USER DOCUMENTATION & INSTALLATION DOCUMENTATION

TimeofFlight Team

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Abstract

This Embedded project is inspired by Time-of-Flight sensor which detects and counts the number of people who passes it. This product can be applied to schools, offices, private houses or anywhere that needs to manipulate the amount of people.

As the preliminary idea, this system will be placed at the entrance so it can detect people who come or leave. This product works based on the order of which sensors are activated first. If the distance sensor is triggered first then the temperature sensor, the system will know one person is coming. By contrast, when the temperature sensor is triggered first then the distance sensor, so there is a person is going to leave the room. Moreover, we have an automatic shift LED from on to off depends on the room is empty or not.

I.   Introduction

1.1   Ultra Distance Sensor (HC-SR04)

This is the sensor which can provides 2cm to 400cm of non-contact measurement functionality with a ranging accuracy that can reach up to 3mm. Each HC-SR04 module includes an ultrasonic transmitter, a receiver, and a control circuit.

Figure 1 Distance sensor

There are only four pins also labeled above the pin:
- VCC (Power)
- Trig (Trigger)
- Echo (Receiver)
- GND (Ground)

1.2   Waterproof Digital Temperature Sensor (DS18B20)

This digital temperature probe lets user precisely measure temperatures in wet environments with a simple 1-Wire interface. The DS18B20 provides 9 to 12 bits

temperature readings over a 1-Wire interface, so that only one wire (and ground) needs to be connected from a central microprocessor.

Figure 2 Contact temperature sensor

1.3   I2C LCD 16x2

The 16x02 LCD display screen with I2C interface is used for display characters on 2 lines, white characters on blue background. In this project, 16x02 LCD is used to display number of people in the room and the LED status.
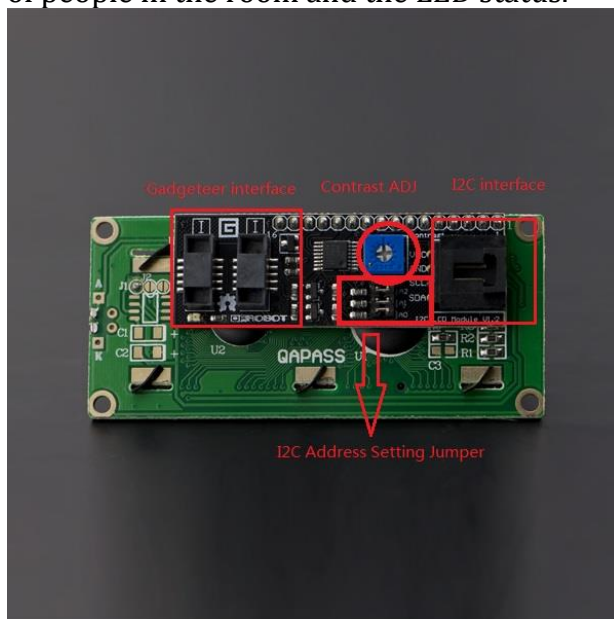

Figure 3 I2C LCD

II.   System construction

Each sensor part is divided into small part to optimize the circuit and ease the combination eventually.

2.1   HC-SR04 connection

Component required:
-        1 pcs, NUCLEO-L152RE (development board)

- 1 pcs, Ultrasonic Distance Sensor HC-SR04
- 3 pcs, 10kΩ Resistor

2.2   DS18B20 connection

Component required:
- 1 pcs, Waterproof Digital Temperature Sensor (DS18B20)
- 1 pcs, 10kΩ Resistor
- 1 pcs, 4.7kΩ Resistor
- 1 pcs, 1.8kΩ Resistor
- 1 pcs, NPN Transistor
- 1 pcs, LED

2.3   LCD connection

Component required:
- 1 pcs, NUCLEO-L152RE (development board)
- 1 pcs, I2C LCD 16x2
- 2 pcs, 2.2kΩ Resistor
- 2 pcs, MAX3485

