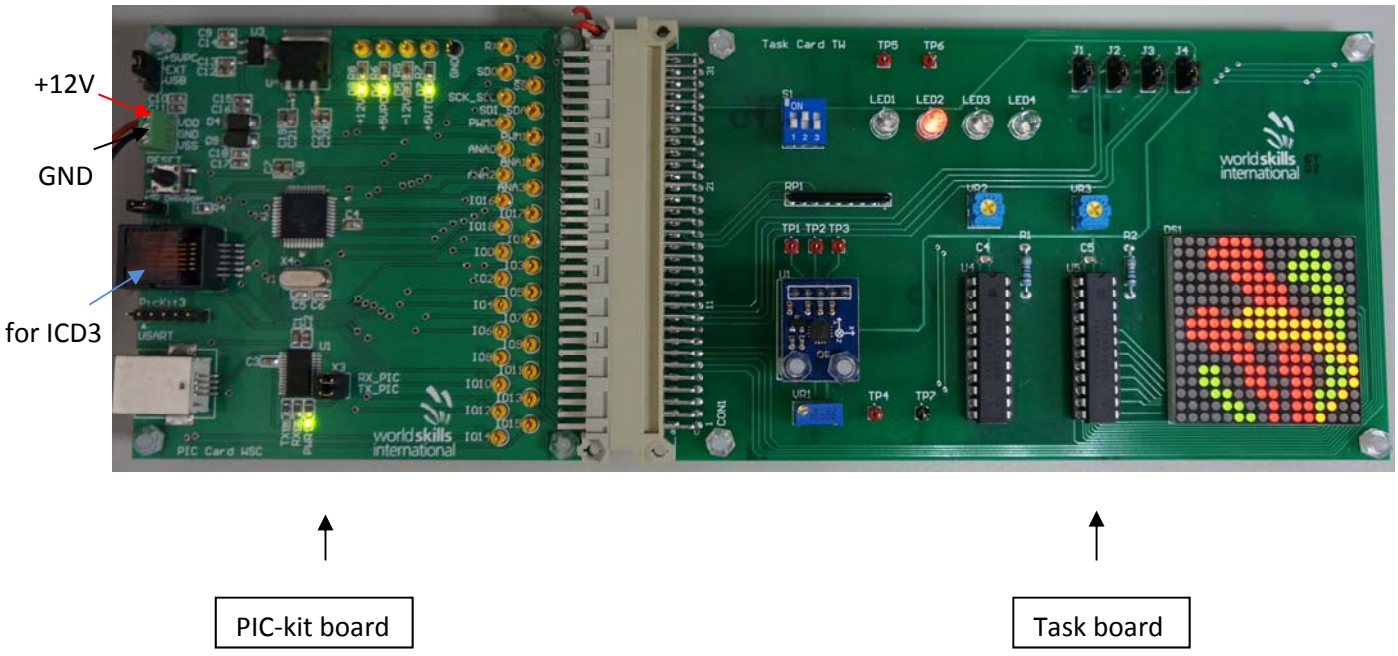


Figure 1. Photograph of PCB boards

INTRODUCTION

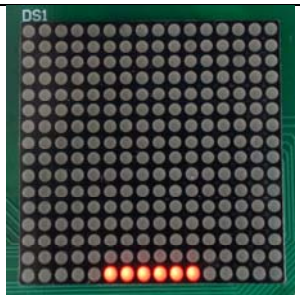
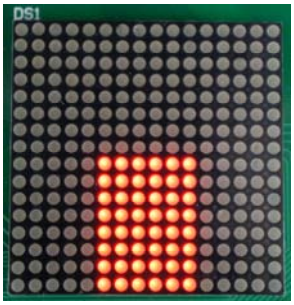
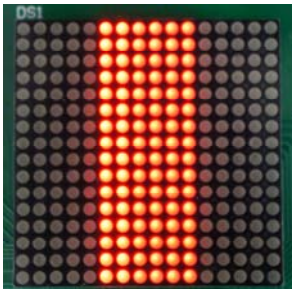
This prototype is to design a 16×16 color LED matrix controller and its applications. There are four main functions in this prototype:

1. Scrolling string display.
2. 2D water level meter.
3. Auto-oriented display.
4. Digital voltage meter.

TEST PROGRAM FOR THE COMPETITOR

1. The aim of this test program is to test and verify the hardware function of task board.
2. The microcontroller has built-in a test program for LEDs (LED1-LED4), DIP SW (S1), varied resistor (VR1), 3D Accelerometer module (U1) and LED matrix test.
3. On power up, (1) The LED1~LED4 will scan sequentially as the following order, LED1, LED2, LED3, LED4, LED3, LED2, LED1, LED2, LED3, LED4, LED3, LED2, LED1… and (2) LED matrix will scan RED sequentially from left column to right column, then from bottom row to top row. Then, LED matrix will scan GREEN sequentially from left column to right column, then from bottom row to top row.
4. After LED and LED matrix tests, you can test the DIP SW, varied resistor and 3D Accelerometer module following Table 1.

Table 1.

DIP SW	LED1~LED4	Functions	DS1
Off, Off, Off	Remained scanning	DS1 varies with the VR1 adjustment	 minimum
Off, Off, On		DS1 varies with the Zout of accelerometer	
Off, On, Off		DS1 varies with the Yout of accelerometer	
On, Off, Off		DS1 varies with the Xout of accelerometer	 maximum

TASKS FOR THE COMPETITOR

You have to create a new program to finish the following tasks. There are four tasks, which are selected by DIP SW following table 2.

Table 2.

DIP SW (S1)	LED1~LED4	Functions
Off, Off, Off (000)	Off, Off, Off, On (0001)	TASK A
Off, Off, On (001)	Off, Off, On, Off (0010)	TASK B
Off, On, Off (010)	Off, On, Off, Off (0100)	TASK C
On, Off, Off (100)	On, Off, Off, Off (1000)	TASK D
Others	Off, Off, Off, Off (0000)	DS1 off

Task A. Scrolling string display

(1) When S1 is 000, DS1 should display the correct real-time message “WSC”.
(2) Initially, the string “WSC 2013” should be displayed and scrolled in RED at correct positions on DS1. The dot layout of characters and numbers is shown in Figure 2, and the string should be scrolled left about every 0.2 sec.
(3) If finger hits the task board, the color of DS1 should be changed in the sequence, RED, YELLOW, GREEN, RED, YELLOW, GREEN….. , shown in Figure 2. The function should include de-bouncing.
(4) LED1~LED4 should follow table 2.

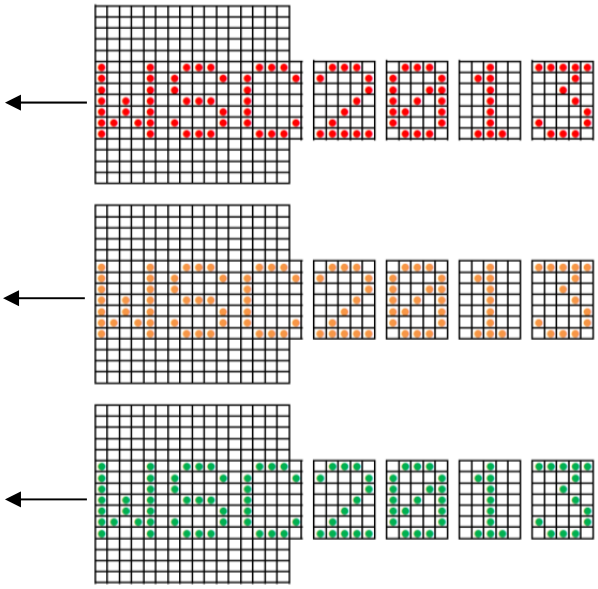


Figure 2. The dot layout of characters and numbers

Task B: 2D water level meter

(1) When S1 is 001, DS1 should function as a 2D water level meter immediately.

