RFID BASED MANAGEMENT SYSTEM

Final Report

MON-08

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INTRODUCTION

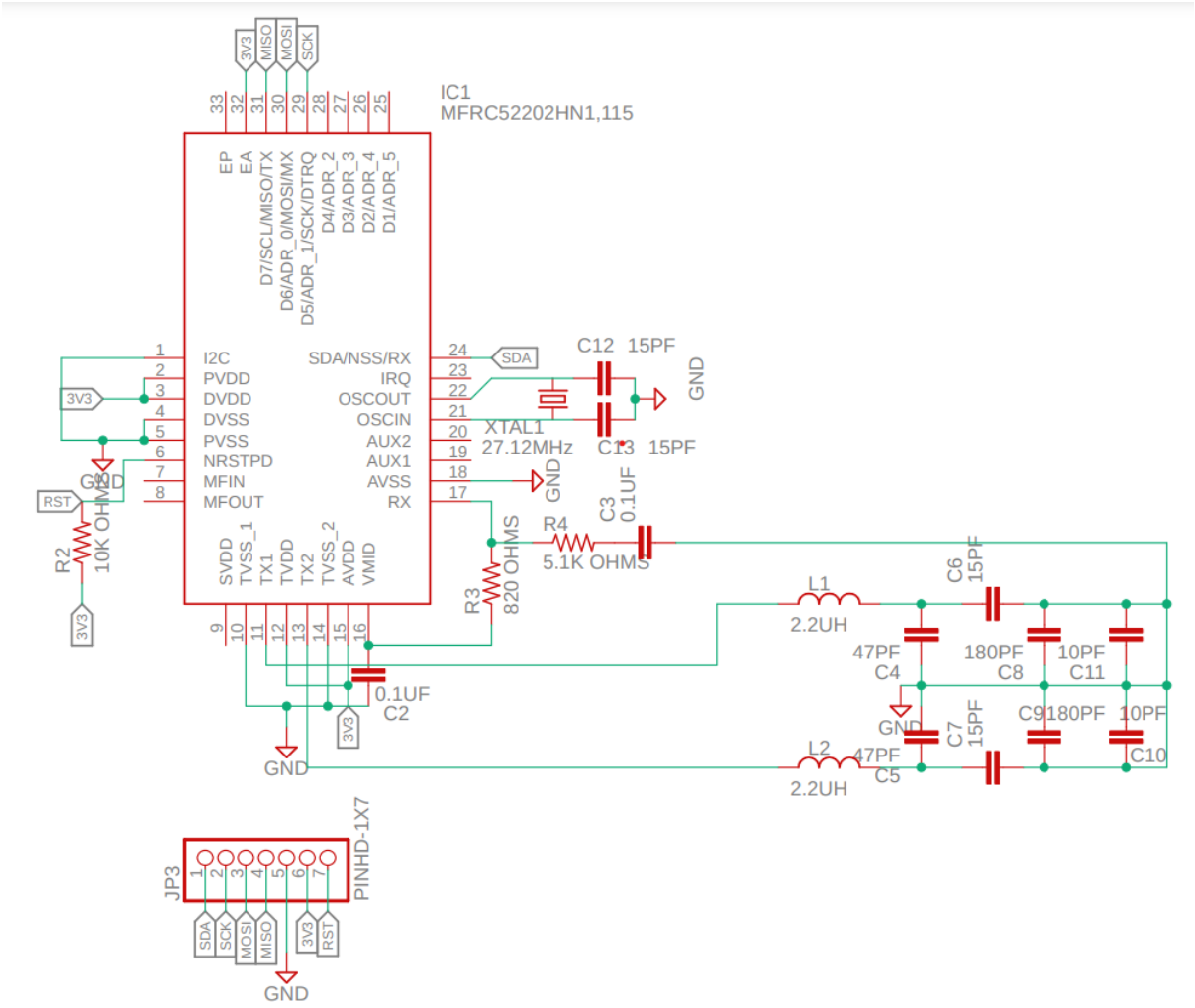
RFID (Radio Frequency Identification) is a form of communication that incorporates the use of electromagnetic or electrostatic coupling in the radio frequency portion of the electromagnetic spectrum to uniquely identify an object. The aim of this project was to build an RFID reader which gets the unique ID of the RFID tag when brought close to reader. This reader should be designed to update the information of the corresponding tag to the central database, which would act as a management system. We have created an elegant-looking enclosure for our complete internal circuit. So, at the final stage, we have delivered our final RFID reader in a 3D printed box.

Following is the representation of RFID module.

