

Name: Het Amrishbhai Valera

Arduino and RFID Based Registration System

Abstract:

Our advanced event registration system, driven by Arduino and RFID technology, revolutionizes the registration process by eradicating redundant form submissions. Utilizing a user-friendly interface crafted through Streamlit, students input their details only once. This information is stored in an Excel spreadsheet with a specific column designated for event registrations. Future participation merely entails a quick tap of an RFID card, promptly updating the Excel record. This streamlined method significantly boosts efficiency, guaranteeing precise and effortless event coordination for both organizers and attendees without the need for repetitive data entry.

Problem Statement and Objective:

In the realm of event management, the recurring challenge lies in the cumbersome and error-prone nature of participant registration. Attendees are often required to repetitively fill out registration forms for each event, leading to inefficiencies and potential inaccuracies in data entry. Our objective is to revolutionize this process by implementing an Arduino and RFID-based solution. Through a user-friendly interface created with Streamlit, attendees input their information just once. This data is stored systematically in an Excel sheet, eliminating redundancy, and minimizing errors. The objective is to provide a seamless, one-time registration experience, significantly reducing administrative workload and enhancing data accuracy. By allowing subsequent event registrations through RFID card taps, we aim to simplify the registration process, making it efficient, accurate, and hassle-free for both organizers and participants. Our system ensures streamlined event management, allowing organizers to focus on creating memorable events while attendees experience effortless and swift registration.

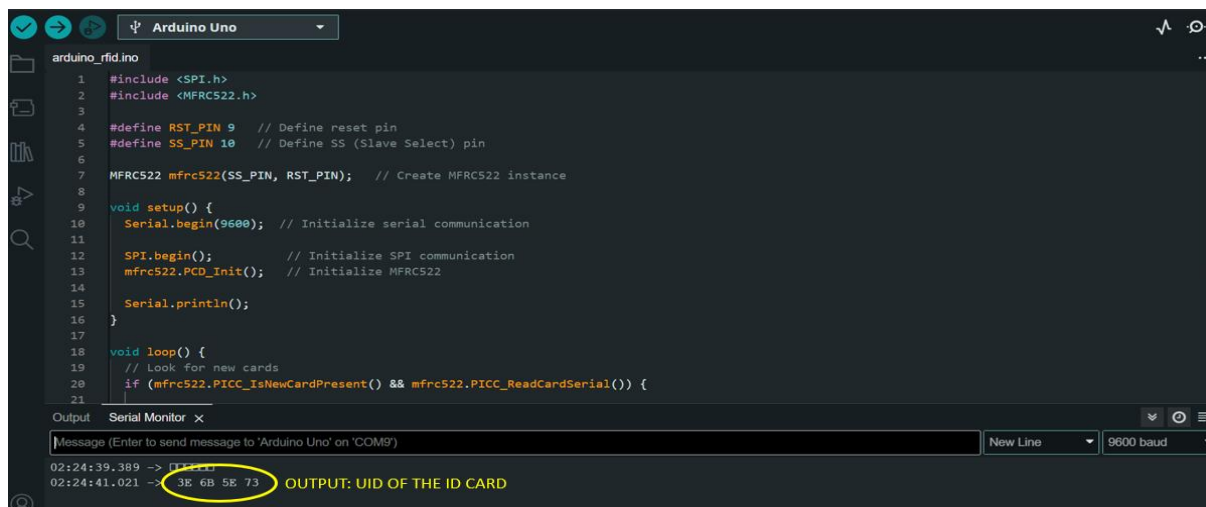
Related Work:

RFID (Radio-Frequency Identification) technology, which utilizes radio waves to automatically identify and track objects, animals, or individuals, plays a pivotal role in enhancing various aspects of our modern world, particularly in the realm of education. This technology comprises RFID readers and tags, communicating through integrated antennas. The reader emits radio waves, energizing the tag and prompting it to transmit information, which the RFID processes. These RFID tags are categorized as active (powered) or passive (battery less), seamlessly integrated into a wide range of items, including packaging, clothing labels, and books. RFID's advantages over