(2) When the PCB is lying on the table, a GREEN bubble with 2×2 dots should be displayed in the center of DS1, as shown in Figure 3.

(3) When Yout = 0g, the bubble should move to correct position smoothly following the PCB tilt angle (Xout), as shown in Figure 4.

(4) When Xout = 0g, the bubble should move to correct position smoothly following the PCB tilt angle (Yout), as shown in Figure 5.

(5) When both of Xout and Yout are not 0g, the bubble should move to the correct position smoothly following the PCB tilt angle (Xout and Yout).

(6) The display and Bubble movements are stable and no glitch.

(7) LED1~LED4 should follow table 2.

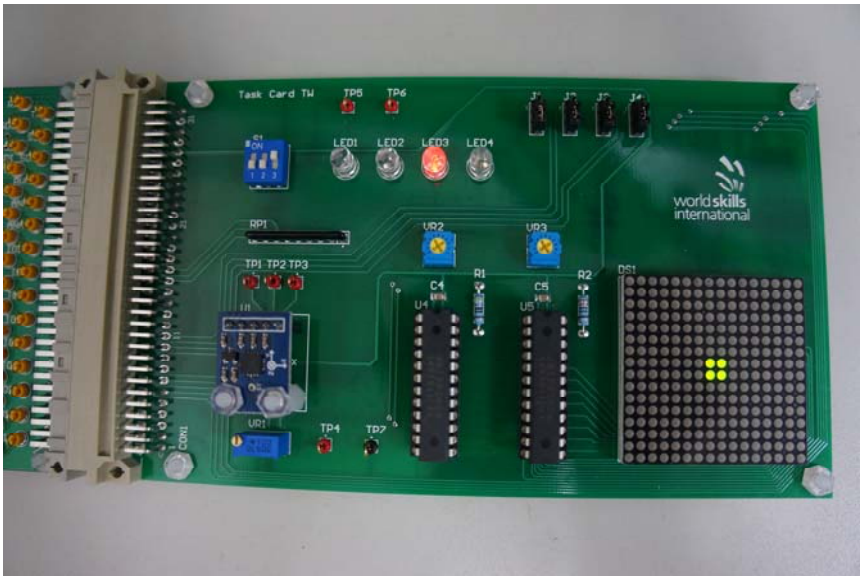


Figure 3

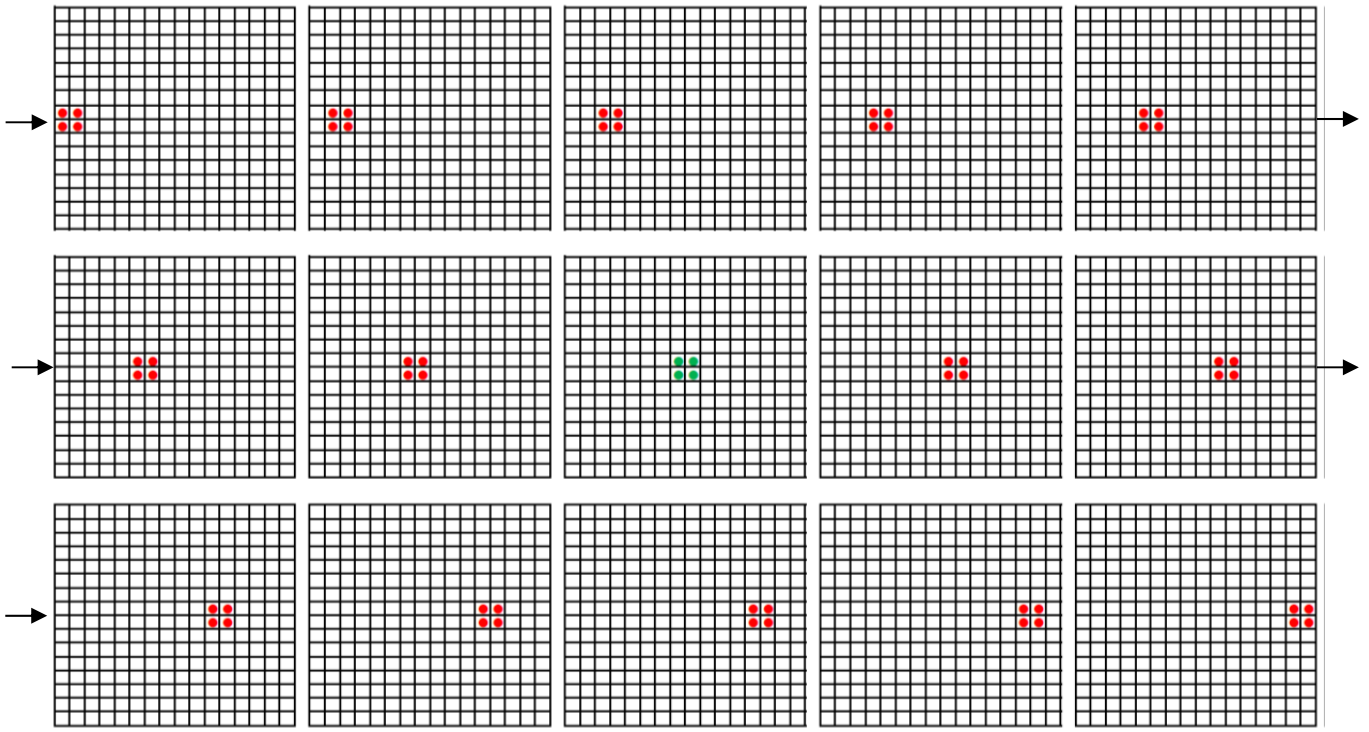


Figure 4. Yout = 0g, Xout from -1g to +1g

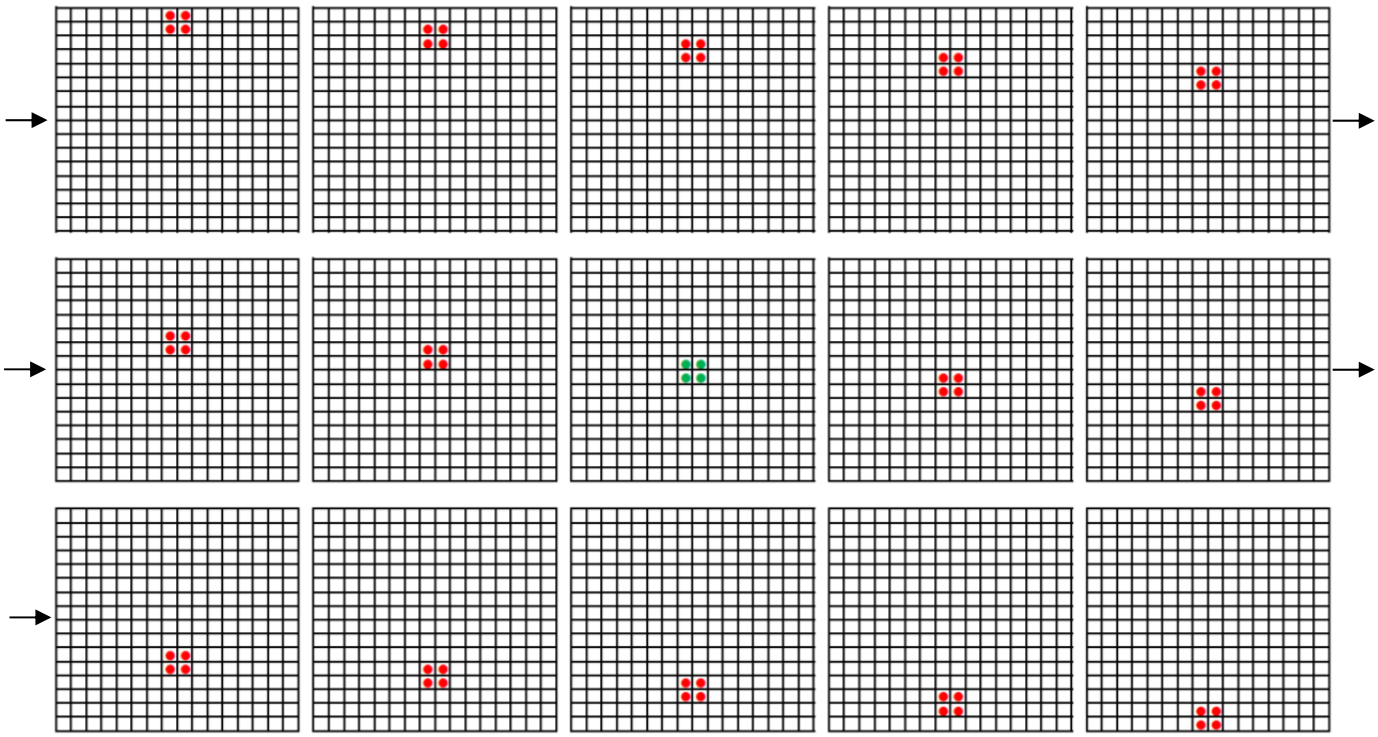
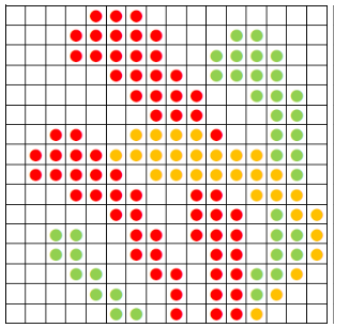