2.4   Installation Circuit

This is a fully connection between microcontrollers and sensors/devices and nucleo boards to the other.
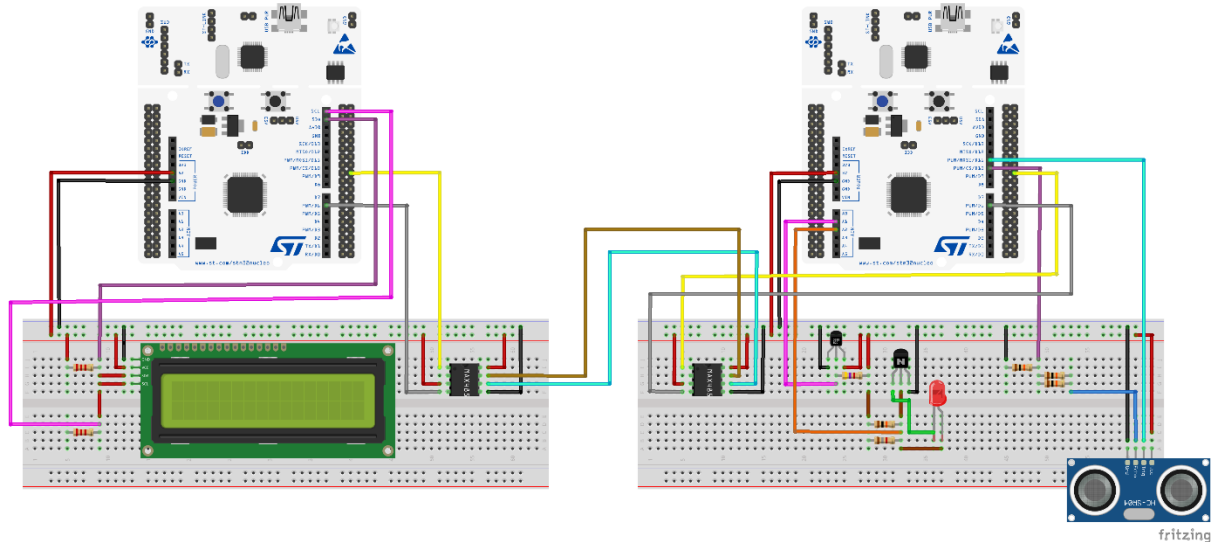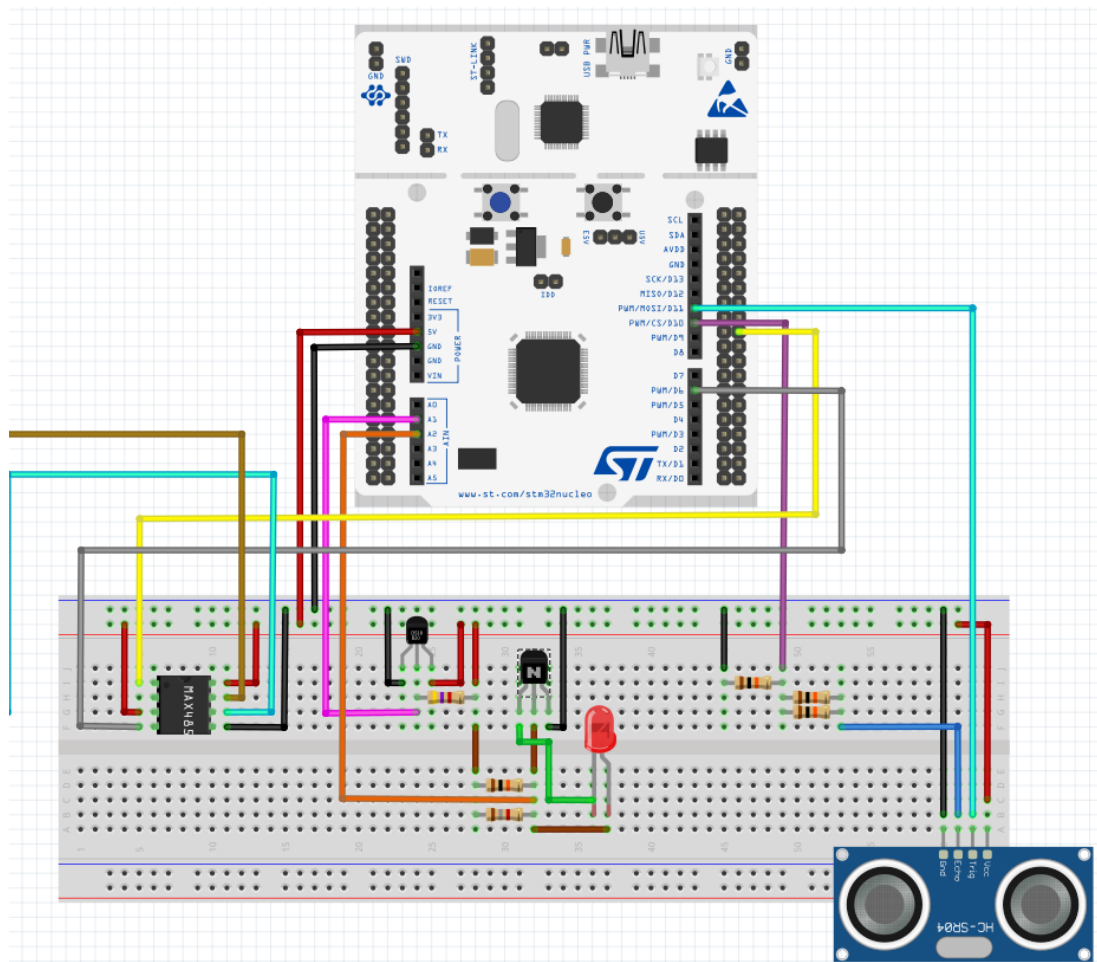

