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FINGERPRINT SENSOR AND RFID BASED ATM SYSTEM USING IoT

Arun Priya N[1], Keerthana S[2], Indhumathi E[3]

Assistant Professor, Panimalar Engineering College, Chennai, India[1]

Student, ECE, Panimalar Engineering College, Chennai, India[2, 3]

Abstract: In the present world, the usage of ATM to withdraw cash has increased. At the same time, theft and robbery cases have also been increased that calls for the need of much- secured ATM that provides additional features for security. In this work, our aim is to create a security-based smart ATM which functions based on RFID and fingerprint authorization for its access. The RFID number and fingerprint details are obtained from the user after which the recognized card number, authorization status, are passed on for checking its authenticity with the database details. Therefore the novelty of the project is 'third person allow to access technology' which means we can make our family member/friend to withdraw money from our card simply by clicking "ALLOW" in the webpage in case of any emergencies. And if we don't know the person withdrawing money we can simply click "DENY" so that the third person(thief) can't able to withdraw money from our ATM card.

Keywords: ATM, IoT, RFID, ESP8266, Fingerprint sensor, Embedded system.

I. INTRODUCTION

An Automated Teller Machine (ATM) is a computerized machine that provides customers of the banks the facility of accessing their accounts for dispensing cash and to carry out other financial and non-financial transactions without the need to visit the bank branch. ATM's were first used in London in 1967, and after 50 years, these machines were introduced nationwide. In the present world, the usage of ATM to withdraw cash has increased. At the same time, theft and robbery cases have also been increased that calls for the need of much-secured ATM that provides additional features for security. In the existing system is just a prototype of an ATM system in which money transferring facilities can be added to be implemented at the ATM. In addition to sending the user the GPS location of the ATM, the amount of cash withdrawn, the image of the face of the user can also be sent. To increase the security against the theft and accidents at the ATM, more accurate sensors for fire detection and damage detection were inserted. In this proposed system, we have implemented the work using IoT technology for secure money transactions. It has two levels of authentication one is RFID and another one is fingerprint sensor. So when the third person is trying to access the account by ATM machine, the system needs user permission.

II. EXISTING SYSTEM

The existing system is a microcontroller-based ATM in which normal cards are replaced with RFID cards that contain the card number of the user. Instead of using the PIN, the fingerprint of the user is used for authorization. Hence if the person is in the vicinity of ATM, his/her card is scanned by the RFID scanner and the system waits for the valid fingerprint of the corresponding card. If a valid fingerprint is recognized by the fingerprint sensor of the ATM, message will be sent to the phone number, registered to the card, stating that "The access is granted". On the other hand, if an invalid fingerprint is recognized, the user of the corresponding card gets a message stating that "Access not granted! Someone has tried to access this card". Regardless of if the access is granted or not, the cardholder also gets details about the time, date, and location of the access. To minimize the storage of unwanted video feed, the images of the people inside ATM are saved in the database through a camera that helps the respective bank and the cardholder in case of theft at the ATM.

In case of fire in the ATM, this system automatically sends a message to the fire station along with the GPS coordinates of the ATM. Moreover, if someone tries to break the ATM, the system automatically sends a message to the police station along with the GPS location of the ATM which is essential. Thus, the existing system combines a lot of required aspects in the field of ATM's security to help the bank and ensures security at the ATM. The block diagram in Fig.1 shows the working of the existing system.