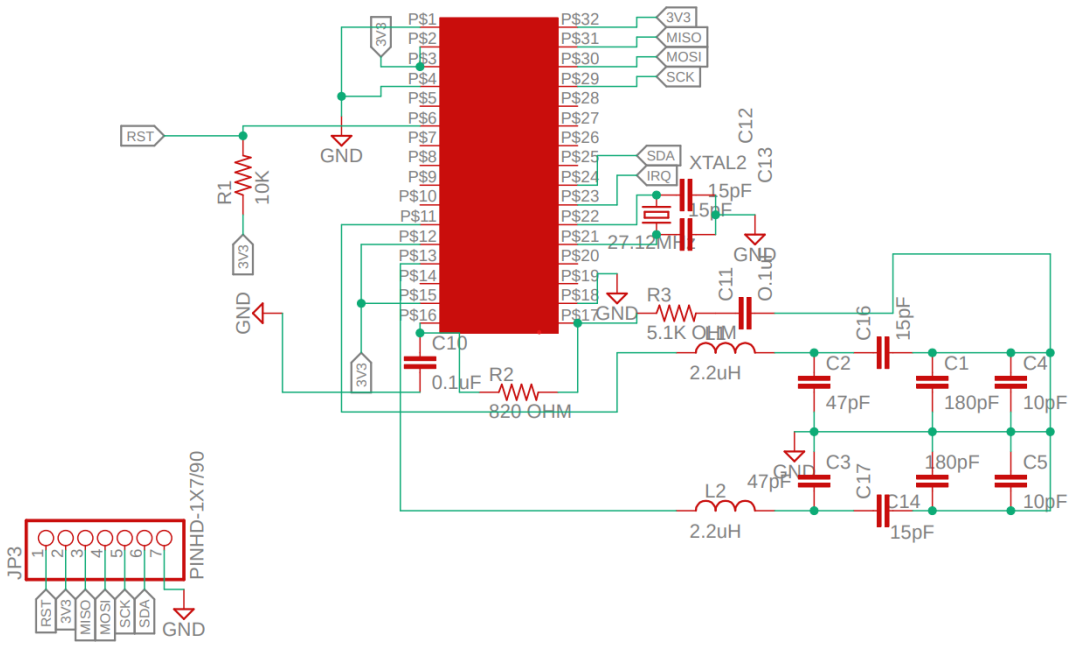
RFID BLOCK DIAGRAM [1]

It contains a reader module, tags and a database. We had to design a reader module and a database. We have designed our reader module using MFRC522 chip and TIVA C as microcontroller. Our results will be shown on an LCD screen as well as in our local database (in an excel file which we generated using a python script). We have discussed the schematics of our project, results and future plans in this report.

SCHEMATIC DESIGNS



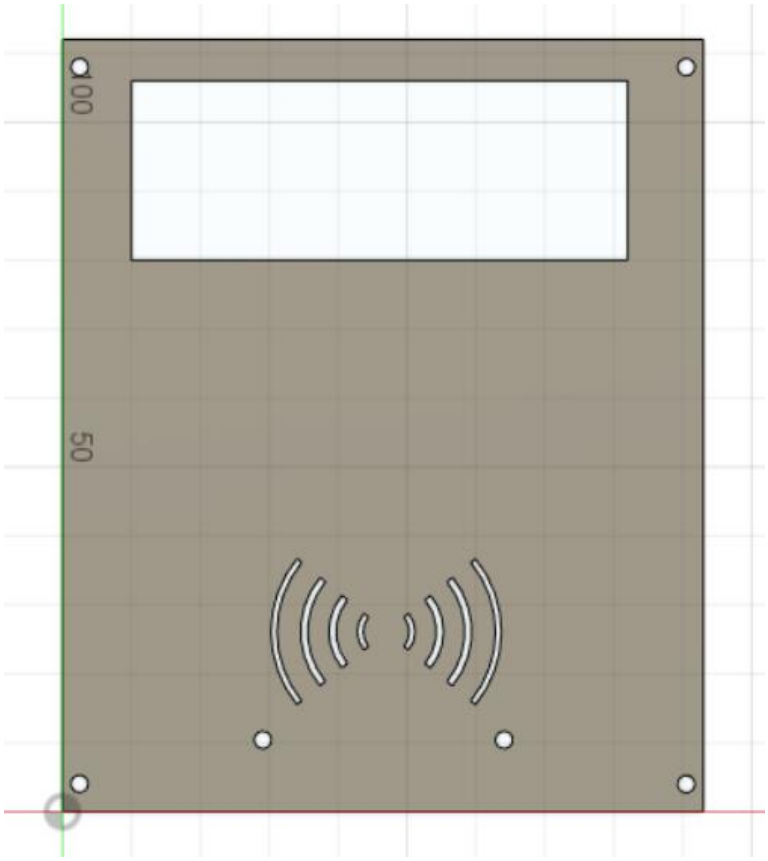
This is our schematic for RFID based attendance management system, which has Chip integrated directly onto PCB and a trace antenna and an efficient match filter. This design has EMC filter along with match filter for supressing additional noises due to high frequency transfer of data. Whole circuit need 3.3V power supply which can be given through Microcontroller. This design is spatially efficient when compared to other implemented using QFN board, this PCB can be made by ordering to high quality PCB makers, therefore it could long last without corrosion.



