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ARDUINO SECURITY ALARM SYSTEM

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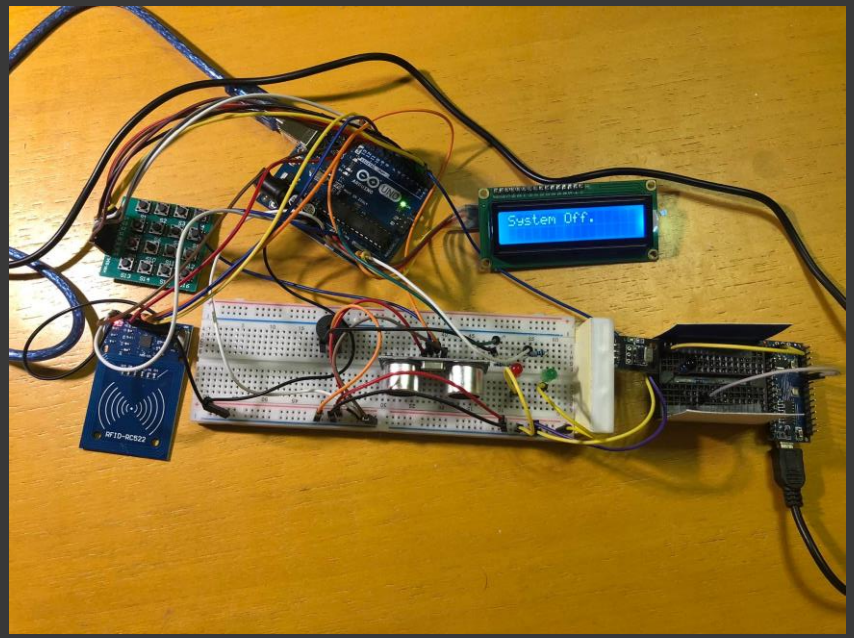
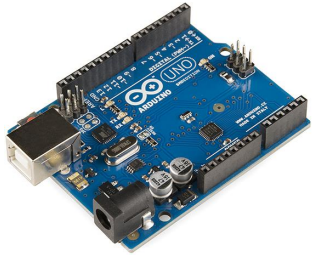
General

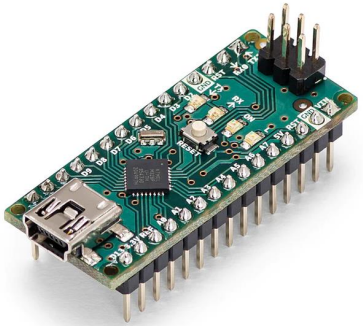
Everybody may want to protect their home, business and other precious things. That's when alarm systems come in to fulfill their needs.
We implement a user-friendly security system with access by code and RFID cards. The user is informed about the system (and their valuables) by specific messages. Most importantly, the system is safe as it uses infrared led technology instead of magnetic contacts which are vulnerable to intruders.

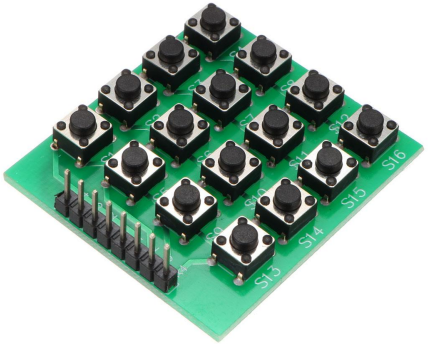
THE PROJECT

Alarm system that detects presence in nearby (specified) area using distance sensor. The user can utilize the keypad to insert the password or the cards for the RFID lock. Messages and instructions are printed to the lcd screen and sounds (like siren) are generated by the buzzer. The door is implemented with infrared receiver on the one side and transmitter on the other. If the transmitter sends a specific signal to the receiver the door is closed. Otherwise, the alarm system is activated.