Figure 4 Completely connection

a. Slave
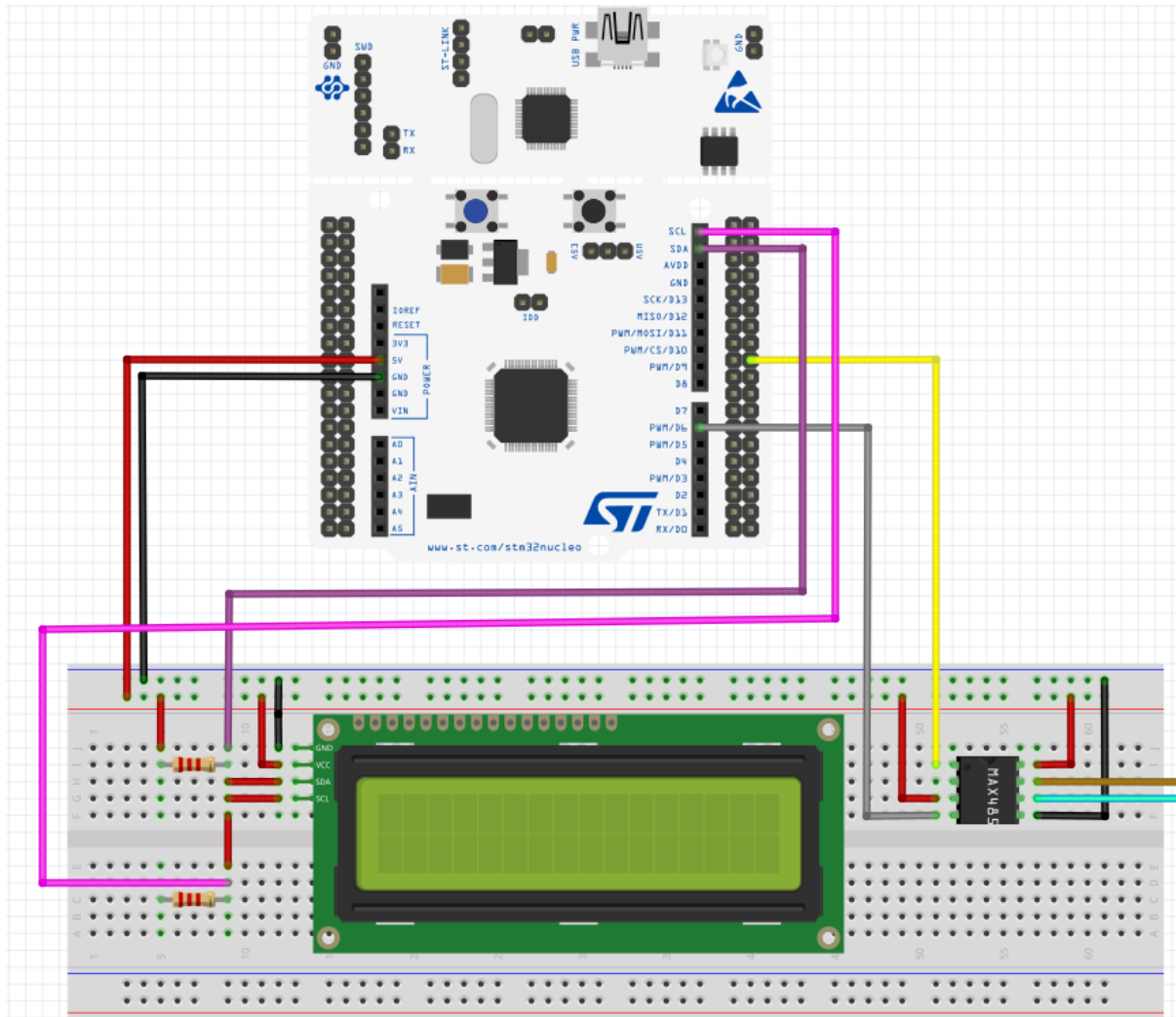

Figure 5 Slave connection

b. Master

Figure 6 Master connection

III. Software Part

The user has to download these programs listed below:
- Visual studio code (1.62.3 version)
- RealTerm: Serial/TCP Terminal