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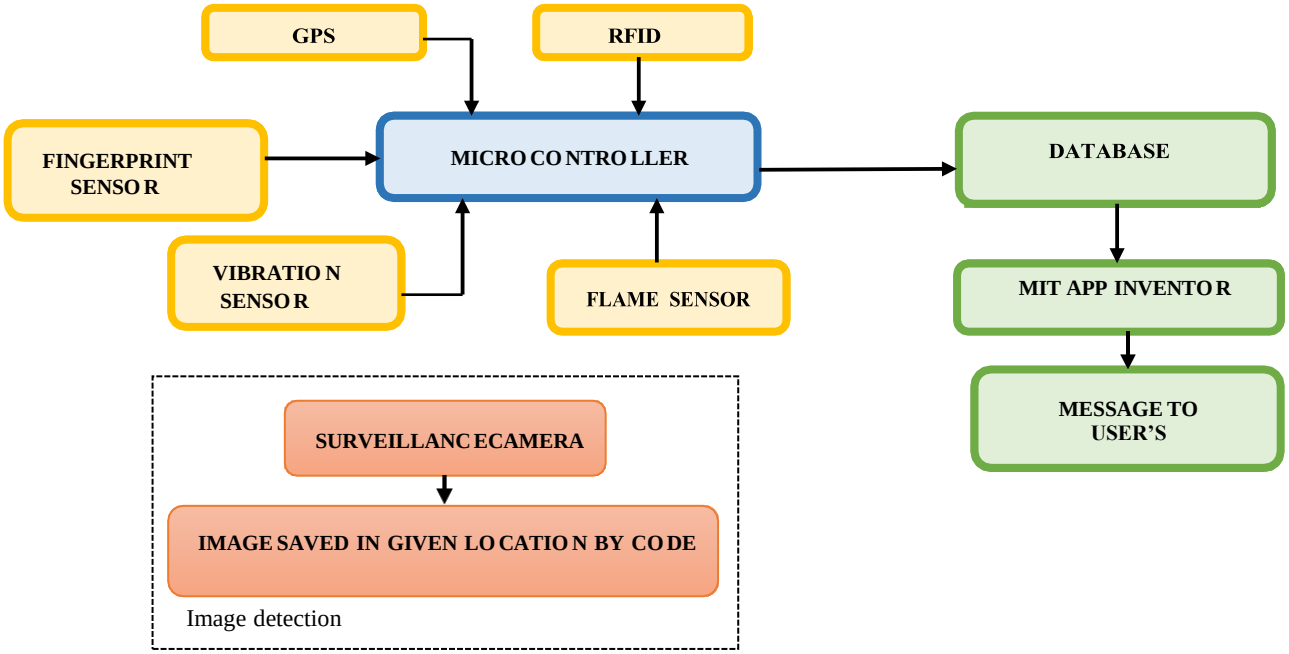

Fig. 1. Block diagram of the existing system

III. PROPOSED SYSTEM

In the proposed system, finger print and RFID based ATM system implemented by IoT technique is done. This system could be more secure by adding the concept of soft biometrics, making biometric essential in both cases of low and high cash withdrawal. A third person is also allow to access this system with user permission.