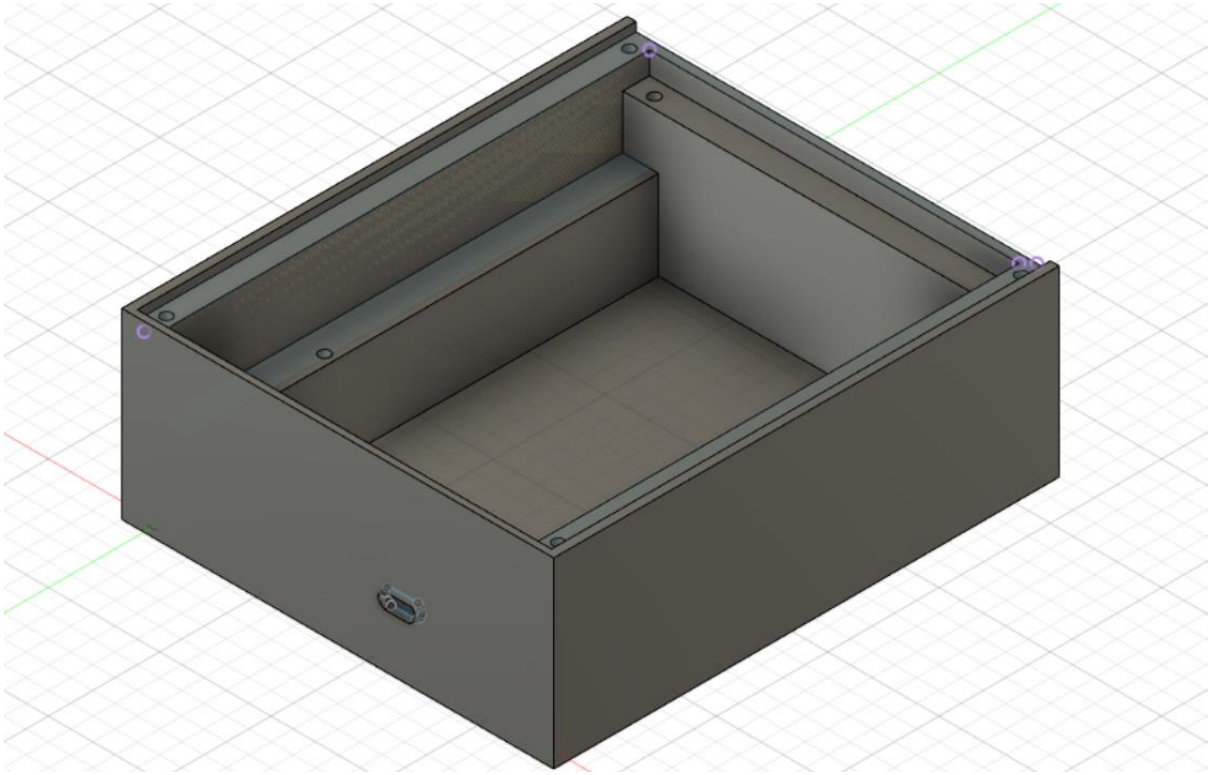
This is our schematic for PCB we have implemented for our final conclusion, this design consists of Chip mounted onto QFN-32 board, this board is directly placed on PCB using PIN headers, this design is not spatially efficient but cost effective with same range and accuracy as that of chip mounted board but as this board is made in PCB lab, it has no insulation thus it could corrode in less time and could cause problem. Overall, this design performs equally or sometimes better than ready-made Chinese module available in market.

CAD MODEL

This is our CAD model that we used as a outer cover for a project. It consists of 2 parts, a bottom box and a top surface. Their representations are shown below.