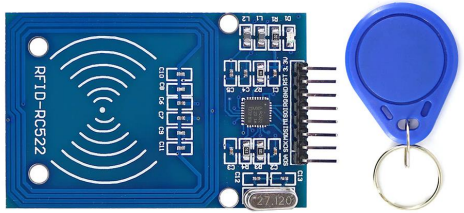


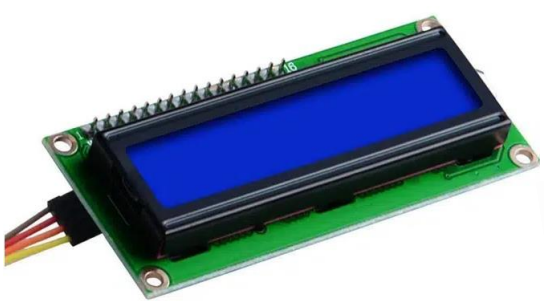


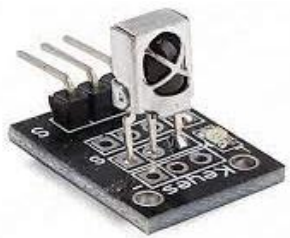


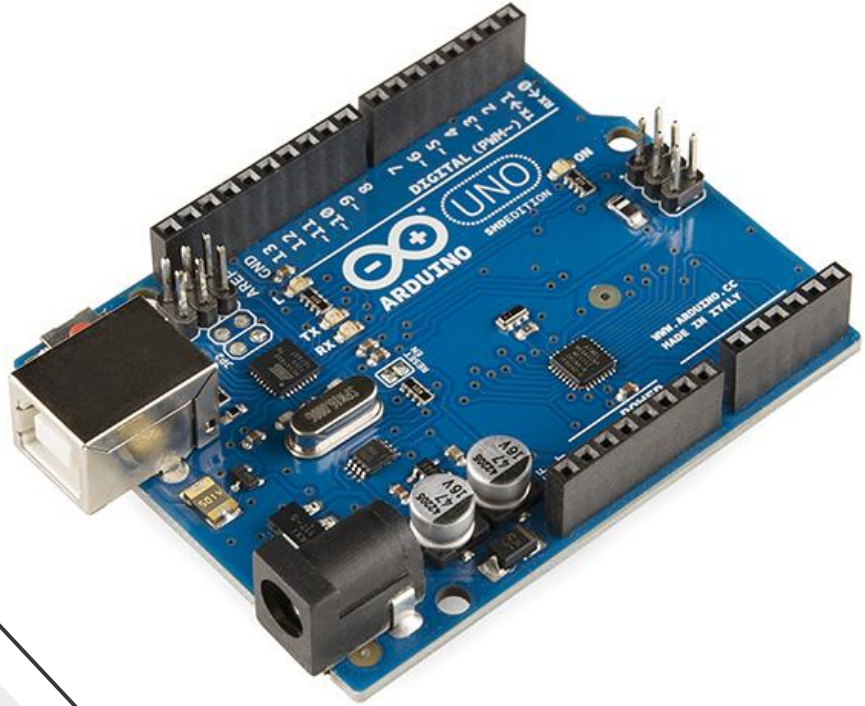


IMPLEMENTATION



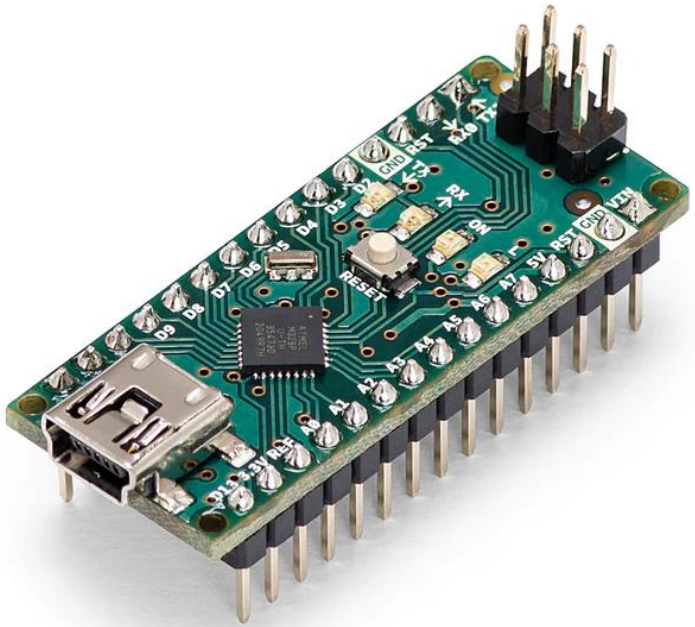






ARDUINO UNO

Microcontroller used for the main circuit.
Microcontroller: Microchip ATmega328P
Digital I/O Pins: 14
Analog Input Pins: 6