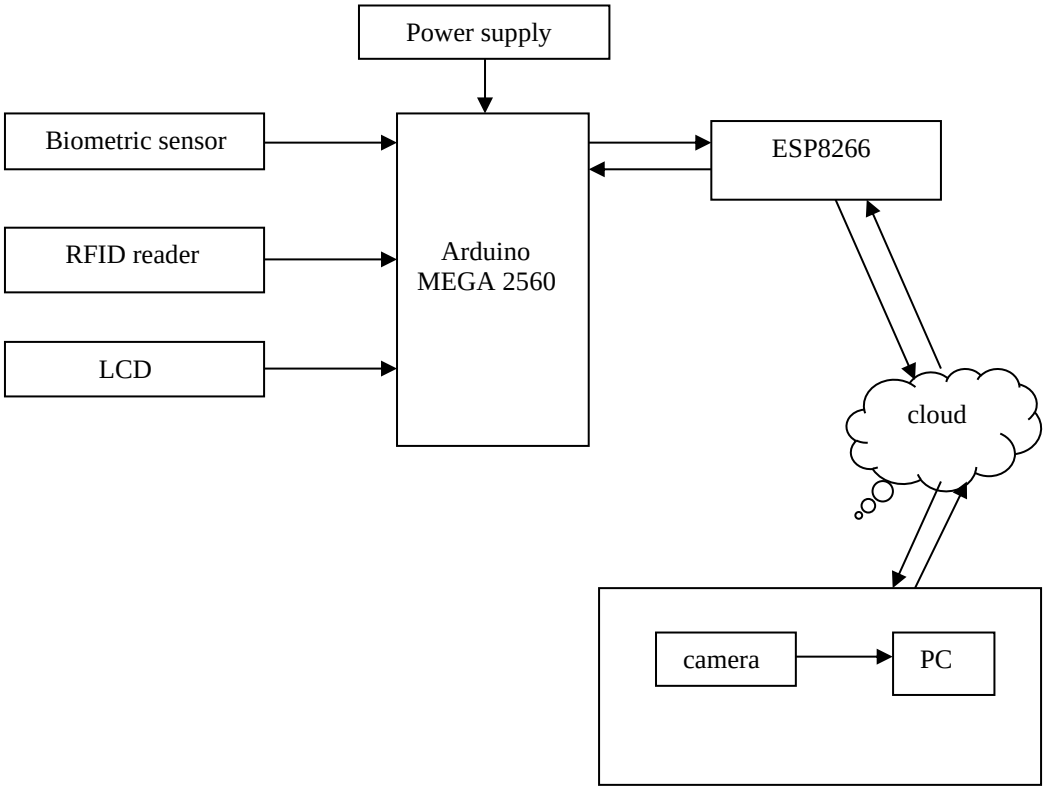

Fig. 2. Block diagram of the proposed system

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The proposed system uses hardware components like Arduino MEGA 2560, RFID card and reader, fingerprint sensor, LCD, ESP8266 WIFI module, web camera and power supply unit. Biometric sensor and RFID (Radio Frequency Identification and Detection) reader are connected to the UART port of Arduino UNO. ESP8266 is a WIFI module that gives microcontroller access to WIFI network and it is used to send user detail to the cloud. The biometric sensor gets finger print from the user and give it to the controller. The controller will compare the user's finger print with the database. If any third person is trying to access the ATM machine for money transaction, system will take images of the person and send to the corresponding user. In case if we are in an emergency situation, we can make our friend to withdraw money from our ATM card, by clicking "ALLOW" in the webpage. If we don't know the person withdrawing money, we can simply click "BLOCK", so that the person will not be able to get money from our card.

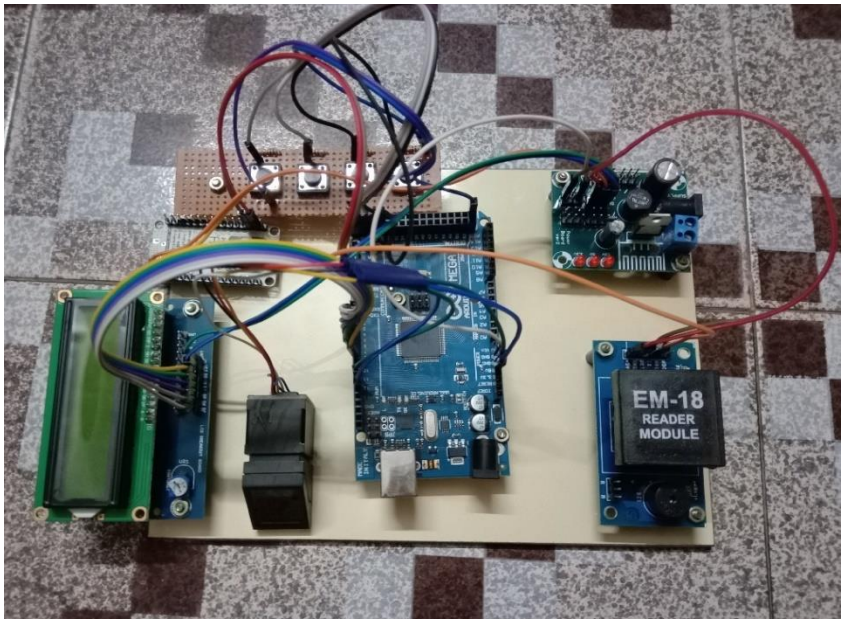

Fig. 3. Circuit diagram of the proposed system

DETAILED DESCRIPTION ABOUT HARDWARE COMPONENTS:

a) ARDUINO MEGA 2560

The Arduino MEGA 2560 is a microcontroller board based on the ATmega2560. It has 54 digital input/output pins (of which 15 can be used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The operating voltage of this microcontroller is 5volts. The recommended Input Voltage will range from 7volts to 12volts. The input voltage will range from 6volts to 20volts. DC Current for each input/output pin is 40 mA. DC Current used for 3.3V Pin is 50 mA. Flash Memory is 256 KB where 8 KB of flash memory is used with the help of boot loader. The static random access memory (SRAM) is 8 KB. The electrically erasable programmable read-only memory (EEPROM) is 4 KB.

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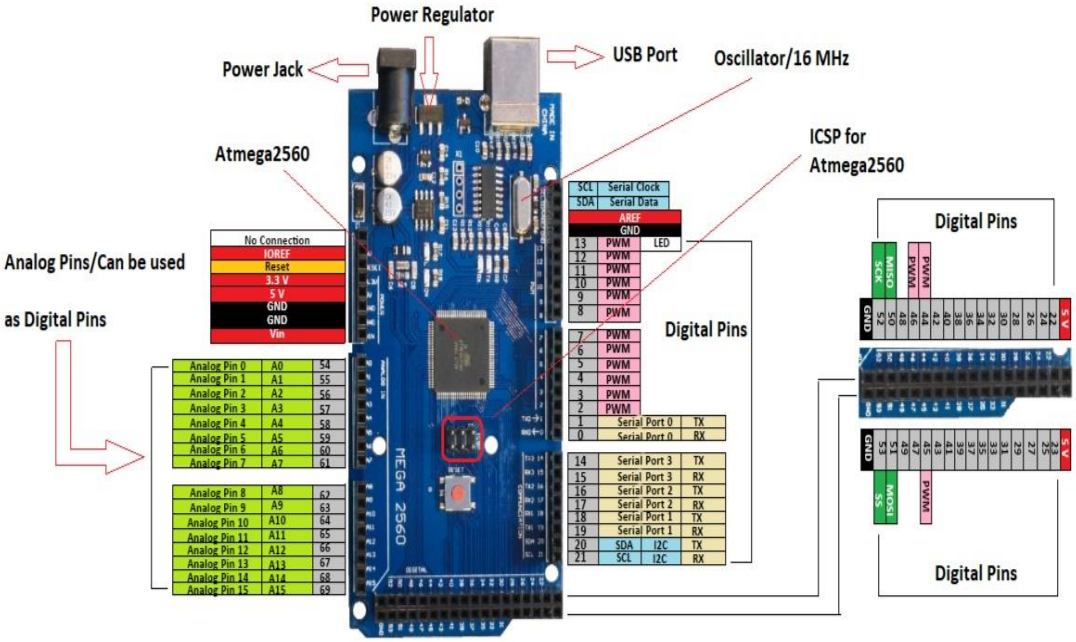

Fig. 4. Arduino MEGA 2560

b) BIOMETRIC SENSOR

A Biometric Sensor is a device (or a transducer, to be specific) that converts the biometric trait of an individual into electrical signals. Biometric Sensors are usually semiconductor devices that processes images from an individual's physical characteristics using complex algorithms. Every human being possesses certain unique features in terms of both physiological and behavioural characteristics that are different from everybody else. The first thing that comes to our mind when speaking of unique features is the FINGERPRINT. But there are also several other features like DNA, retinal structure, vein pattern, etc. All these are physiological characteristics. But there are other characteristics that are more of behavioural in nature like the way we speak, the way we type on a keyboard, the way we put our signature etc...Here, it is used to get the fingerprint of the user.