Top surface

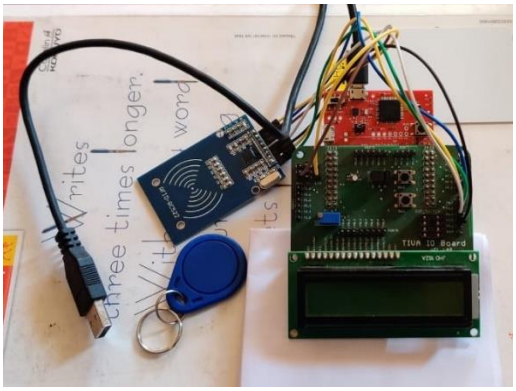


Bottom surface

RESULTS

Test Setup:

- RC522 was connected with the TIVA C microcontroller by SPI communications, as available on the RC522 module and connected to the respective pins of TIVA C, and the code built was transferred to it, so that it can handle RC522 as required.
- The power to microcontroller, and hence to RC522, is given with the help of micro usb cable of the controller, connected to the laptop.



Method Followed:

- TIVA C has ports which can be used to interface with the RC522 through SPI. So, with help of jumping wires, corresponding connection was done between them, and the SPI port was activated of the microcontroller.
- TIVA C works on embedded C, and does not support Arduino codes. For this reason, the library for MFRC522 was found for C code from the internet, and made changes in them to work efficiently with the CCS IDE (original IDE for TIVA C).
- The library had some functions which need to be changed on the register level of the MFRC522 chip, for which we read the datasheet and learnt about its commands.
- After completing the work on the coding level for attendance, register, and de-register systems, we activated the MFRC522, and activated the antenna on RC522. So, whenever an RFID card comes in range of the reader, blue LED glows of the microcontroller, implying that the detection was successful.
- Simultaneously, the controller checks the database whether the scanned card is found or not, and responds accordingly in the above three systems (there is a database in the **EEPROM memory** of TIVA C, which contains the UIDs of all the registered cards, which increases the process to respond whether the card is registered or not).
- For reading/writing data blocks of the card, we read the datasheet of MIFARE card, and followed the steps to do so. The steps required to select the card by sending the

UID of the card to MFRC, followed by an authentication with the data sector (with the help of data sector password) to read/write the data successfully from the card.

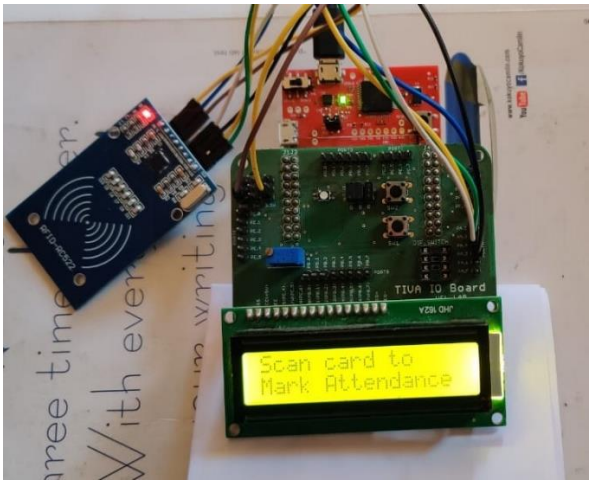
- We used UART0 port of the microcontroller, which is hardwired with the USB connector of the TIVA C, to communicate with the laptop. So, whenever the card is detected, UART sends data to Serial Monitor (Tera Term) successfully. This data is logged into a file, which is connected to local Excel file to update attendance.
- To automate the process of updating a particular student's attendance in the excel sheet, we made a Python script, which automatically connects the excel sheet with the logged data file, and add the time and date of attendance of a student.
- Similarly, the other two systems take the data of the card, and work as required.

Results and explanations:

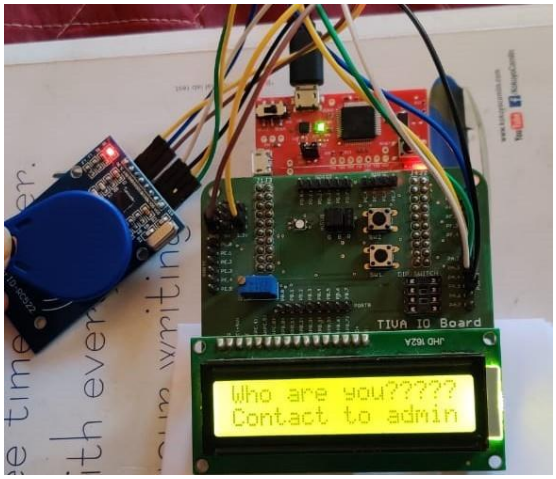
All the expected goals of this experiment were completed successfully. Here are the results:

1. Attendance System:

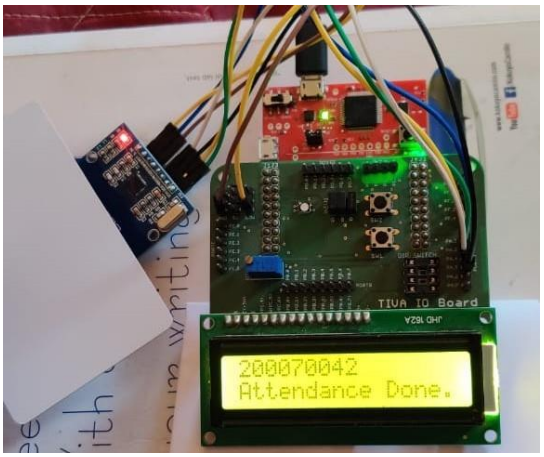
- Attendance system code was loaded in the microcontroller, which activated the RC522 and is ready to mark attendance.



- Whenever a card, whose data is not stored in the database, and hence not registered, would not be accepted and he/she would be asked to contact the admin.



- If a person, who is registered, scans the card, his/her roll no. would be sent to the Serial Monitor, which eventually logs the data in a txt file. During the process, the card holder would be informed that attendance has been marked.



- The roll no. with a timestamp would be stored in the txt file. We had made a python script to automate the process of updating this data in an excel file.

capture.txt - Notepad

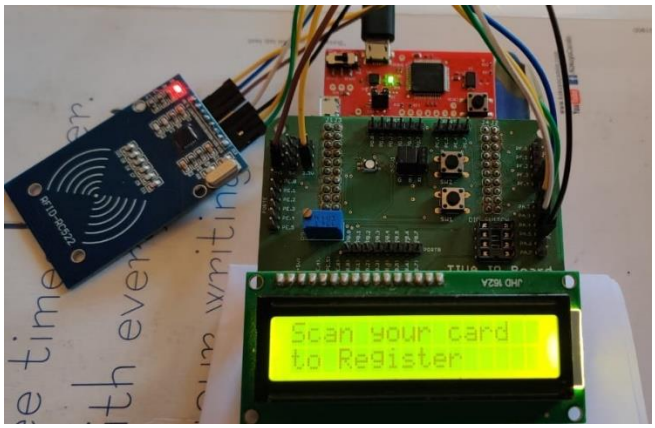
File Edit Format View Help

```
[2023-03-26 10:50:32.492] 200070044
[2023-03-26 10:50:38.933] 200070042
```

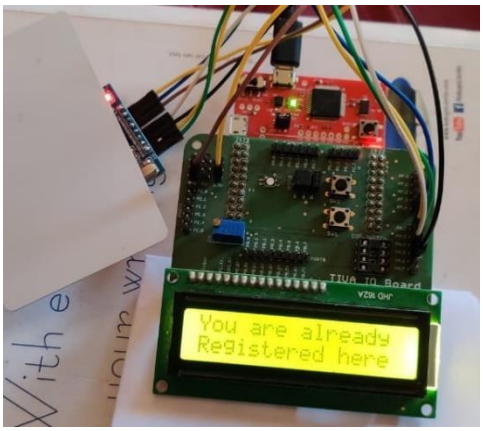
	A	B	C	D	E	F
1	**Roll No.**	**1st**	**2nd**	**3rd**	**4th**	**5th**
2	**200070044**	'26-Mar-2023 10:50:32				
3	**200070042**	'26-Mar-2023 10:50:38				

2. *Register System:*

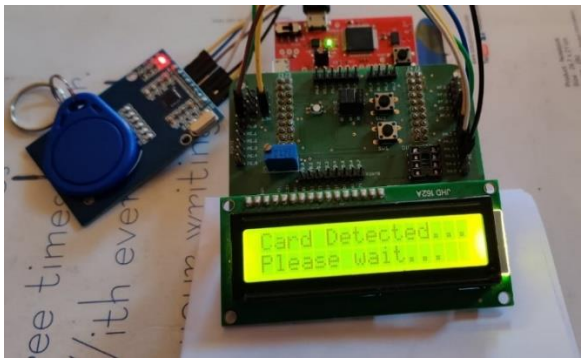
- Registration system code was loaded in the microcontroller, which activated the RC522 and is ready to register new cards.



