

智能仓储系统的开发研究

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1 第七章: 部署

这一章主要介绍实际如何部署好一个货架。一个完整的货架包含: 一个触摸屏, 多个电子秤还有整个架子。软件上需要给所有电子秤烧录好代码, 触摸屏的 UI 界面设计好; 硬件上要连好 Arduino 和压力传感器, 读卡器等元器件的连线, 以及整个货架的 IIC 通信线路。上述过程分为四步来完成:

- 第一步: 秤的组装;
- 第二步: 上传程序;
- 第三步: 货架布线;
- 第四步: 触摸屏显示;

1.1 秤的组装

压力测量模块连接, 详见第一章:

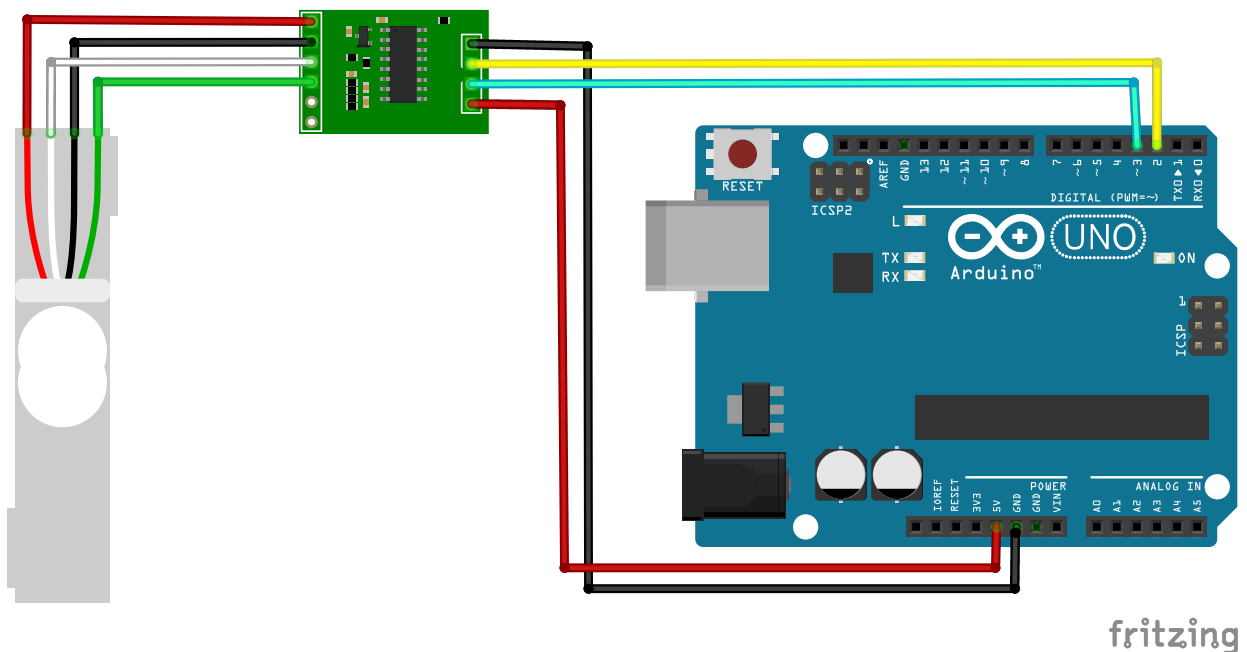


图 1: 压力测量模块流程

两种读卡器连接, 详见第五章第六章:

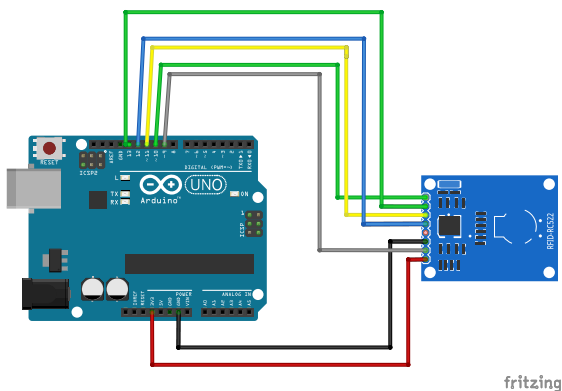


图 2: RC522 硬件连接

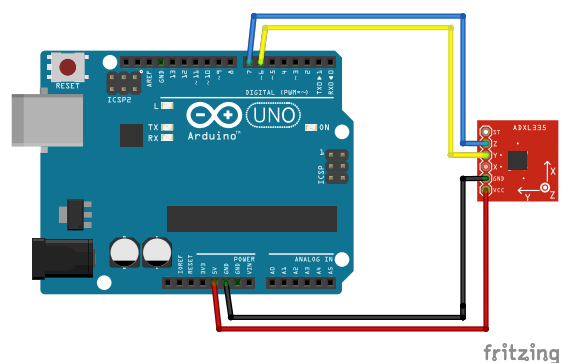


图 3: R505 与 arduino 的实物连接图

1.2 上传程序

这里我们选择的是 TCA9548A 的布线方式, arduino 分为多个主机一个从机,

主机: 如果是采取近的读卡器读取物品种类及单个物体质量信息, 就烧录下面的程序:

```
1  #include "master.h"
2  #include "transform.h"
3  #include "Surface.h"
4  #include "Calibrate.h"
5  #include "Oled.h"
6  #include "RC522.h"
7
8  master m1;
9  Surface YL_Surface;
10 Calibrate YL_Calibrated;
11 transform tf;
12 Oled oled;
13 RC522 rc522;
14
15 long numbefore=0, numnow=1;
16 char te[3];
17 unsigned long Sweight;
18 bool rflag=1; //1 ---> read; 0 ---> write
19
20 void setup() {
21     Serial.begin(9600);
22     m1.initialize(8); //8needschanged
23     YL_Calibrated.setpin_SCKDT(4, 5);
24     YL_Calibrated.set_range(20);
25     YL_Calibrated.kb_Initialize();
26     oled.initialize();
27     rc522.initialize(9,10);
28 }
29
30 void loop() {
31     switch(rflag){
32         case 0:
33             while(1) {
34                 bool state = rc522.write();
35                 if(state==1)
36                     break;
37             }
38             rflag=1;
39             break;
40         case 1:
41             while(1) {
42                 bool state = rc522.read();
43                 if(state==1)
44                     break;
45             }
46             break;
47     }
48     for (int i=0; i<sizeof(rc522.Type_Name);i++) te[i]=rc522.Type_Name[i];
49     Sweight=rc522.Single_Weight;
50
51     numbefore = numnow;
52     unsigned long CalibratedWeight = YL_Calibrated.Output_CalibratedWeight(YL_Surface.
53         Get_Surface());
54     numnow = ceil(CalibratedWeight/Sweight);
55
56     bool flag= (numbefore==numnow?0:1);
```

```

56     if(flag){
57         tf.initialize(te, m1.address, numnow, CalibratedWeight);
58         tf.pack();
59         digitalWrite(3,HIGH);
60         m1.send(9, tf.Transmission_Information);
61         Serial.println(tf.Transmission_Information);
62         oled.showIIC(te, numnow);
63         digitalWrite(3,LOW);
64     }
65
66     delay(3000);
67 }

```

如果是采取远的读卡器读取物品种类及单个物体质量信息, 就烧录下面的程序:

```

1  #include "master.h"
2  #include "transform.h"
3  #include "Surface.h"
4  #include "Calibrate.h"
5  #include "Oled.h"
6  #include "RC522.h"
7  #include "RC505.h"
8
9  master m1;
10 Surface YL_Surface;
11 Calibrate YL_Calibrated;
12 transform tf;
13 Oled oled;
14 RC522 rc522;
15 RC505 rc505;
16
17 long numbefore=0, numnow=1;
18 char te[3];
19 unsigned long Sweight;
20 char MessageNow[arrayMax];
21 bool flag=0; //1--->write; 0--->read
22
23 void setup() {
24     //设置串口波特率38400
25     Serial.begin(38400);
26     m1.initialize(8); //8needschanged
27     YL_Calibrated.setpin_SCKDT(4, 5);
28     YL_Calibrated.set_range(20);
29     YL_Calibrated.kb_Initialize();
30     oled.initialize();
31     rc522.initialize(9,10);
32 }
33
34
35 void loop() {
36     switch(flag){
37         case 0:
38             // while(1) {
39             //     bool state = rc505.write();
40             //     if(state==1)
41             //         break;
42             // }
43             rflag=1;
44             // break;
45         case 1:
46             while(1) {
47                 bool state = rc505.read(MessageNow);