conventional barcodes, such as real-time data updates, simultaneous identification of multiple items, and the ability to operate without a direct line of sight, have spurred its rapid adoption across various industries. [1] In education, RFID holds significant potential, offering simplified processes, time savings, and improved learning environments. Despite initial challenges related to privacy concerns and production costs, RFID applications in education encompass a spectrum of possibilities, ranging from interactive learning in museums to assisting visually impaired students on campus, optimizing outdoor education experiences, and even ensuring school safety through RFID-based panic buttons. Moreover, RFID technology extends its reach to streamline exam scheduling, track students in schools, and enhance access control in educational institutions, revolutionizing the educational landscape. It is important to note its connection to NFC (Near Field Communication), a wireless technology. [2] NFC has two communication modes (active and passive) and three operating modes (reader/writer, card emulation, and peer-to-peer). In an NFC communication, two devices are involved: the originator (active mode) and the target (which responds to the originator's requests). This conversation begins when the active device approaches the target, creating a 13.56 MHz magnetic field to power the target equipment. NFC technology offers advantages like integration into mobile devices and the ability to read/write data from/to NFC tags, making mobile devices versatile digital storage. Within NFC's three operating modes, reader/writer mode allows NFC devices to read and modify data stored in NFC tags, useful for applications like smart posters and menu cards. Card emulation mode is popular for payments and transport ticketing, where the mobile device acts as a smart card. Peer-to-peer mode facilitates data exchange between two NFC-enabled devices. NFC builds upon RFID's principles for secure, contactless communication, and both technologies have found applications in diverse fields.

Methodology: Navigation through the User Interface

1. Arduino IDE Code to extract UID of ID Card uploaded and executed:



The screenshot displays the Arduino IDE interface. The main editor window shows the code for `arduino_rfid.ino`. The code includes headers for `<SPI.h>` and `<MFRC522.h>`, defines pins for reset and slave select, and initializes the `MFRC522` module. The `setup()` function initializes serial communication at 9600 baud, SPI, and the `MFRC522` module. The `loop()` function continuously checks for new cards and prints the UID when one is detected. The serial monitor at the bottom shows the output: `02:24:39.389 -> [11111]` and `02:24:41.021 -> 3E 6B 5E 73`. The output `3E 6B 5E 73` is circled in yellow, and a yellow text label `OUTPUT: UID OF THE ID CARD` points to it.

```
arduino_rfid.ino
1 #include <SPI.h>
2 #include <MFRC522.h>
3
4 #define RST_PIN 9 // Define reset pin
5 #define SS_PIN 10 // Define SS (Slave Select) pin
6
7 MFRC522 mfrc522(SS_PIN, RST_PIN); // Create MFRC522 instance
8
9 void setup() {
10   Serial.begin(9600); // Initialize serial communication
11
12   SPI.begin(); // Initialize SPI communication
13   mfrc522.PCD_Init(); // Initialize MFRC522
14
15   Serial.println();
16 }
17
18 void loop() {
19   // Look for new cards
20   if (mfrc522.PICC_IsNewCardPresent() && mfrc522.PICC_ReadCardSerial()) {
21     Serial.println("New card detected. UID: ");
22     Serial.print(mfrc522.uid.raw);
23     Serial.println();
24   }
25 }
```