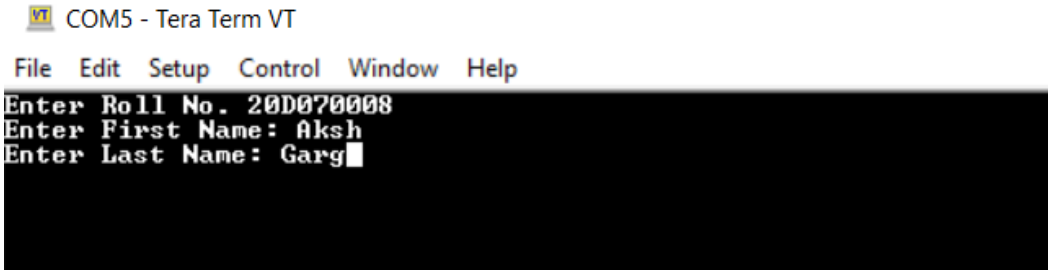
- This system does not allow someone to register again, if he/she has already been registered in the database. For this, microcontroller investigates the database and try to find the scanned in it. If found, then he/she is unable to register again.



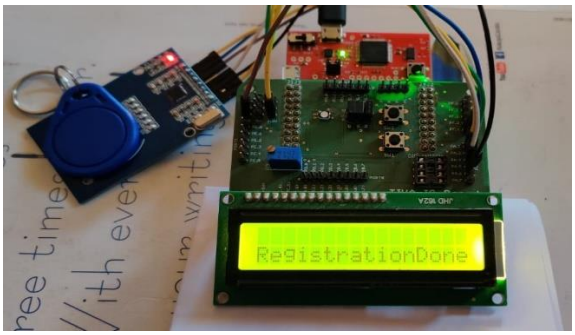
- If the controller is unable to find the scanned card in the database, this implies that the person is not registered and the system should allow him/her to register.



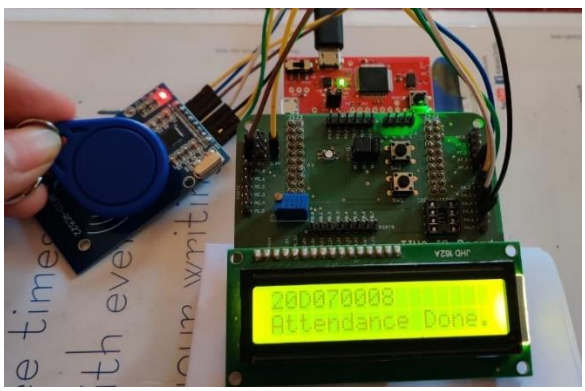
- The controller is waiting for the response by the Serial Monitor, which provides the roll no., first name, and the last name to it. This information is typed by the user in the Serial Monitor itself, which is programmed such that whenever pressed ‘Enter’, would be sent to the controller. This card’s data would also be stored in the database. On the other hand, the name, and the roll no. would be stored in the card itself too.



- If the process contains no errors, then the person would be informed that the registration had been done successfully.

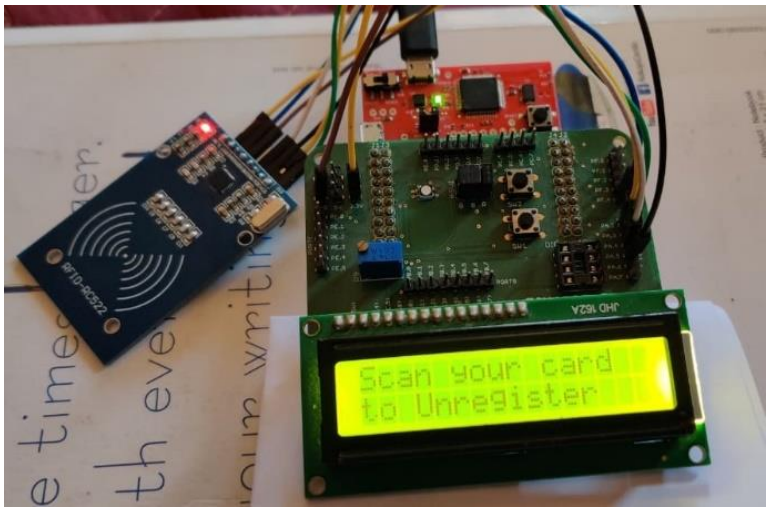


- To check again, whether this process works fine or not, we ran the attendance system again and scanned this card. This card is now accepted, which implies that registration had been done successfully and registration system works.