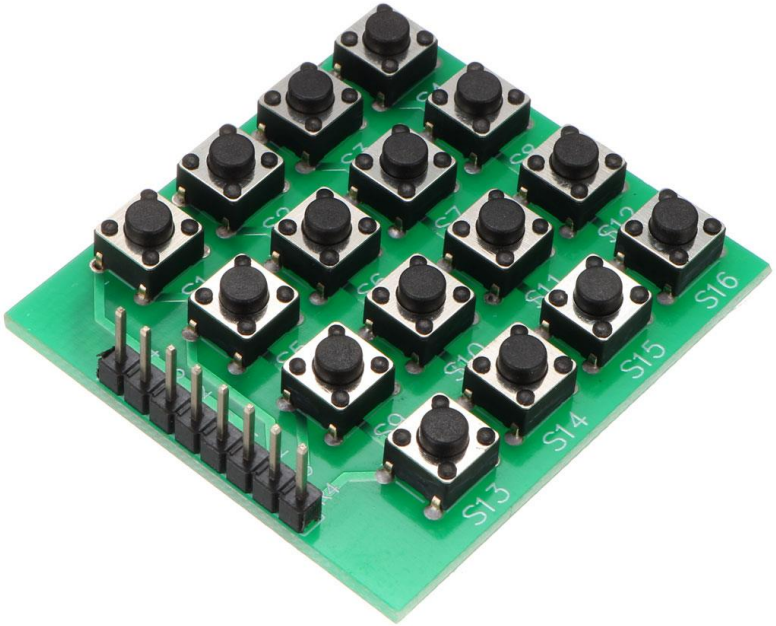


ARDUINO NANO

Microcontroller used to implement the other side of the door that is connected with the infrared transmitter.
Microcontroller: Microchip ATmega328
Digital I/O Pins: 14
Analog Input Pins: 8

Ultrasonic sensor

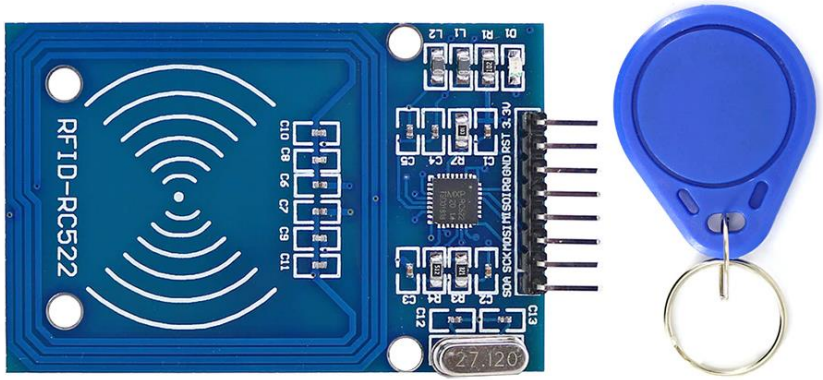
Distance sensor
Used to detect somebody's presence inside the protected by the alarm system area.