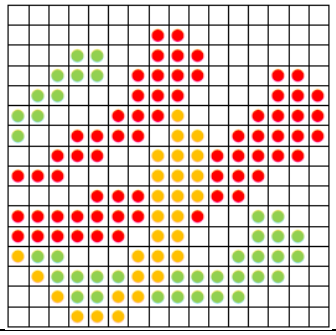
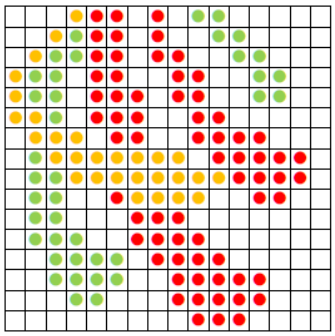
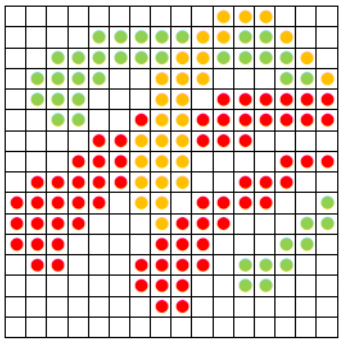


Figure 5. Xout = 0g, Yout from +1g to -1g

Task C: Auto-Oriented display

(1) When S1 is 010, DS1 should function as an auto-oriented display immediately.
(2) The display pattern should follow table 3.
(3) LED1~LED4 should follow table 2.

Table 3.

Accelerometer	DS1 pattern	Accelerometer	DS1 pattern
Xout = 0 g Yout = 0 g Zout = +1 g or Xout = 0 g Yout = +1 g Zout = 0 g	DS1 	Xout = +1 g Yout = 0 g Zout = 0 g	DS1 
Xout = 0 g Yout = -1 g Zout = 0 g	DS1 	Xout = -1 g Yout = 0 g Zout = 0 g	DS1 

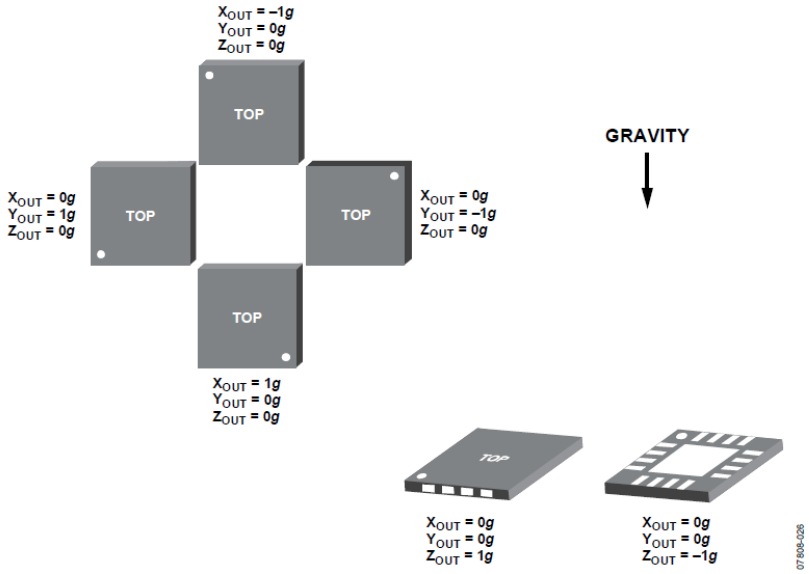


Figure 6. ADXL335 output with gravity

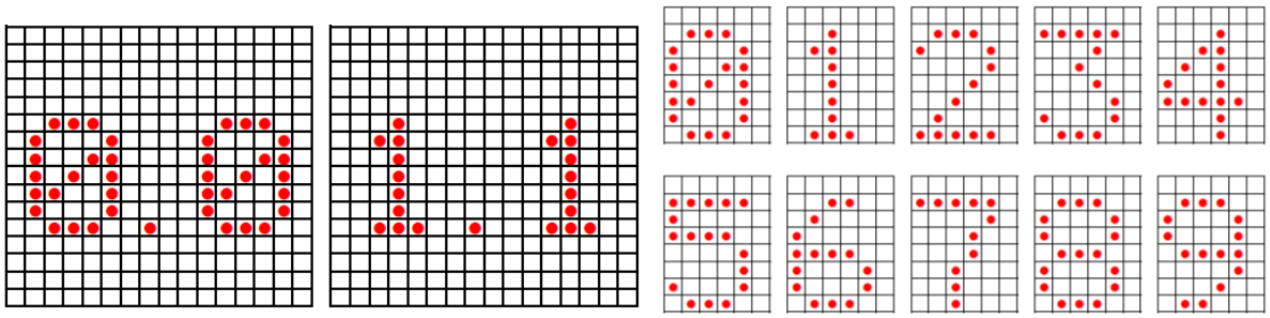
Task D: Digital voltage meter

(1) When S1 is 100, DS1 should function as a digital voltage meter immediately.