Fig. 5. Biometric sensor

c) RFID READER

Radio-frequency identification (RFID) uses electromagnetic fields to automatically identify and track tags attached to objects. An RFID system consists of a tiny radio transponder, a radio receiver and transmitter. When triggered by an electromagnetic interrogation pulse from a nearby RFID reader device, the tag transmits digital data, usually an identifying inventory number, back to the reader. An RFID tag consists of an integrated circuit and an antenna. The tag is also composed of a protective material that holds the pieces together and shields them from various environmental conditions. The protective material depends on the application. For example, employee ID badges containing RFID tags are typically made from durable plastic, and the tag is embedded between the layers of plastic. RFID tags come in a variety of shapes and sizes and are either passive or active.

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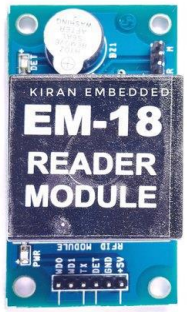

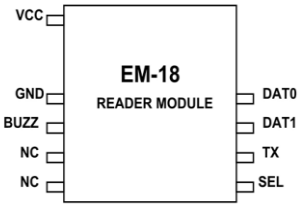

Fig. 6. RFID reader

PIN CONFIGURATION

PIN NUMBER	DESCRIPTION
VCC	Should be connected to positive of power source.
GND	Should be connected to ground.
BUZZ	Should be connected to BUZZER
NC	No Connection
SEL	SEL=1 then o/p =RS232 SEL=0then o/p=WEIGAND
TX	DATA is given out through TX of RS232
DATA1	WEIGAND interface DATA HIGH pin
DATA0	WEIGAND interface DATA LOW pin

d) ESP8266 WIFI MODULE

The ESP8266 WIFI Module is a self contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your WIFI network. The ESP8266 is capable of either hosting an application or offloading all WIFI networking functions from another application processor. In order to connect this WIFI module with Arduino, connect ESP8266 module transmit pin (TX) to the receive pin (RX) of Arduino Mega and to receive pin (RX) of USB to serial converter. The ESP8266 WIFI module comes with 17 GPIO pins. Not all GPIOs are exposed in all ESP8266 development boards, some GPIOs are not recommended to use, and others have very specific functions.

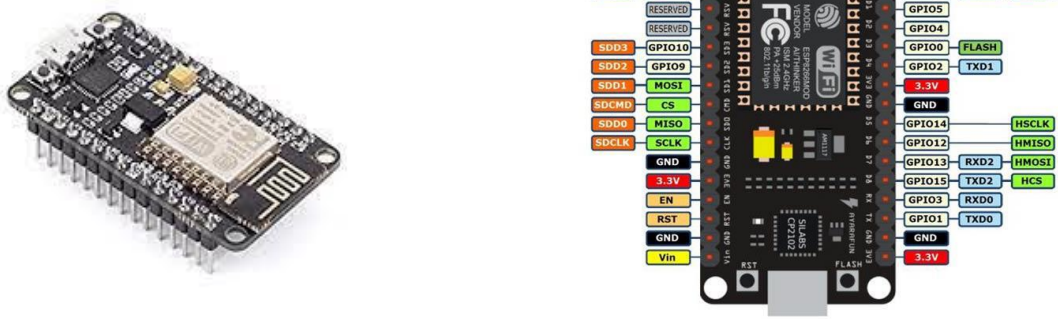

Fig. 7. ESP8266 WIFI module

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e) WEB CAMERA:

A webcam is a video camera that feeds or streams an image or video in real time to or through a computer to a computer network, such as the Internet. Webcams are typically small cameras that sit on a desk, attach to a user's monitor, or are built into the hardware. Webcams can be used during a video chat session involving two or more people, with conversations that include live audio and video. It is a compact digital camera you can hook up to your computer to broadcast video images in real time (as they happen). Just like a digital camera, it captures light through a small lens at the front using a tiny grid of microscopic light-detectors built into an image-sensing microchip (either a charge-coupled device (CCD) or, more likely these days, a CMOS image sensor). As we'll see in a moment, the image sensor and its circuitry converts the picture in front of the camera into digital format—a string of zeros and ones that a computer knows how to handle. Unlike a digital camera, a webcam has no built-in memory chip or flash memory card: it doesn't need to "remember" pictures because it's designed to capture and transmit them immediately to a computer. That's why webcams have USB cables coming out of the back. The USB cable supplies power to the webcam from the computer and takes the digital information captured by the webcam's image sensor back to the computer—from where it travels on to the Internet.

Fig. 8. Web camera

f) LCD

A Liquid Crystal Display (LCD) is a flat-panel display or other electronically modulated optical device that uses the light-modulating properties of liquid crystals combined with polarizers. Liquid crystals do not emit light directly, instead using a backlight or reflector to produce images in colour or monochrome. These displays are mainly preferred for multi-segment light-emitting diodes and seven segments. The main benefits of using this module are inexpensive; simply programmable, animations, and there are no limitations for displaying custom characters, special and even animations, etc. This LCD has two registers: Command and Data. Here, it is used to display card authentication, Balance Check and Withdraw Option.

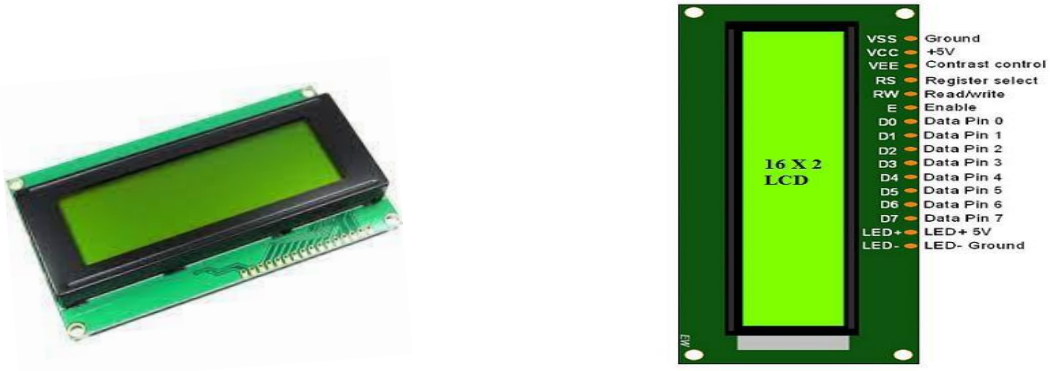

Fig. 9. LCD

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g) POWER SUPPLY UNIT

A Power Supply Unit (PSU) converts mains AC to low-voltage regulated DC power for the internal components of a computer. Modern personal computers universally use switched-mode power supplies. Some power supplies have a manual switch for selecting input voltage, while others automatically adapt to the mains voltage. Most power supplies are switched-mode (SMPS), which has both efficiency advantages and makes designing for multiple voltage inputs easier. This means that most PSUs can operate in different countries where the power input might change. In the UK, the voltage is 240V 50Hz, whereas in the USA the voltage is 120V 60Hz, and in Australia it is 230V 50Hz.