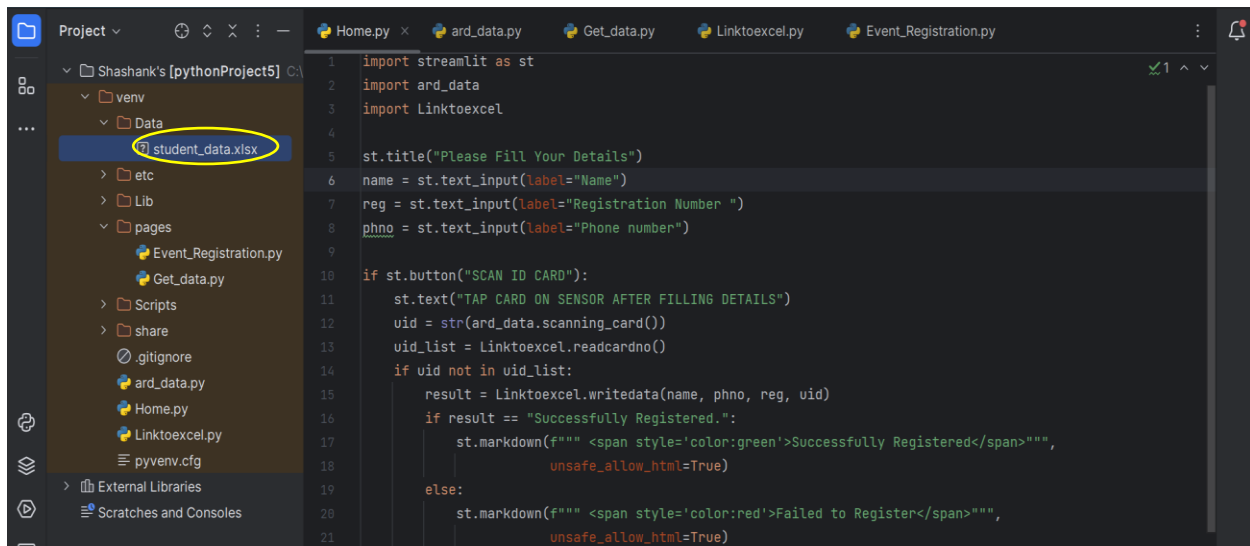
Output: Serial Monitor x

Message (Enter to send message to 'Arduino Uno' on 'COM9')

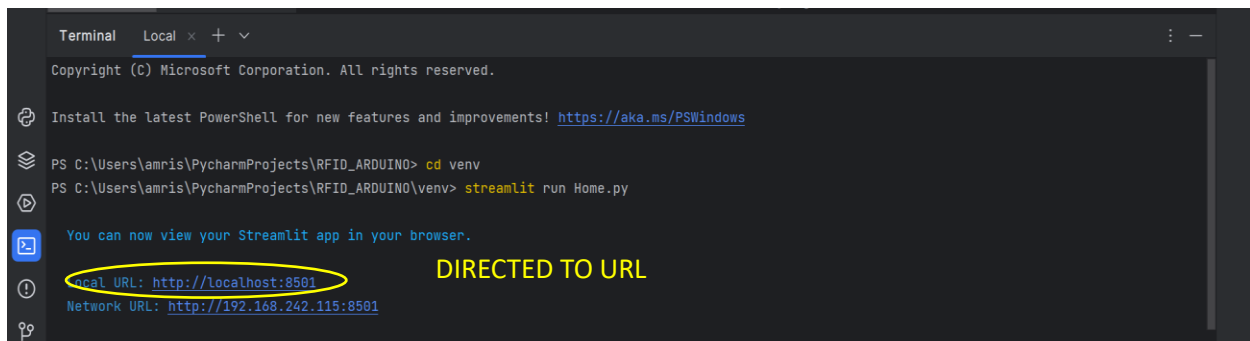
02:24:39.389 -> [11111]