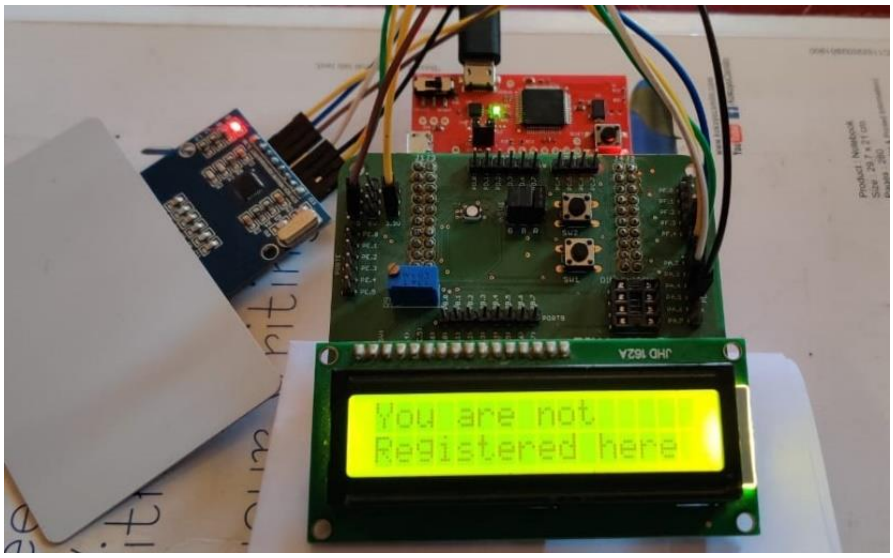


3. *De-Register System:*

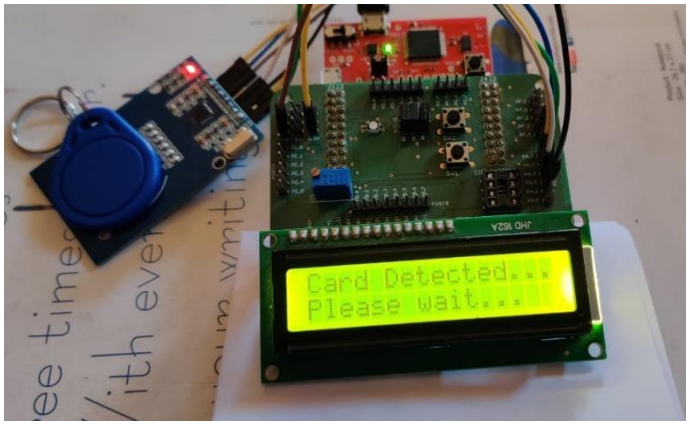
- De-registration system code was loaded in the microcontroller, which activated the RC522 and is ready to de-register the registered cards only.



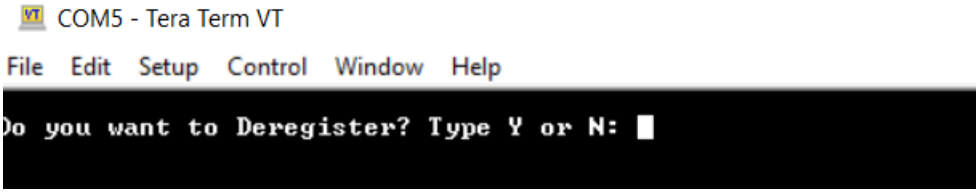
- This system does not allow someone to de-register, who is not registered already. For this, microcontroller investigates the database and try to find the scanned in it. If not found, then he/she is unable to de-register, which should obviously be the case.



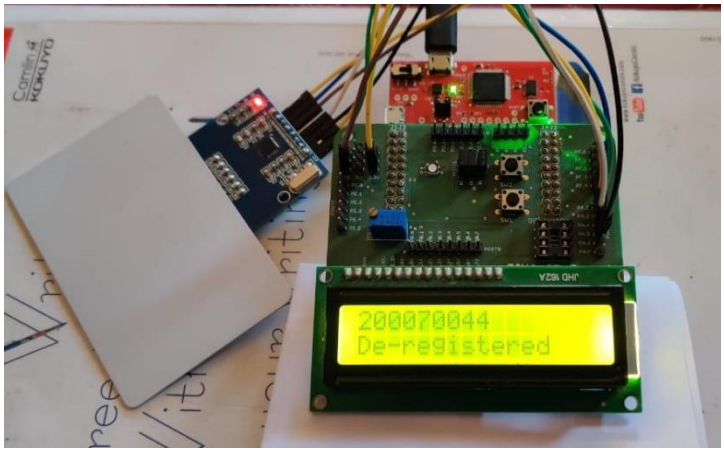
- If the controller is able to find the scanned card in the database, this implies that the person is registered and the system should allow him/her to de-register.