KEYPAD

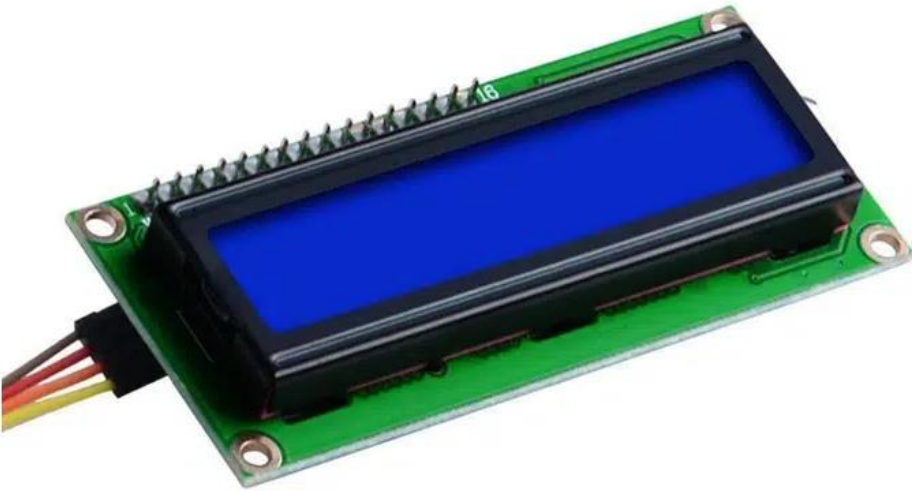
4x4 keypad
Used to insert system's password.
The implementation of keys order is the following:

1	2	3	A
4	5	6	B
7	8	9	C
*	0	#	D



RFID

Radio Frequency Identification System
RFID tags (/cards) contain saved information (UID: unique identifier and info that can be written to them). When the tag comes close to reader, the RFID reader reads the info and sends them to the microcontroller. If they are identical with the default values in the code, the tag/card acts like a key for the system.

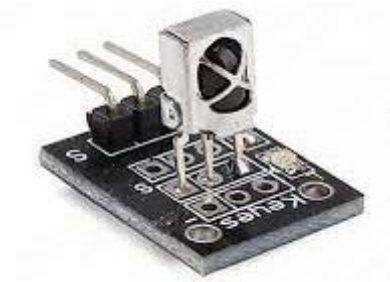


LCD DISPLAY

I2C 16X2 Liquid Crystal Character LCD Display
The LCD display (2 lines, 16 characters) is used to print messages and instructions for the user.

BUZZER

(Passive) buzzer is used to generate sound with tone and frequency set by the code.
It represents the sound of the siren in case of detection or/and alarm activation.



Simulation of door's control

IR RECEIVER

It is connected to the main circuit and it represents the stable side of door. When it stops receiving the right signal, it activates the alarm signifying that the door was opened.