(2) The DS1 should display the voltage value of TP4 with X.X format, as shown in Figure 7 (a); the error should ≤ 0.1V. The dot layout of numbers is shown in Figure 7 (b).

(3) The display is stable and no glitch.

(4) LED1~LED4 should follow table 2.



(a) (b)

Figure 7. (a) Pattern of DS1 when TP4 = 0.0V and 1.1V (b) The dot layout of numbers

Others

(1) When S1 is 011, 101, 110 or 111, DS1 and LED1~LED4 should be all off.

MARKING SCHEME

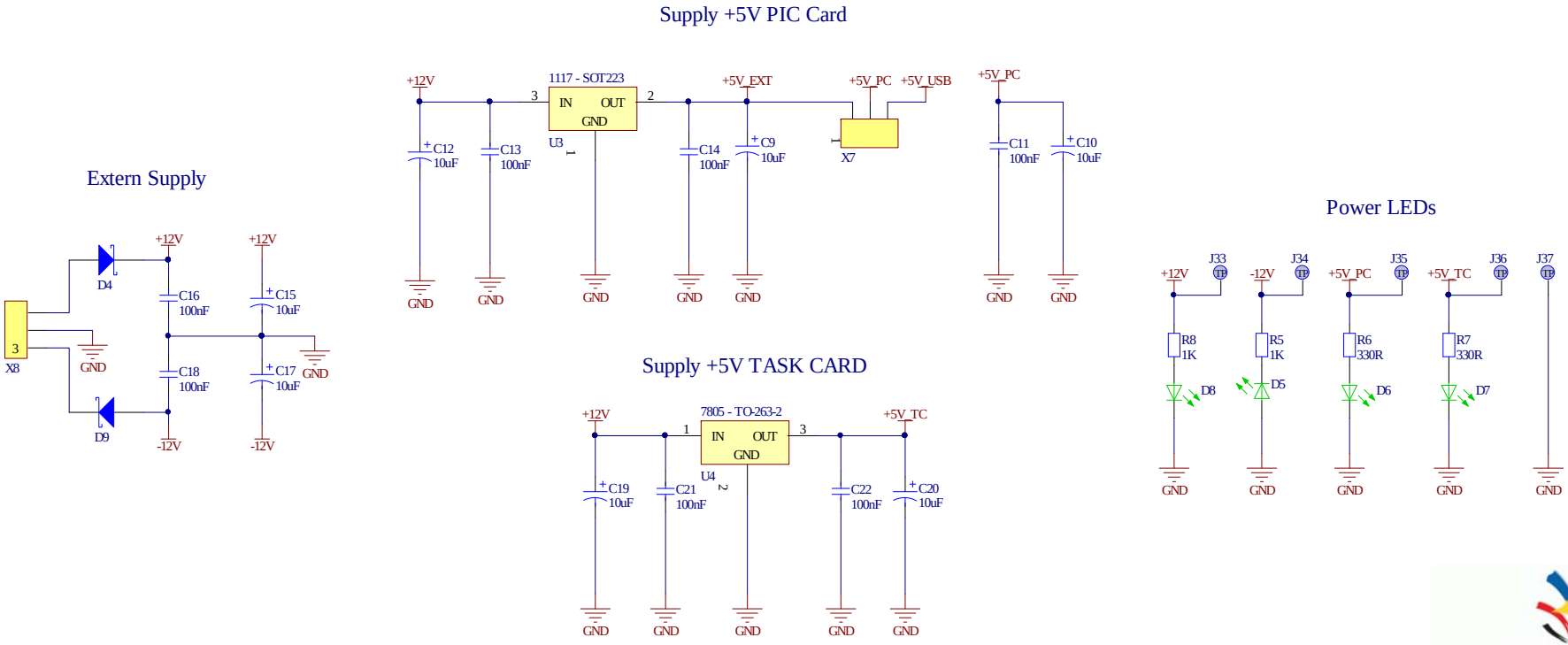
The completed tasks will be weighted as follows:

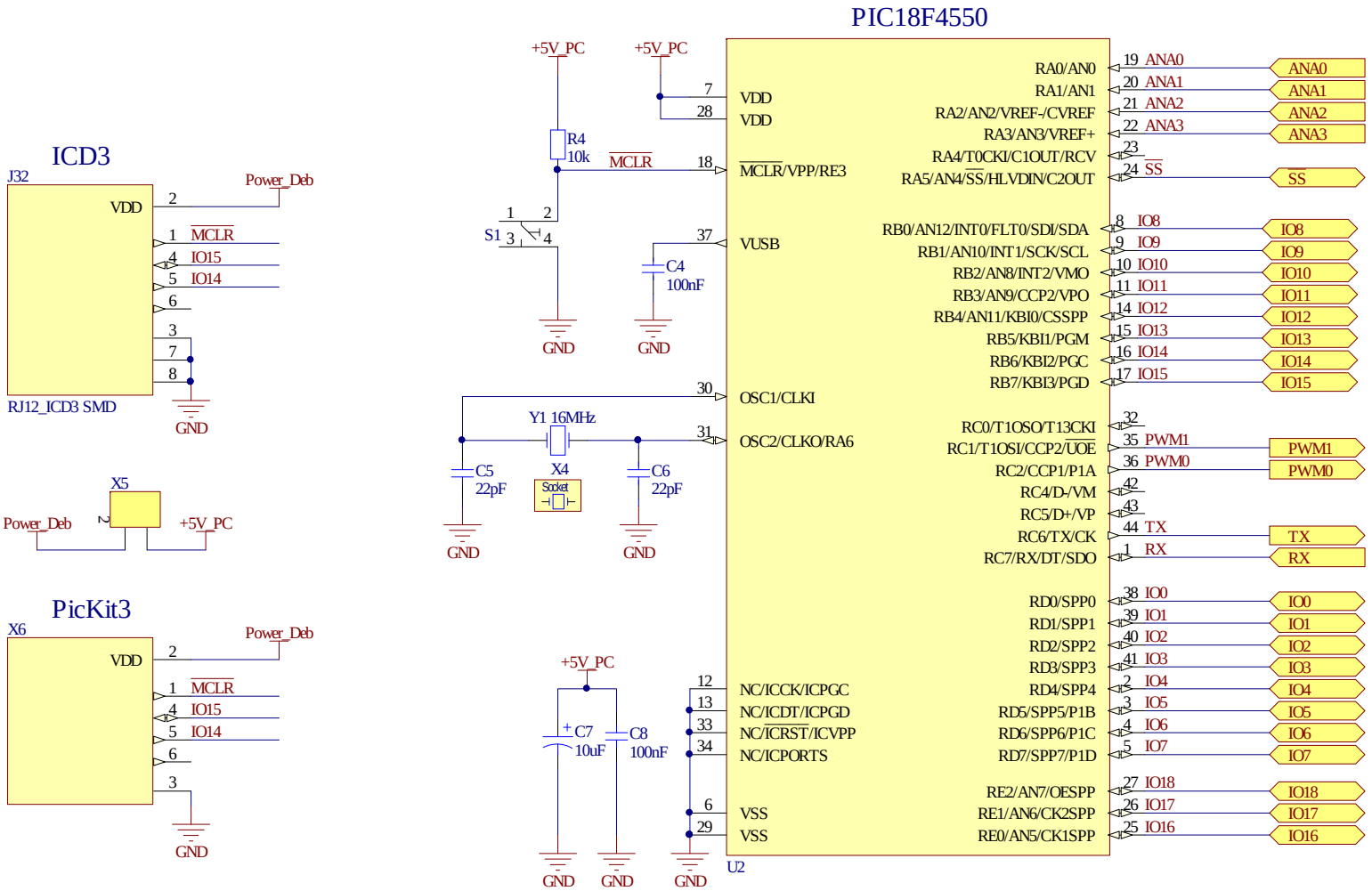
Task		Mark
A	TASK A-1 When S1 is 000, DS1 clear and display correct real-time message “WSC”.	1
	TASK A-2-1 Initially, the string “WSC 2013” should be displayed and scrolled in RED at correct positions on DS1.	1
	TASK A-2-2 The string should be scrolled left about every 0.2 sec.	1
	TASK A-3-1 If finger hits the task board, the color of DS1 should be changed in the sequence, RED, YELLOW, GREEN, RED, YELLOW, GREEN.	1.5
	TASK A-3-2 The function should include de-bouncing.	1
	TASK A-4 Display correct LEDs (LED1~LED4) based on S1 value.	0.5
B	TASK B-1 When S1 is 001, DS1 should function as a 2D water level meter immediately.	1
	TASK B-2 When the PCB is lying on the table, a GREEN bubble with 2×2 dots should be displayed in the center of DS1.	1
	TASK B-3 When Yout = 0g, the bubble should move to correct position smoothly following the PCB tilt angle (Xout).	1
	TASK B-4 When Xout = 0g, the bubble should move to correct position smoothly following the PCB tilt angle (Yout).	1
	TASK B-5 When both of Xout and Yout are not 0g, the bubble should move to the correct position smoothly following the PCB tilt angle (Xout and Yout).	1
	TASK B-6 The display and Bubble movements are stable and no glitch.	1
	TASK B-7 Display correct LEDs (LED1~LED4) based on S1 value.	0.5

C	TASK C-1 When S1 is 010, DS1 should function as an auto-oriented display immediately.	1
	TASK C-2 Display correct pattern following table 3.	5
	TASK C-3 Display correct LEDs (LED1~LED4) based on S1 value.	0.5
D	TASK D-1 When S1 is 100, DS1 should function as a digital voltage meter immediately.	1
	TASK D-2 Display correct voltage value of TP4 on DS1.	2.5
	TASK D-3 The display and Bubble movements are stable and no glitch.	1
	TASK D-4 Display correct LEDs (LED1~LED4) based on S1 value.	0.5
Others	Display correct LEDs (LED1~LED4) and DS1 based on S1 value.	1
Total		25

OTHERS

1. PIC-kit board schematics:

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MCLR
IO15
IO14
Power_Deb
RJ12_ICD3 SMD
GND
X5
Power_Deb
+5V_PC
PicKit3
X6
VDD
MCLR
IO15
IO14
Power_Deb
GND
PIC18F4550
+5V_PC
+5V_PC
R4
10k
MCLR
S1
C4
100nF
GND
GND
VDD
VDD
MCLR/VPP/RE3
VUSB
OSC1/CLKI
OSC2/CLKO/RA6
Y1 16MHz
C5
22pF
X4
Socket
C6
22pF
GND
GND
+5V_PC
C7
10uF
C8
100nF
GND
GND
GND
NC/ICCK/ICPGC
NC/ICDT/ICPGD
NC/ICRST/ICVPP
NC/ICPORTS
VSS
VSS
U2
RA0/AN0
RA1/AN1
RA2/AN2/VREF-/CVREF
RA3/AN3/VREF+
RA4/T0CKI/C1OUT/RCV
RA5/AN4/SS/HLVDIN/C2OUT
RB0/AN12/INT0/FLT0/SDI/SDA
RB1/AN10/INT1/SCK/SCL
RB2/AN8/INT2/VMO
RB3/AN9/CCP2/VPO
RB4/AN11/KBI0/CSSPP
RB5/KBI1/PGM
RB6/KBI2/PGC
RB7/KBI3/PGD
RC0/T1OSO/T13CKI
RC1/T1OSI/CCP2/UOE
RC2/CCP1/P1A
RC4/D-/VM
RC5/D+/VP
RC6/TX/CK
RC7/RX/DT/SDO
RD0/SPP0
RD1/SPP1
RD2/SPP2
RD3/SPP3
RD4/SPP4
RD5/SPP5/P1B
RD6/SPP6/P1C
RD7/SPP7/P1D
RE2/AN7/OESPP
RE1/AN6/CK2SPP
RE0/AN5/CK1SPP
ANA0
ANA1
ANA2
ANA3
SS
IO8
IO9
IO10
IO11
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IO13
IO14
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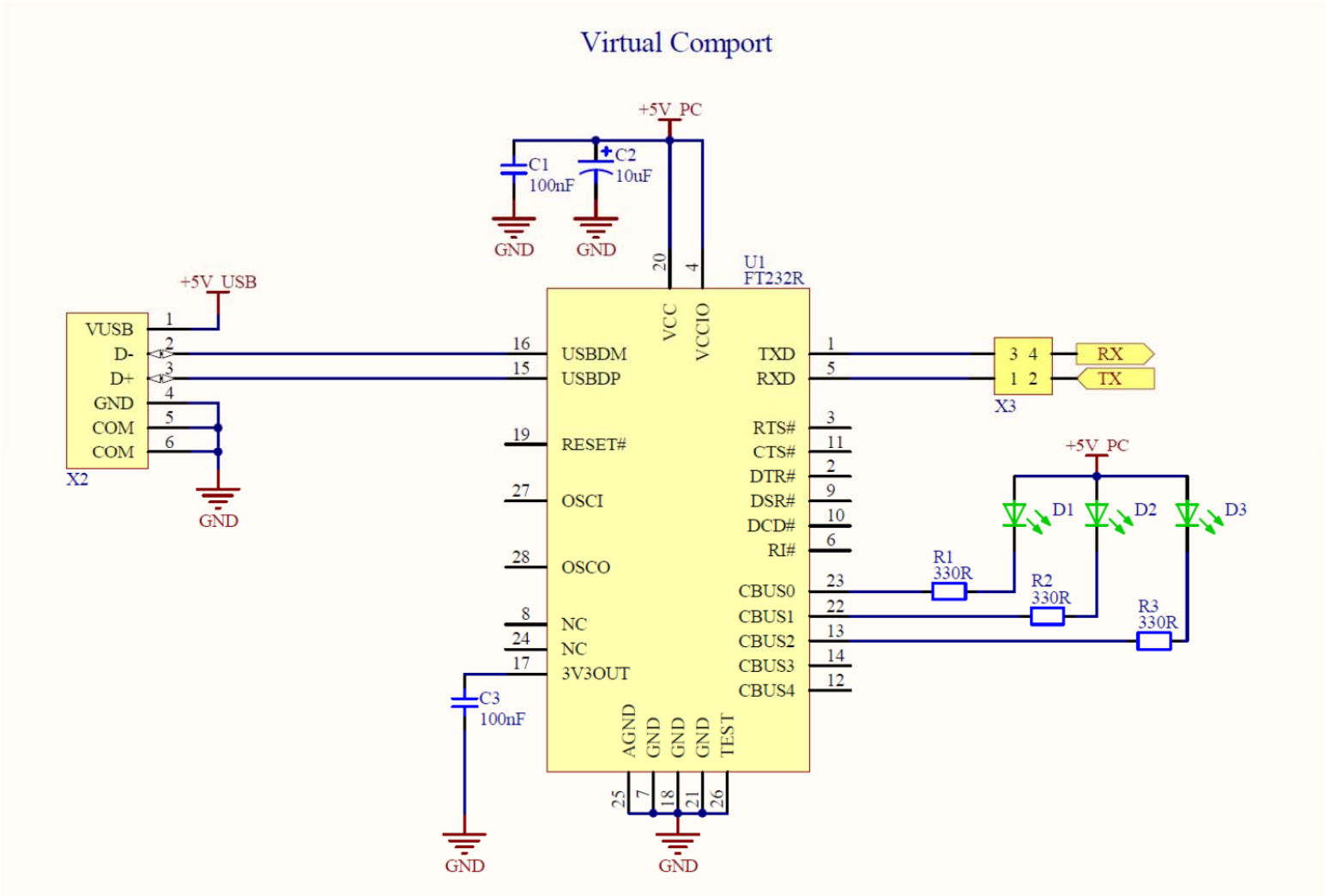
IO16