```

```

48         if(state==1)
49             break;
50     }
51     break;
52 }
53 for (int i=0; i<sizeof(rc505.Type_Name);i++) te[i]=rc505.Type_Name[i];
54 Sweight=rc505.Single_Weight;
55
56 numbefore = numnow;
57 unsigned long CalibratedWeight = YL_Calibrated.Output_CalibratedWeight(YL_Surface.
    Get_Surface());
58 numnow = ceil(CalibratedWeight/Sweight);
59
60 bool flag= (numbefore==numnow?0:1);
61 if(flag){
62     tf.initialize(te, m1.address, numnow, CalibratedWeight);
63     tf.pack();
64     digitalWrite(3,HIGH);
65     m1.send(9, tf.Transmission_Information);
66     Serial.println(tf.Transmission_Information);
67     oled.showIIC(te, numnow);
68     digitalWrite(3,LOW);
69 }
70
71 delay(3000);
72 }

```

从机 (也就是与 TCA9548A 相连的 arduino 板上的主程序如下):

```

1  #include "Oled.h"
2  #include "slave.h"
3  #include "transform.h"
4
5  String slave::comdata="";
6
7  Oled oled;
8  slave s;
9  transform tf;
10
11 void setup() {
12     Serial.begin(9600);
13     s.initialize(8);
14     oled.initialize();
15     pinMode(7,INPUT);
16     digitalWrite(7, LOW);
17 }
18
19 void loop() {
20     tf.unpack(s.comdata);
21     oled.showIIC(tf.Type_Name, tf.Number, tf.DEVICE_ADDRESS);
22     delay(1000);
23 }

```

1.3 货架布线

IIC 通信及 OLED 屏显示连线, 详见第三章第四章:

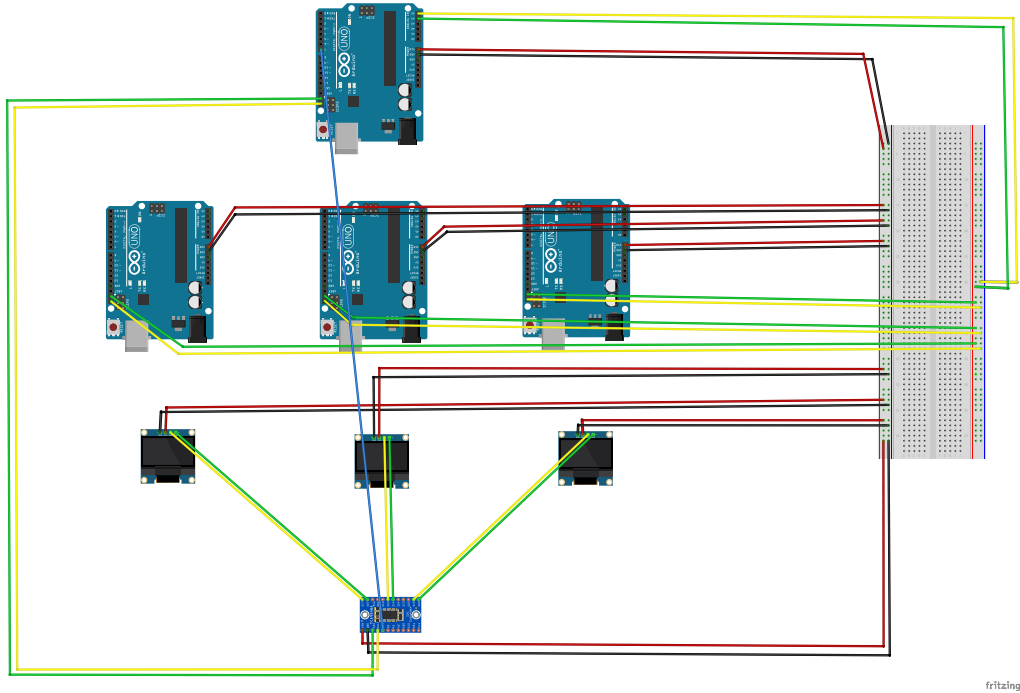


图 4: 一层货架示意图

对于第二层甚至更多层的话, 就要考虑总的电子秤数量是否超过 8, 超过了的话则需要更多从机和 TCA9548A 模块。

1.4 触摸屏显示

上传下面的 python 代码到树莓派上运行, 树莓派就可以接收到从机发来的信号, 从而在屏幕上显示对应电子秤的重量变化。

```
1 import sys
2 from PyQt5.QtWidgets import QApplication, QWidget, QVBoxLayout, QHBoxLayout,
  QGridLayout, QLabel, QMainWindow
3 from PyQt5.QtGui import QPixmap
4 from PyQt5.QtCore import Qt, QTimer, QIODevice, QByteArray
5 from PyQt5.QtSerialPort import QSerialPort, QSerialPortInfo
6 from qt_material import apply_stylesheet
7 from PyQt5.uic import loadUi
8
9
10 class MainWindow(QMainWindow):
11     def __init__(self):
12         super().__init__()
13         loadUi("main_window1.ui", self) # 加载UI文件
14         # 设置窗口标题和大小
15         self.setWindowTitle('货物管理')
16
17         # 创建网格布局
18         grid = QGridLayout(self)
19         grid.setAlignment(Qt.AlignCenter)
20
21         pixmap = QPixmap('jimu1.jpg')
22         pixmap = pixmap.scaled(150, 130, Qt.KeepAspectRatio)
23         self.label1.setPixmap(pixmap)
```

```

24     self.label1.setFixedSize(pixmap.width(), pixmap.height())
25     self.label1.setAlignment(Qt.AlignCenter)
26     self.pushButton.clicked.connect(self.click_button)
27     self.pushButton_2.clicked.connect(self.click_button2)
28
29     # 应用Qt Material主题
30     apply_stylesheet(self, theme='light_teal.xml')
31
32     # 创建串口监视器
33     self.serial = QSerialPort()
34     self.serial.setPortName("COM3") # 设置端口号
35     self.serial.setBaudRate(QSerialPort.Baud9600)
36     self.serial.readyRead.connect(self.handle_serial_data)
37     self.serial.open(QIODevice.ReadWrite)
38
39     def click_button(self):
40         self.serial.close()
41
42     def click_button2(self):
43         self.serial = QSerialPort()
44         self.serial.setPortName("COM8") # 设置端口号
45         self.serial.setBaudRate(QSerialPort.Baud9600)
46         self.serial.readyRead.connect(self.handle_serial_data)
47         self.serial.open(QIODevice.ReadWrite)
48
49     def handle_serial_data(self):
50         # 读取串口数据
51         data = self.serial.readAll().data()
52         data_str = str(data, encoding='utf-8')
53         print(data)
54         # 处理数据
55         module_data = data_str.split(',')
56         for i, module_str in enumerate(module_data):
57             # 如果模块数据不为空，则更新数量和种类
58             if module_str:
59                 try:
60                     type_, num = module_str.split(':')
61                     self.update_module_info(i, type_, num)
62                 except ValueError as e:
63                     print(f"Error: {e}. Received data: {module_str}")
64
65     def update_module_info(self, module_num, type_, num):
66         # 获取模块信息字典
67         module_info = {
68             0: {'num': None, 'type': 'AA', 'image': 'jimu1.jpg'},
69             1: {'num': None, 'type': 'B', 'image': 'picture2.jpg'},
70             2: {'num': None, 'type': 'C', 'image': 'picture3.jpg'},
71             3: {'num': None, 'type': 'D', 'image': 'picture4.jpg'},
72             4: {'num': None, 'type': 'E', 'image': 'picture5.jpg'},
73             5: {'num': None, 'type': 'F', 'image': 'picture6.jpg'},
74             6: {'num': None, 'type': 'G', 'image': 'picture7.jpg'},
75             7: {'num': None, 'type': 'H', 'image': 'picture8.jpg'},
76             8: {'num': None, 'type': 'I', 'image': 'picture9.jpg'},
77             9: {'num': None, 'type': 'J', 'image': 'picture10.jpg'},
78             10: {'num': None, 'type': 'K', 'image': 'picture11.jpg'},
79             11: {'num': None, 'type': 'L', 'image': 'picture12.jpg'}
80         }
81
82         # 更新模块信息字典中对应模块的数量和种类
83         for i in range(12):
84             if module_info[i]['type'] == type_:

```

```

85         module_info[i]['num'] = num
86         num_label = self.findChild(QLabel, f'label_num_{i}')
87         type_label = self.findChild(QLabel, f'label_type_{i}')
88         if num_label is None:
89             print(f"label_num_{module_num}_not_found!")
90             return
91
92         num_label.setText(num)
93         break
94
95
96 if __name__ == '__main__':
97     app = QApplication(sys.argv)
98     main_window = MainWindow()
99     main_window.show()
100    sys.exit(app.exec_())

```