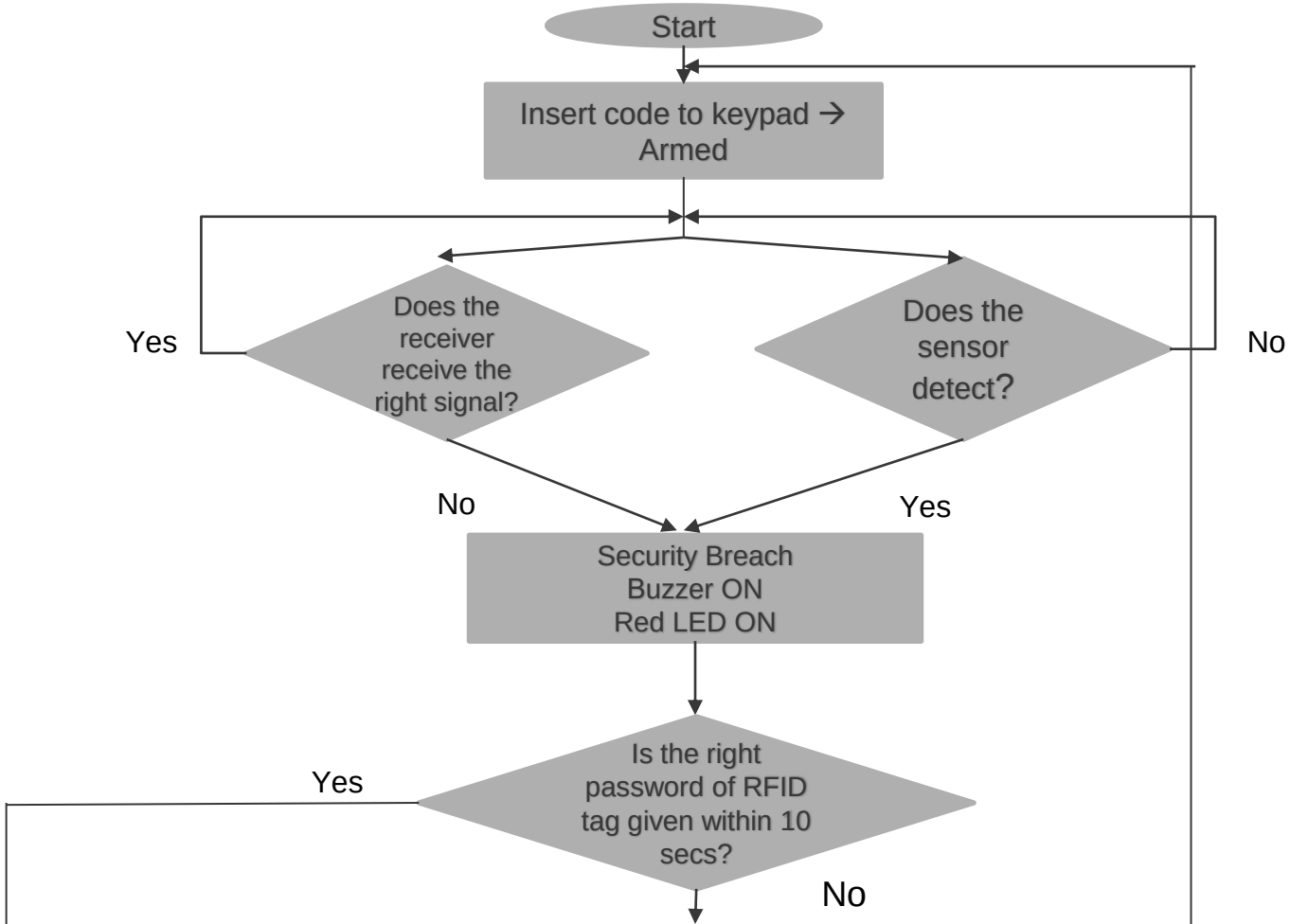
IR TRANSMITTER

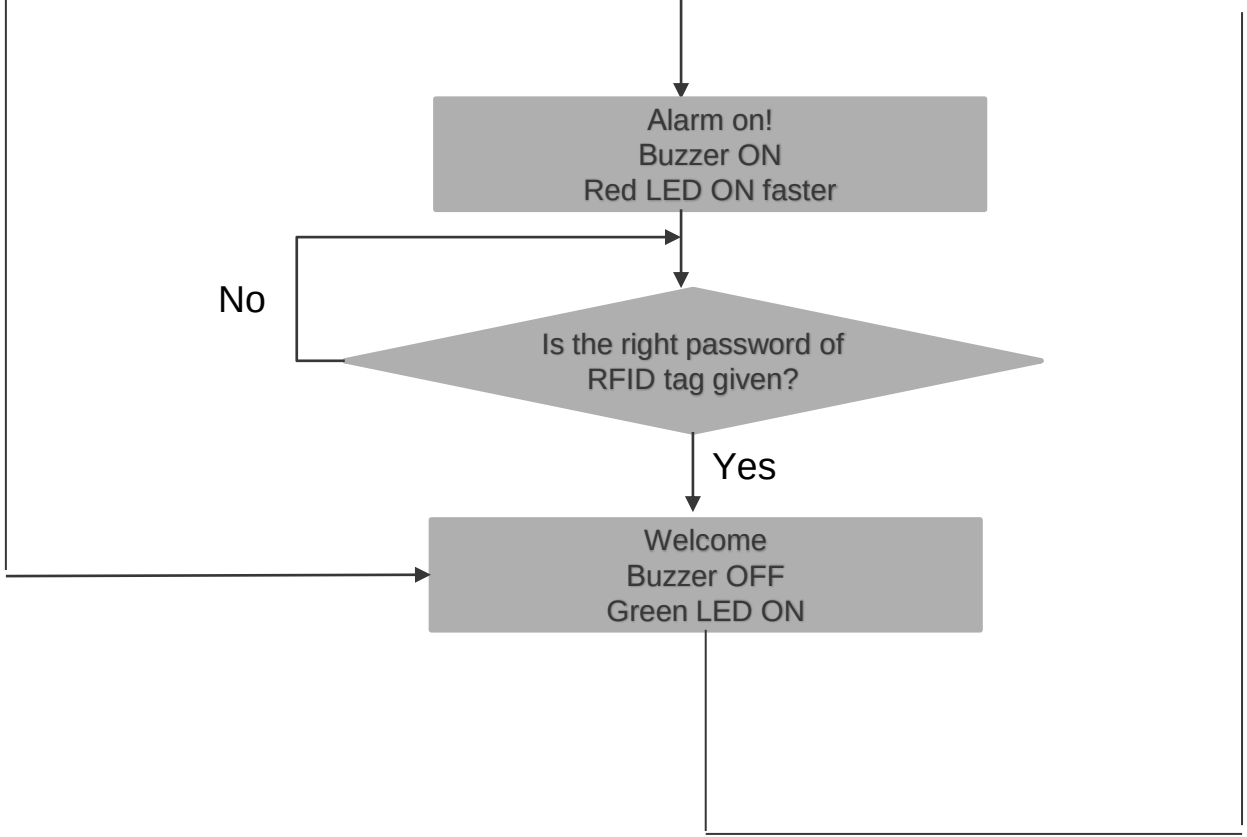
It is connected to a separate circuit with Arduino nano and it is located outside the door's region. It constantly sends the right signal to the receiver on the other side.