Virtual Comport
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C1
100nF
C2
10uF
GND
GND
U1
FT232R
20
4
VCC
VCCIO
+5V_USB
VUSB
D-
D+
GND
COM
COM
X2
1
2
3
4
5
6
GND
16
15
19
27
28
8
24
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USBDM
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GND
AGND
GND
GND
GND
TEST
25
7
18
21
26
GND
TXD
RXD
RTS#
CTS#
DTR#
DSR#
DCD#
RI#
CBUS0
CBUS1
CBUS2
CBUS3
CBUS4
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5
3
11
2
9
10
6
23
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13
14
12
3 4
1 2
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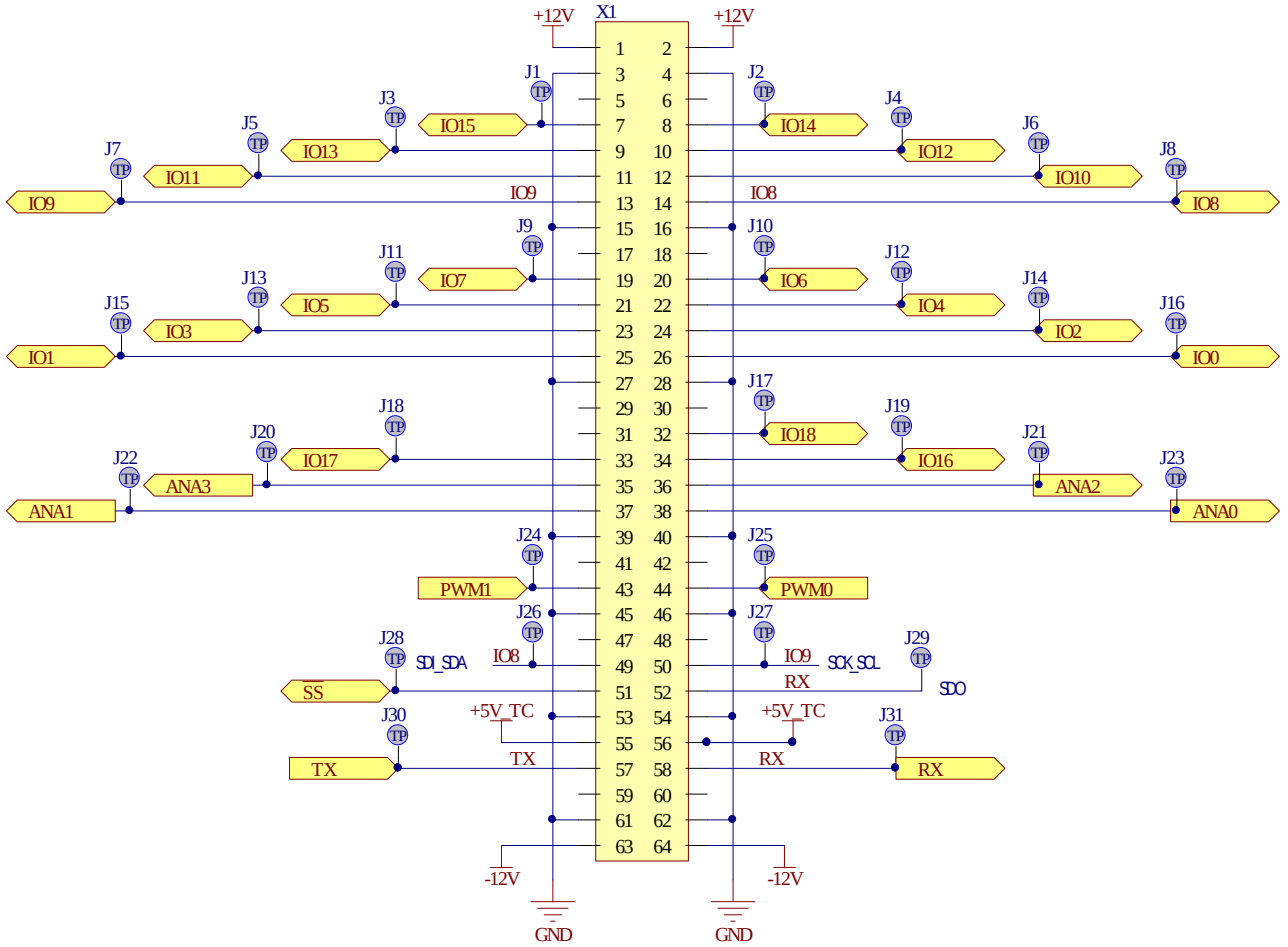
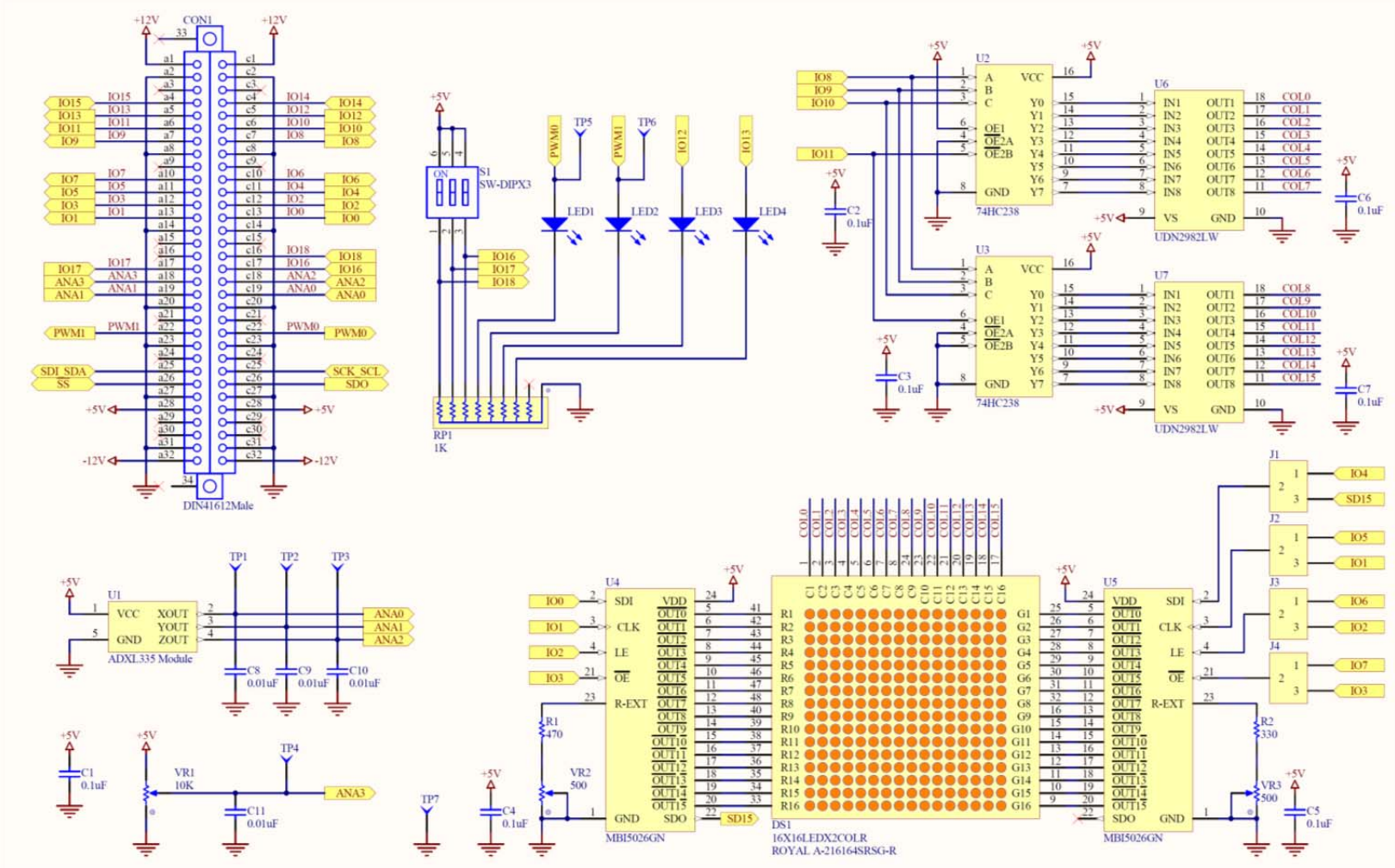
RX
TX
+5V_PC
D1
D2
D3
R1
330R
R2
330R
R3
330R