- Git – version control

First of all, Git should be downloaded via this link Git - Downloads (git-scm.com).

After setting up, open VS code, on the activity bar on left of the screen select clone like figure 6.
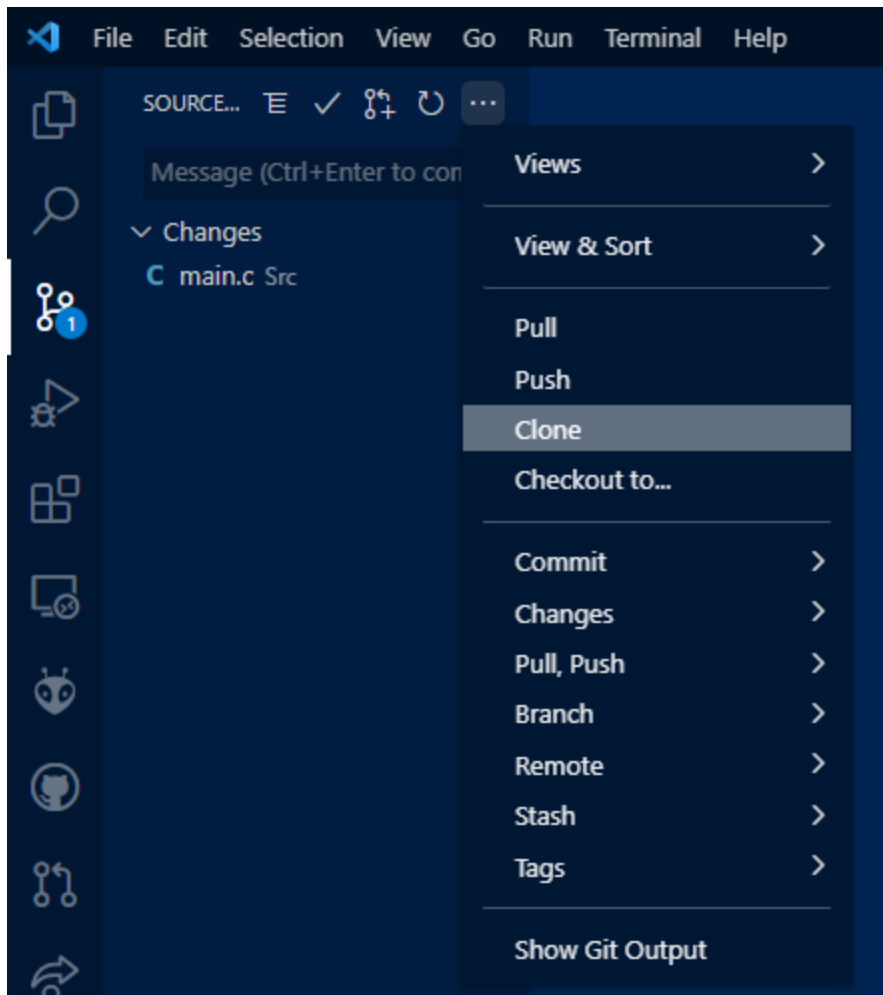
Figure 7 Source control process