LEDS

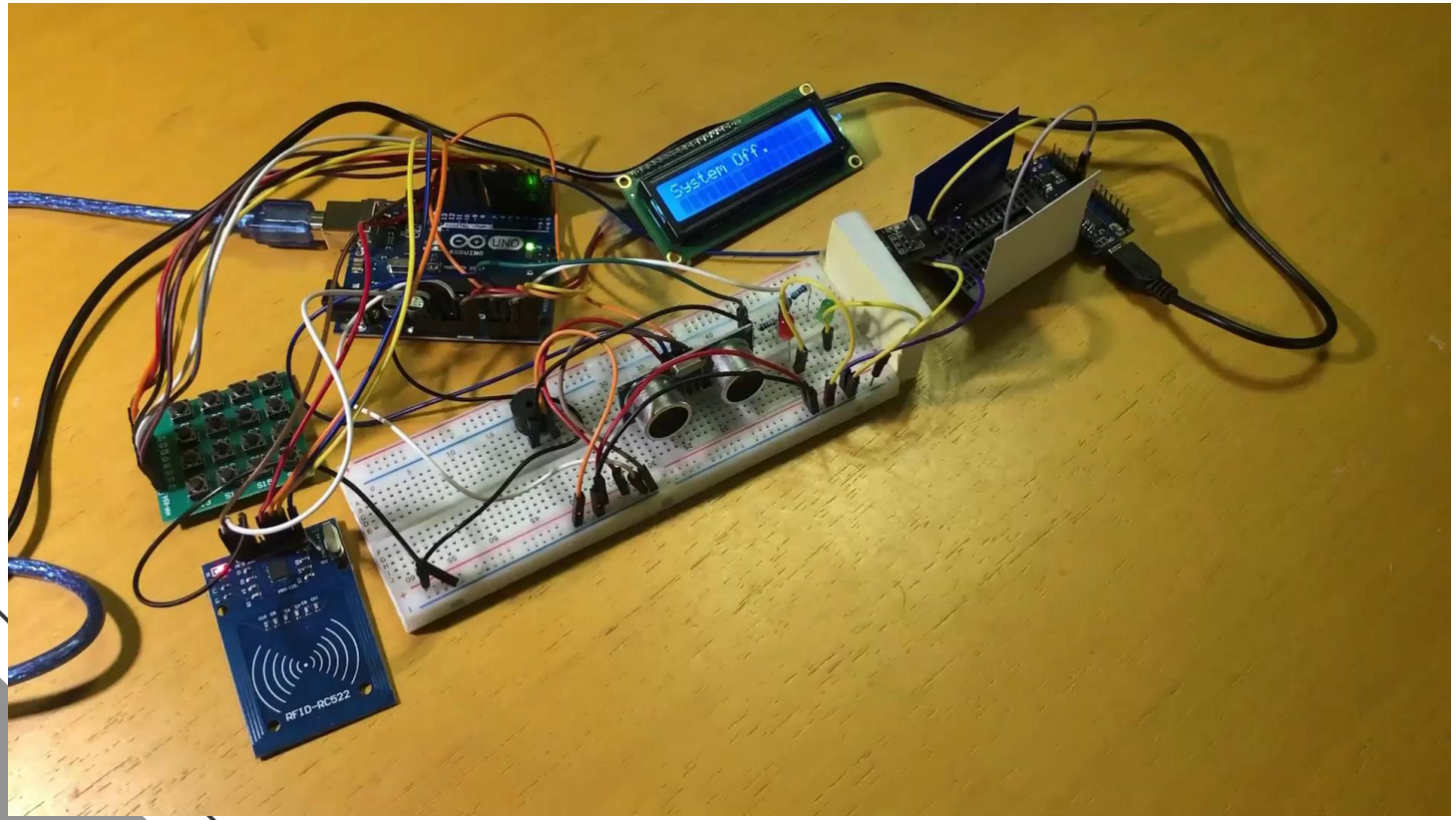
Used to show the state of the system.

OPERATION


Start
Insert code to keypad → Armed
Does the receiver receive the right signal?
Yes
No
Does the sensor detect?
No
Yes
Security Breach
Buzzer ON
Red LED ON
Is the right password of RFID tag given within 10 secs?
Yes
No


Alarm on!
Buzzer ON
Red LED ON faster
No
Is the right password of
RFID tag given?
Yes
Welcome
Buzzer OFF
Green LED ON

Project demo



DIFFICULTIES

In order to ensure the stronger safety of the system we should give more consideration to the signal that is transferred between IR components. We made an attempt to implement RSA cryptography algorithm. But it would be successfull if we could save and transfer large numbers which is impossible because of the fact that the microcontroller we use doesn't support the required memory.

SOLUTIONS/EXTENSIONS

We could avoid a possible intercept of the control signal using a cryptographic algorithm as well as increasing the hardware resources. Another choice is the consequent change of the signal in specific time intervals or with an indication from the one microcontroller to the other.

Another possible extension is the implementation of communication with the owner via SMS or WiFi in case of security breaches.

THE END

Thank you!