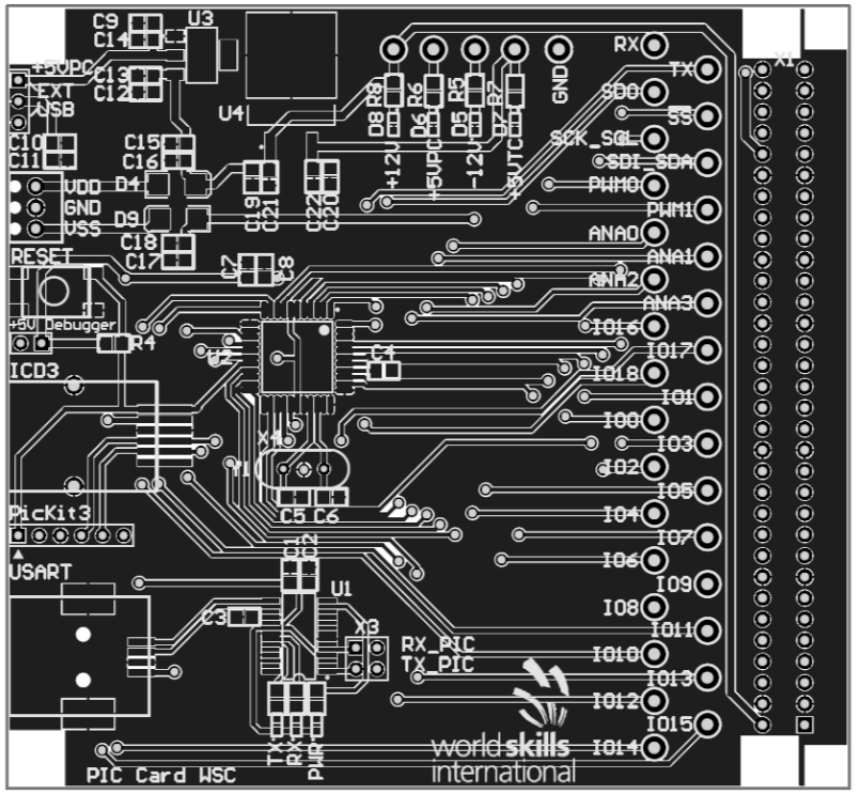
Connector 64pol



2. Task board schematics



3. PIC-kit board layout



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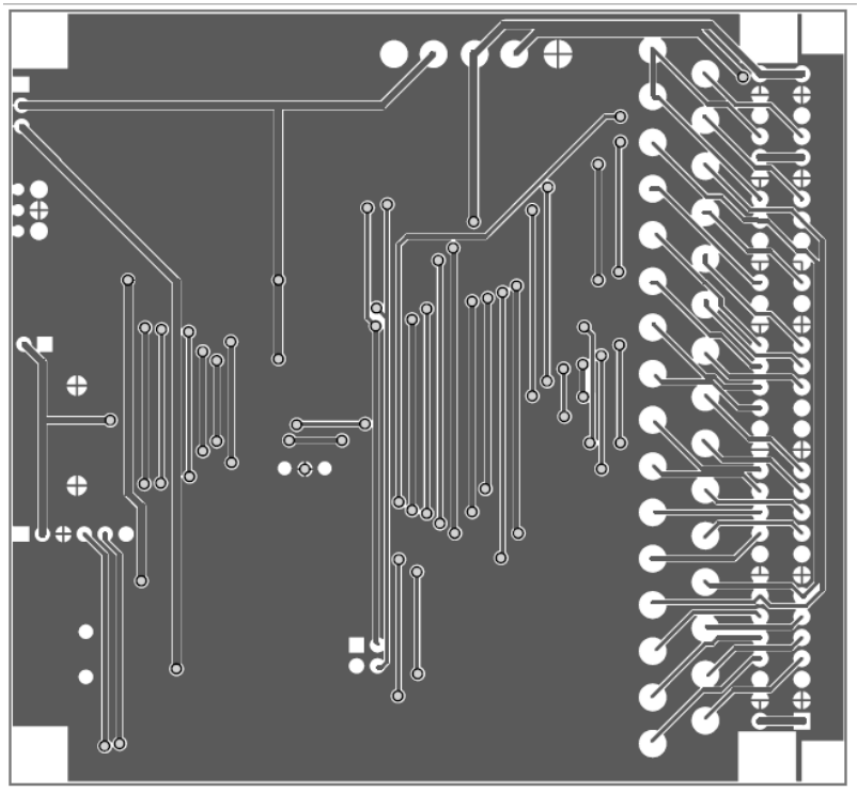