3.1 Slave

Top of the screen will pop up a search bar to enter the repository URL, copy and paste the line below:

https://github.com/quanghoang72/Slave.git

Select the desire folder the store the project, open and trust the authors. Now all the source code of this project we automatically clone into your folder.
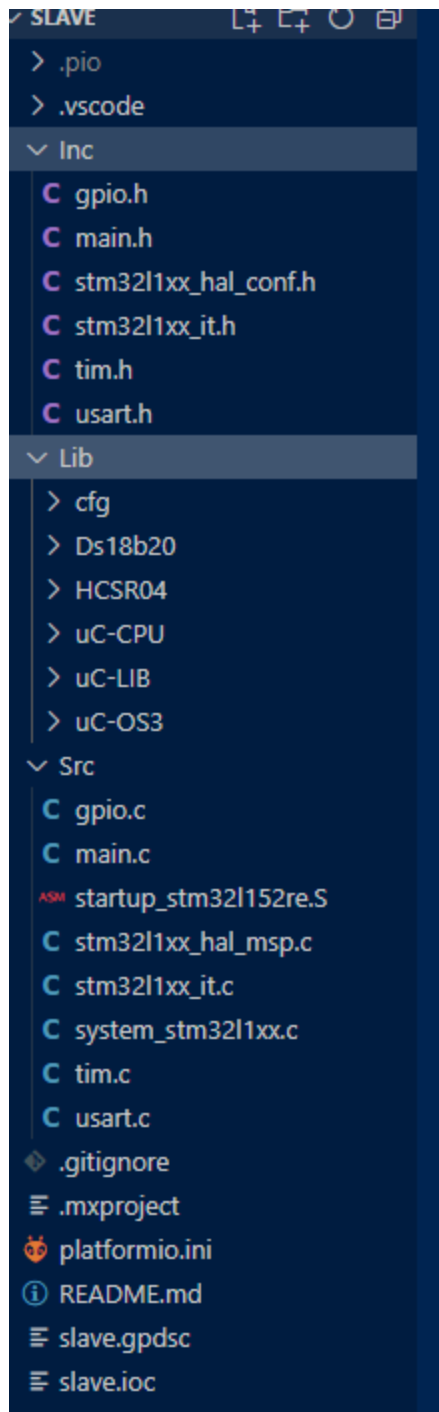
Figure 8 Tree of slave