02:24:41.021 -> 3E 6B 5E 73 OUTPUT: UID OF THE ID CARD

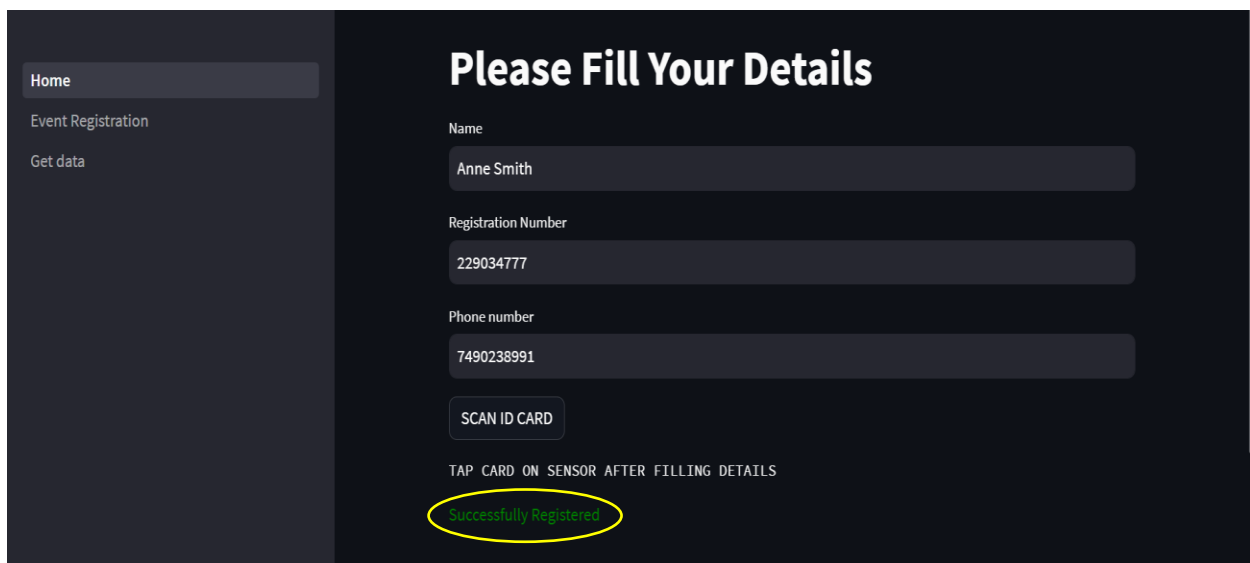
Outlook of the project containing all the .py files and the excel sheet in the data directory that stores all the details:



Changing director to venv and running Home.py file using streamlit through the terminal:



Student fills details on Home Page and scans their card:



Successfully Registered gets displayed if the student is doing first time registration. Their details get stored in the excel file:

	A	B	C	D	E	F	G	H
1	Anne Smith	7490238991	229034777	2E 2A C4 73				
2	Jonas Lautner	5678001121	35465899	3E 6B 5E 73				
3								
4								
5								
6								
7								
8								
9								

If the student has already registered once, then It displays an error message as shown below:

Please Fill Your Details

Name
Jonas Lautner

Registration Number
35465899

Phone number
5678001121

SCAN ID CARD

TAP CARD ON SENSOR AFTER FILLING DETAILS

You are already Registered

If the excel file is open during the registration, then it will fail to register the details and thus also display an error message as shown below:

Please Fill Your Details

Name
Jonas Lautner

Registration Number
35465899

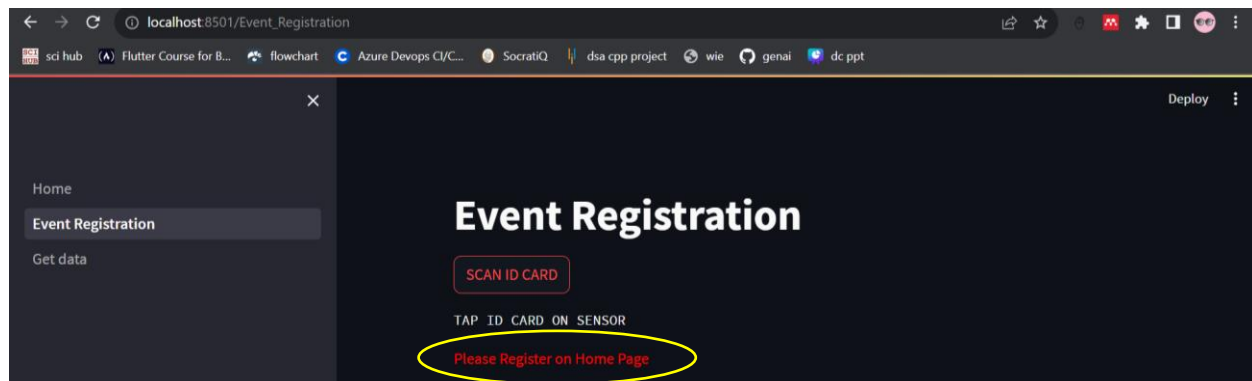
Phone number
5678001121

SCAN ID CARD

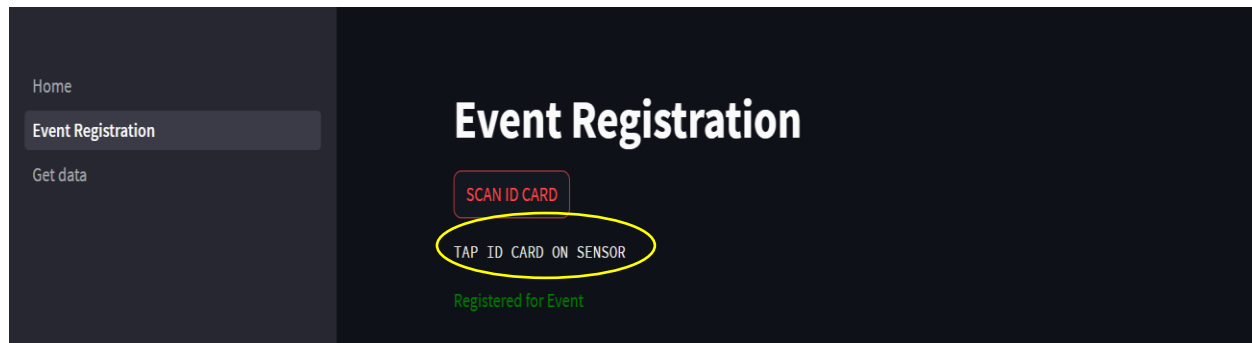
TAP CARD ON SENSOR AFTER FILLING DETAILS

Failed to Register

Next, for event registration, student can only register if their personal details have been registered via the home page first or it will display an error message as shown below:



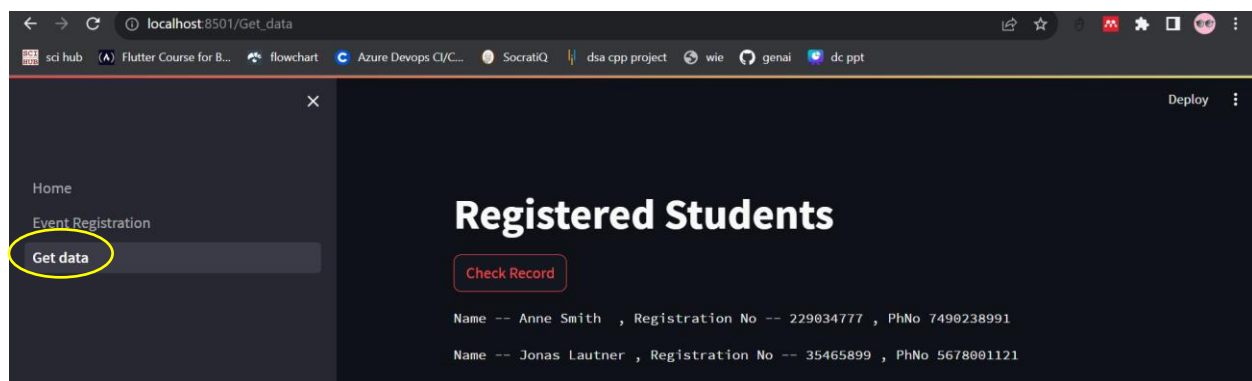
If the details of the student is already registered on home page then they will get registered for the event, a message of confirmation will be displayed as shown below:



The same will get updated in the excel sheet as highlighted below:

Anne Smith	7490238991	229034777	2E 2A C4 73	registered_event			
Jonas Lautner	5678001121	35465899	3E 6B 5E 73				

The record of students who are registered after first time usage can be checked on under interface on the Get Data page as well:



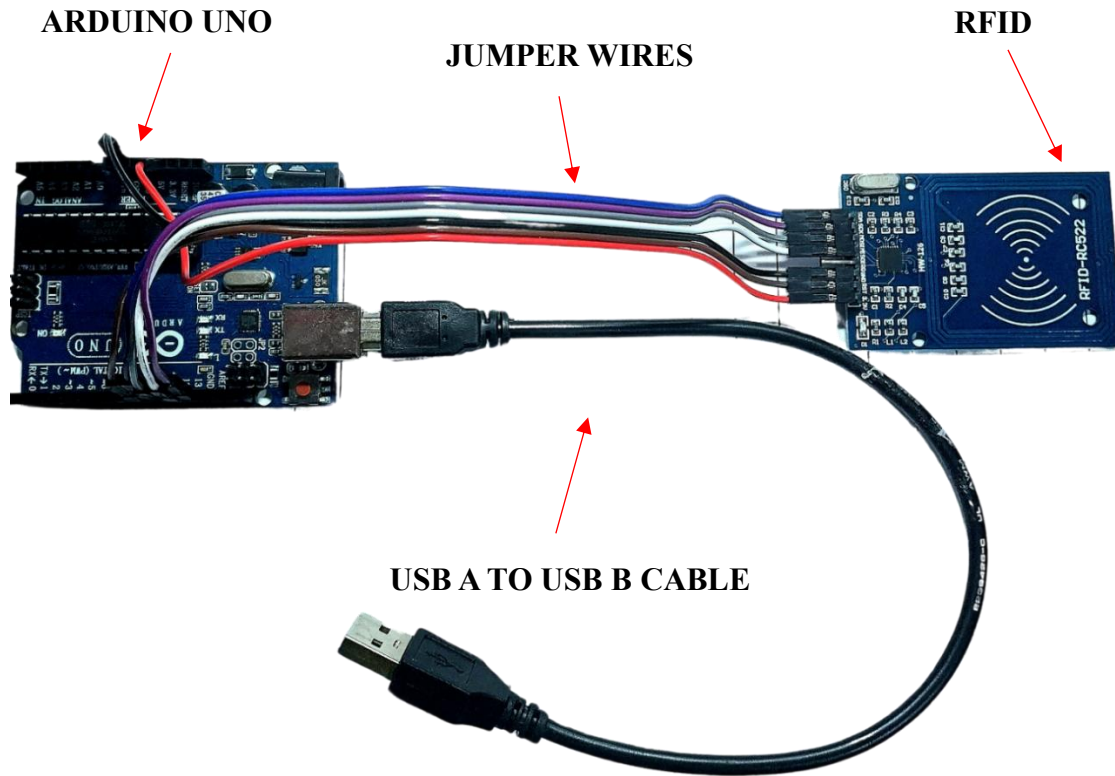


Fig. 2. Hardware Components Setup

Limitations and Future Work:

One major limitation of our system is the absence of a pre-existing student database, necessitating manual input during the initial registration. While subsequent event registrations are streamlined through RFID technology, this one-time manual data entry remains obligatory. Additionally, maintaining an updated Excel sheet for every event poses a challenge. As events multiply, managing multiple Excel sheets becomes potentially cumbersome and time-consuming. The absence of real-time synchronization or an automated database update mechanism means organizers must vigilantly ensure accurate record-keeping, introducing complexities when handling numerous events concurrently. Addressing these limitations will enhance the system's overall efficiency and user experience.

To enhance this system, future efforts could focus on integrating a centralized student database, reducing the need for initial manual input. Implementing real-time data synchronization mechanisms, such as cloud-based solutions, would enable seamless updates to the Excel sheet during each event registration, eliminating manual intervention and minimizing errors. Additionally, exploring advanced RFID technologies like NFC (Near Field Communication) or integrating mobile applications could offer more flexibility and user convenience. These advancements would optimize the system, making it more efficient and user-friendly for event organizers and attendees.

Conclusion:

In conclusion, our Arduino and RFID-based event registration system presents an innovative solution to streamline the registration process. While initial manual input and Excel sheet updates pose challenges, the system significantly reduces redundancy for subsequent events. By addressing these limitations in future iterations, the project holds immense potential. This approach not only enhances efficiency but also lays the groundwork for further advancements, promising a more seamless and automated event management experience.

References:

1. S. Larabi Marie-Sainte, M. S. Alrazgan et al., "From Mobile to Wearable System: A Wearable RFID System to Enhance Teaching and Learning Conditions", Hindawi Publishing Corporation, 7 April 2016.
2. S. Jain, P. S. Halgaonkar, and V. M. Wadhai, "Review of RFID, NFC Technology and Its Applications," in International Journal of Engineering Research & Technology (IJERT), vol. 3, no. 2, Feb. 2014.
3. M. Kaur, M. Sandhu, N. Mohan, and P. S. Sandhu, "RFID Technology Principles, Advantages, Limitations & Its Applications," in International Journal of Computer and Electrical Engineering, vol. 3, no. 1, February 2011.