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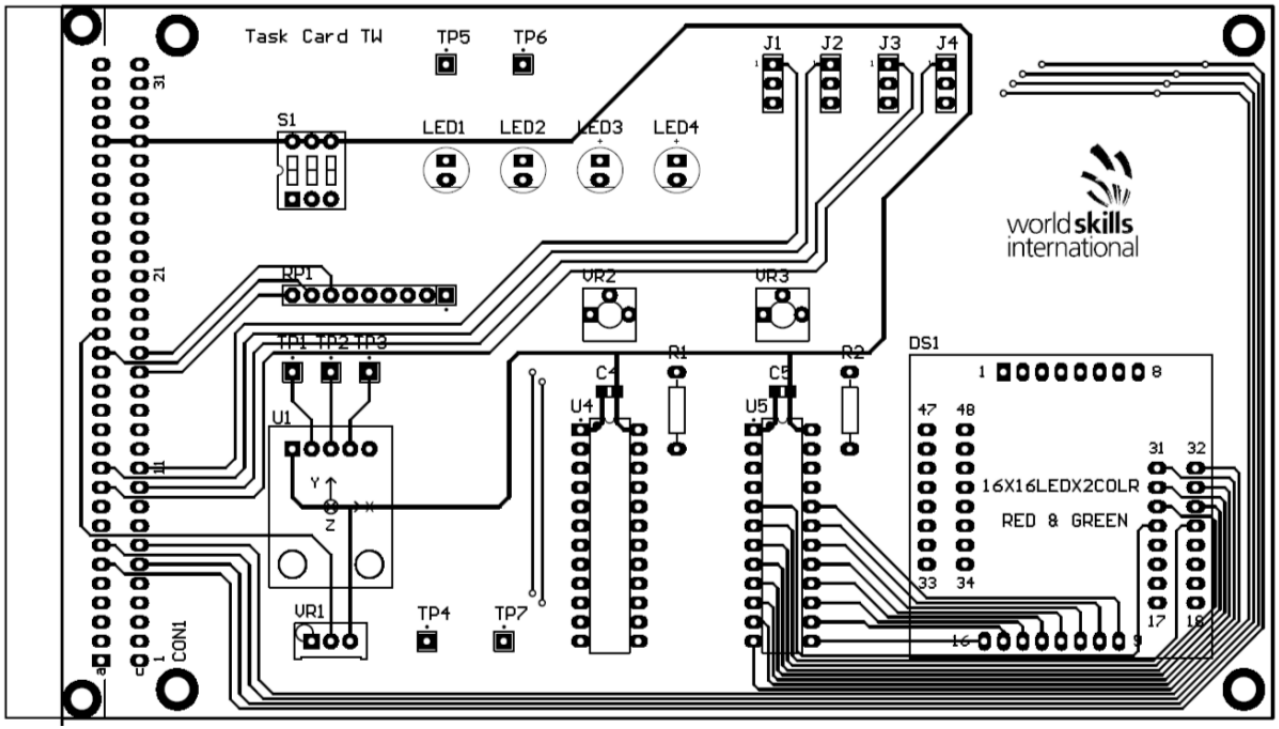
4. Task board PCB layout



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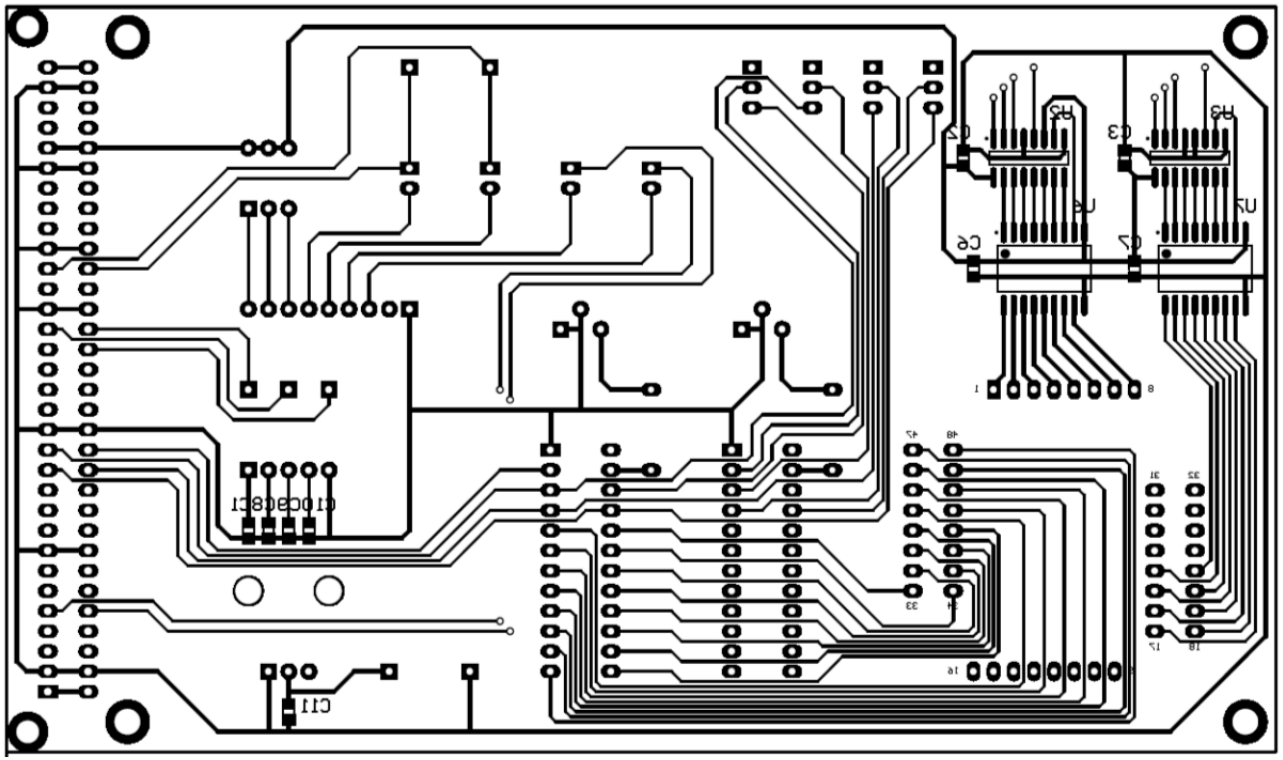

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5. ADXL335 module schematics