3.2 Master

After loading the code into the first stm32 microcontroller, take the second one to play a receiver (master) and to demonstrate the information. Clone the code from this new repository remote link
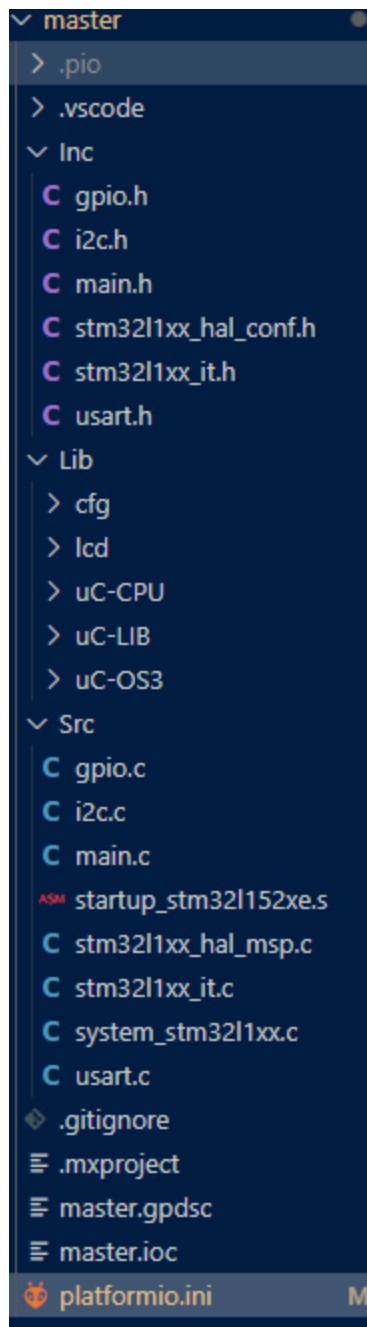*https://github.com/quanghoang72/Master.git*

Figure 9 Tree of master

Compile and load the code to the second nucleo board. Ensure that all the physical is connected correctly so the user can just compile and run the code. The data also send to USART2 and can be read by RealTerm.
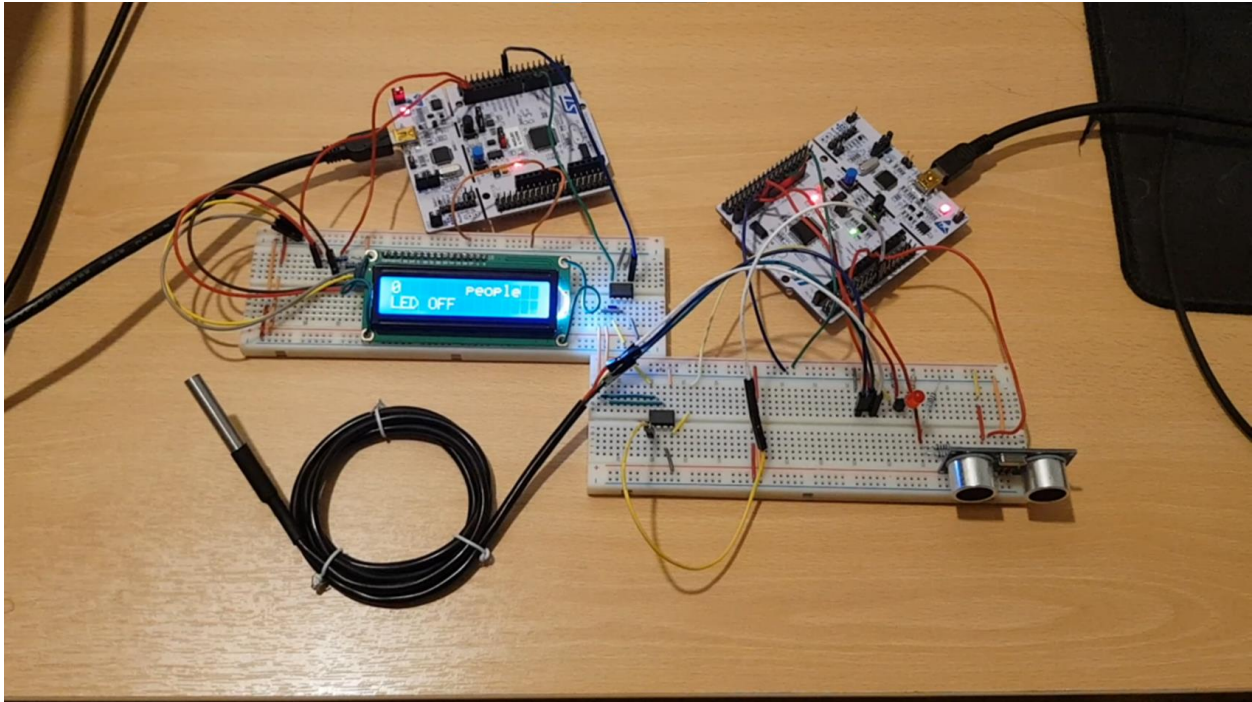
The result should look like this at the beginning.

