

# Arduino Projects: Fingerprint Door Unlock System

This simple fingerprint sensor project using Arduino can be very useful for door security, forensics, crime investigation, personal identification, attendance system and much more. -- DINU D. AND CINLA K. PAPPACHAN

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This simple fingerprint door unlock project using Arduino can be very useful for door security, forensics, crime investigation, personal identification, attendance system and much more. In the future, there could be many more applications like fingerprint based driving licences, bank accounts operation and so on.

The whole system works under a simple algorithm called matching algorithm, which is used to compare previously-stored templates of fingerprints against users' fingerprints for authentication purposes.

A key is normally used for traditional door opening, but it provides very poor security. In this fingerprint door unlock project, only when an authorized person places a finger on the sensor, the door unlocks and the LCD displays a welcome message along with that person's name.

## Circuit and working

The circuit shown in Fig. 1 operates using a 12V power supply. An Arduino microcontroller (MCU) requires only 5V but the solenoid electric lock requires 12V. As Arduino Uno has an inbuilt 5V voltage regulator, a common 12V supply can be used for the whole system.

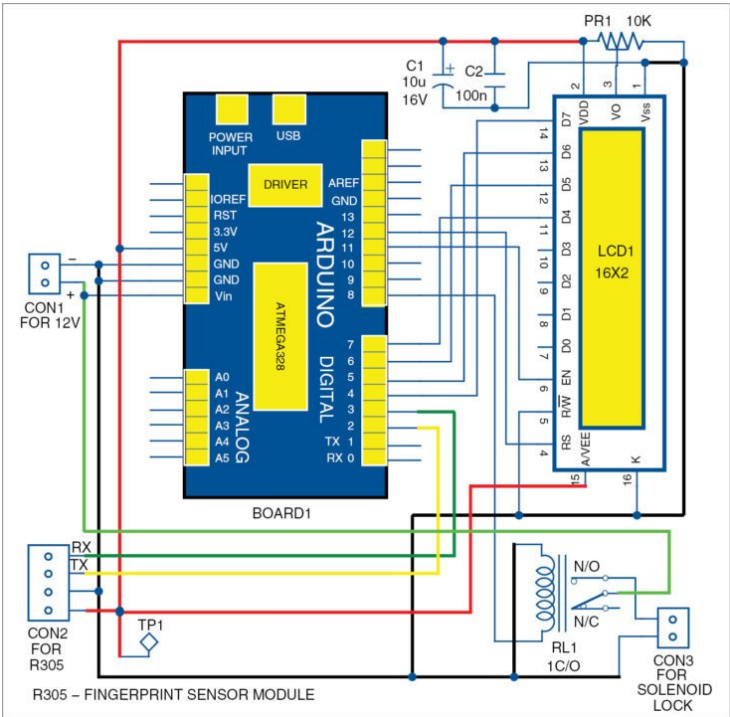


Fig. 1: Circuit diagram of the fingerprint door unlock system

The brain of the circuit is Arduino Uno MCU board (BOARD1). It is based on ATmega328/ATmega328P and has 14 digital input/output (I/O) pins, six analogue inputs, 32k flash memory, 16MHz crystal oscillator, a USB connection, power jack, ICSP header and reset button, among others. It can be programmed using Arduino IDE software.

Fingerprint sensor module R305 (connected across CON2) has UART interface with direct connections to the MCU or to the PC through max232/USB serial adaptor. The user can store fingerprint data in the

Test Points	
Test point	Details
TP1	5V
(Voltage measure w.r.t. GND)	

module and configure it in 1:1 or 1:N mode for identification. Pins TX and RX of R305 sensor are connected to Arduino digital pins 2 and 3, which are used for serial communication.

The LCD display (LCD1) is used to display messages during action. Here, a 16×2 display is used; each character is made of 5×7 dot-matrix. Pins 3, 4, 5 and 6 of the LCD are the control lines connected to preset (PR1) output, pin 12 (Arduino), GND and pin 11 (Arduino). Pins 11, 12, 13 and 14 are data pins of the LCD that are connected to pins 7, 6, 5 and 4 of Arduino, respectively. Preset PR1 is used to adjust the contrast of the LCD display.

PARTS LIST	
Semiconductors:	
BOARD1	- Arduino Uno
Resistors (all 1/4-watt, ±5% carbon):	
PR1	- 10-kilo-ohm preset
Capacitors:	
C1	- 10µF, 16V electrolytic
C2	- 100nF, ceramic disk
Miscellaneous:	
RL1	- 5V, 1C/O relay
LCD1	- 16×2 alphanumeric display
CON1	- 2-pin connector
	- DC supply
CON2	- 4-pin connector
	- R305
CON3	- 2-pin connector
	- Solenoid lock

An electronic door-lock solenoid (connected across connector CON3) is basically an electromagnet made of a big coil of copper wire with an armature (slug of metal) in the middle. When the coil is energised, the slug is pulled into the centre of the coil. This allows the solenoid to move to one end.



Fig. 2: Initial state



Fig. 3: Valid finger



Fig. 4: Invalid finger

The solenoid lock requires more current than what Arduino can provide. Therefore to operate the lock, a 5V relay (RL1) is used. CON3 is connected between normally open (N/O) contacts of RL1 and GND. The sequence of messages on the LCD from author’s prototype are shown in Figs 2, 3 and 4.