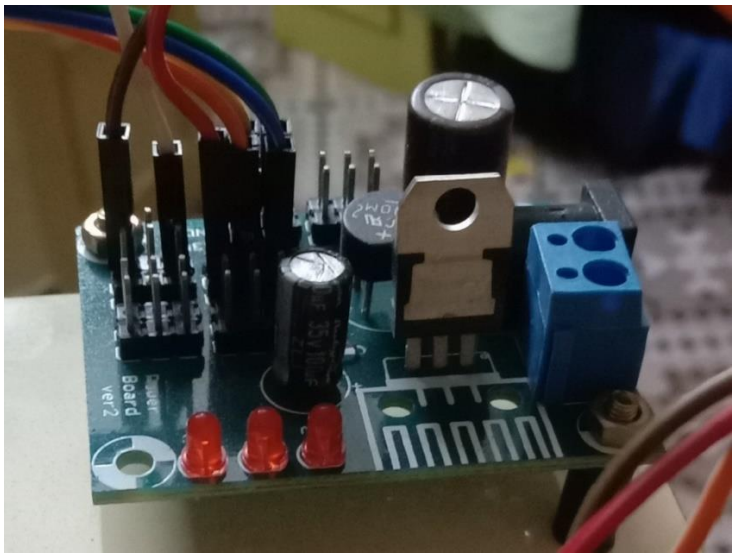

Fig. 10. Power supply unit

SOFTWARE – ARDUINO IDE:

The Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino to upload programs and communicate with them. This System is programmed using Embedded C.

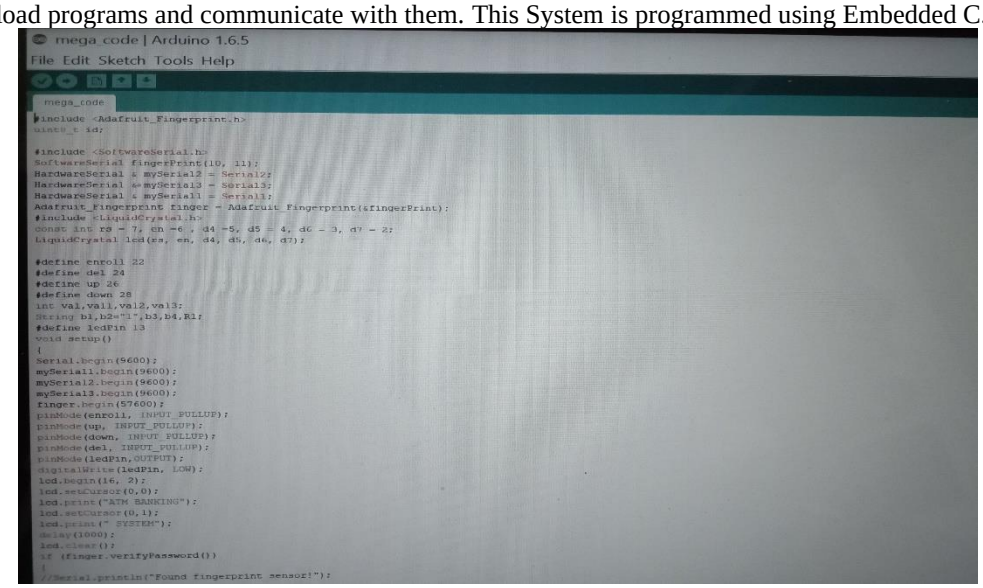

Fig. 11. Code execution

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IV. CONCLUSION

Thus this proposed system uses the RFID card and the user's fingerprint for authorization. In the case of multiple accounts, different RFID cards can be used for each bank accounts. The card closest to the proximity of the card reader will be considered for the current operation. It enhances the security by sending notifications to the webpage where it shows the image of the person along with two options (ALLOW and BLOCK) and also a mail will be sent to the user regarding the person's name, address and phone number which we have already stored in the cloud. Also, a camera that is set regularly checks who is trying toaccess the card in the ATM that helps in cases of frauds. It prevents accidents and robbery cases and helps to secure the money. Since the fraud in fingerprint recognition has increased, to ensure security towards this issue in the future proposed system, extra tiers of safety measures like face detection, iris scanner, OTP generation can be added.

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