Figure 10 Final result

This code works by passing through distance sensor with the length is less than 10 centimeters or hold the 1-wire temperature sensor to increase to 28 Celsius degrees. By this way, it will activate the sensors counter and only if two sensor both meet their counter condition it will end up with two scenarios. Therefore, when there is only 1 sensor is provoked, the product will not count as a person to avoid obstacles or to avoid when he/she is not meant to going in the room – just stay at the door and leave. Depends on the activation order of the sensor, there are 2 scenarios:

- Distance <=10 cm → Temperature >=28 Celsius Degree → Count as 1 person enters
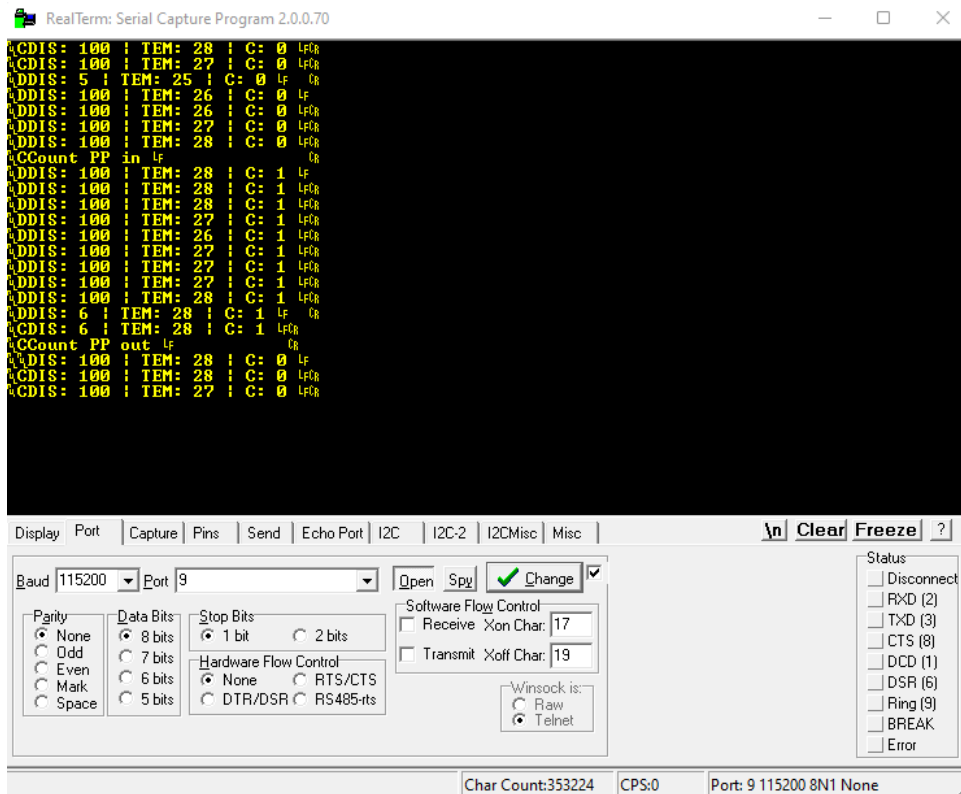- Tem >= 28 Celsius degree → Dis <=10 cm → Count as 1 person exits

Figure 11 Realterm sample