RFID Based Vehicle Access Control System Components & Circuit Diagram

- **Components**
  - **Arduino UNO**
    Arduino UNO is an open-source microcontroller board based on the ATmega328P. It is used to read inputs from sensors and control outputs. In this project, it processes the RFID data and decides whether to allow or deny vehicle access.

  - **RFID Card**
    An RFID card contains a unique identification number (UID). When placed near the RFID reader, the card transmits this UID wirelessly. The system checks this ID against stored values to authenticate the user.

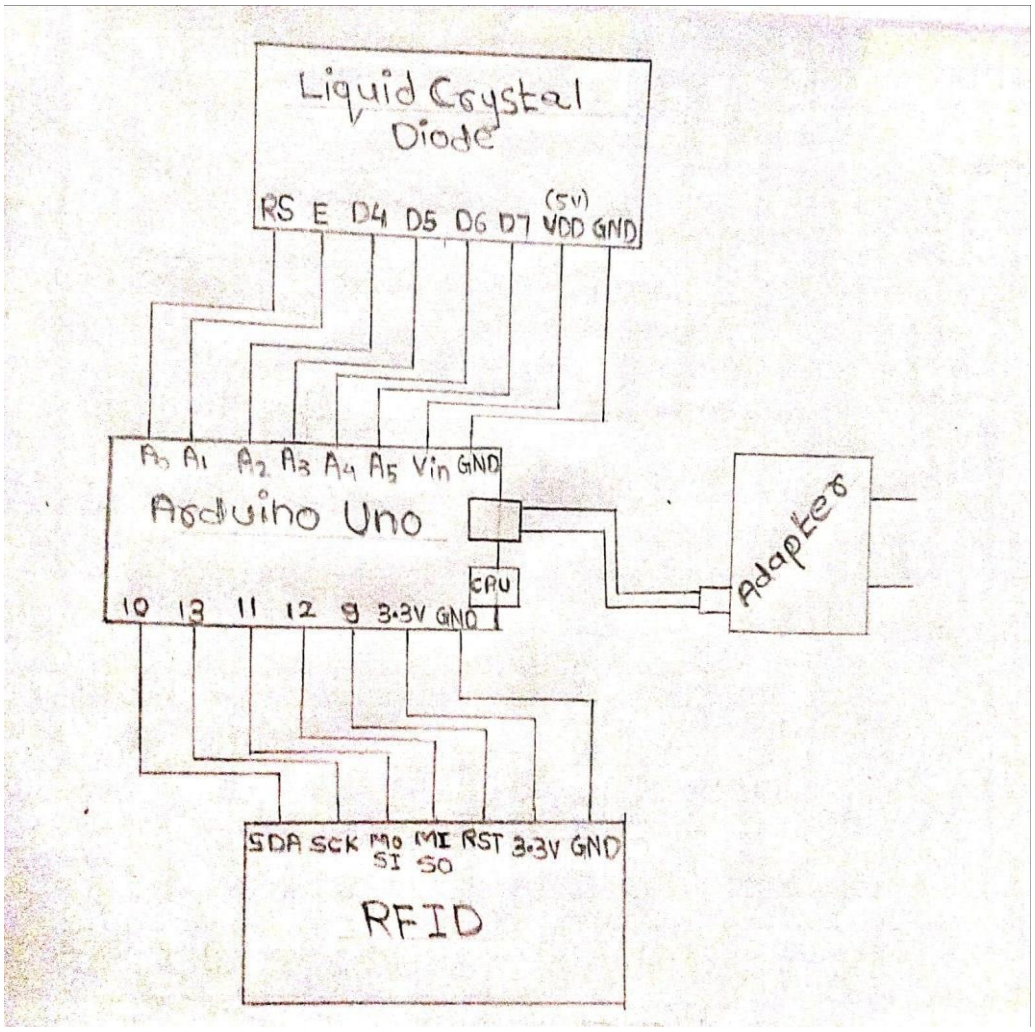
  - **16*2 LCD (Liquid Crystal Display)**
    A 16×2 LCD can display 16 characters per line across 2 lines. It is used in this project to show messages such as "Access Granted," "Access Denied," or to display the scanned UID.

  - **Adapter**
    The adapter provides stable external power to the Arduino and the entire circuit. It ensures the system runs continuously without relying only on USB or battery power.

  - **Battery**
    The battery acts as an alternative power source for the system, useful during power outages or for portable setups. It ensures that the access control system keeps functioning even without external power.

  - **Connecting Wires**
    Connecting wires are used to make electrical connections between the Arduino, RFID module, LCD, and other components. They allow proper communication and power flow throughout the circuit.

- **Circuit Diagram & Working**



RFID Based Vehicle Access Control System

- **Working**

The RFID-based vehicle access control system works on the principle of radio frequency identification (RFID), which enables wireless communication between an RFID tag and an RFID reader for automatic identification and authentication of vehicles. Each authorized vehicle is assigned a unique RFID tag embedded with a specific identification code. When a vehicle approaches the entrance gate, the RFID reader module (RC522) continuously emits a low- frequency electromagnetic field. As soon as the RFID tag comes within the reader's range, it is energized by this field and transmits its unique ID back to the reader through radio waves.

The RFID reader captures this data and sends it to the Arduino Uno microcontroller

via the SPI (Serial Peripheral Interface) communication protocol. The Arduino processes this information by comparing the received ID with the list of pre-stored authorized IDs in its internal memory or database. If a valid match is found, the system identifies the vehicle as authorized and sends a signal to a relay module that triggers the gate control mechanism, such as a motor or servo, to open the gate.

At the same time, a 16×2 LCD display shows the message “Access Granted” along with the card number, and a buzzer gives a short beep to indicate successful entry. In contrast, if the tag’s ID does not match any stored value, the Arduino recognizes the vehicle as unauthorized, keeps the relay inactive to prevent gate opening, displays “Access Denied” on the LCD, and activates the buzzer with a different tone to alert the operator. The system is powered through a 12V DC adapter, while a rechargeable battery acts as a backup to maintain continuous operation during power cuts. This setup ensures reliable, contactless, and efficient vehicle identification and access management.

The use of RFID eliminates the need for manual verification, minimizes errors, enhances security, and enables quick vehicle movement through automated gate control. Optional features such as data logging using an SD card module or real-time tracking with a clock module (RTC) can be added to record each access event, providing a complete, smart, and secure solution for parking areas, institutions, offices, or residential complexes.