- The controller is waiting for the response by the Serial Monitor, which asks the confirmation to de-register. The user can confirm by typing ‘Y’ or ‘N’ as required.

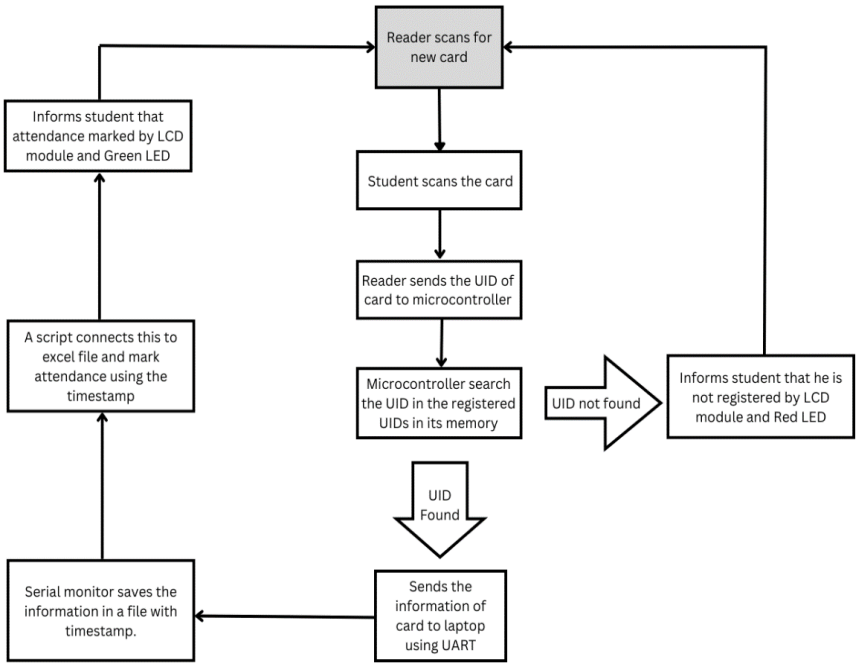


- Based on the input, the controller takes the required steps. If the user types in ‘Y’, which implies YES, then the controller will delete the card’s data from the database, as well as from the card itself too. The person would be informed that the de-registration had been done successfully.

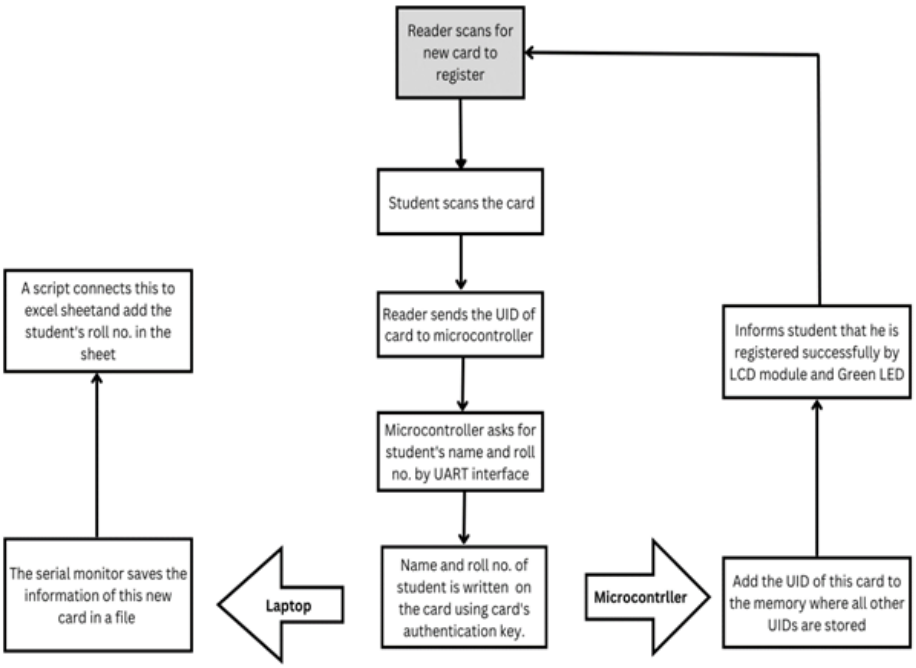


For all these three systems, all the results show that the systems are working perfectly fine, with **test percentage rate** of about **95%** for **20 cards** testing with the current database.

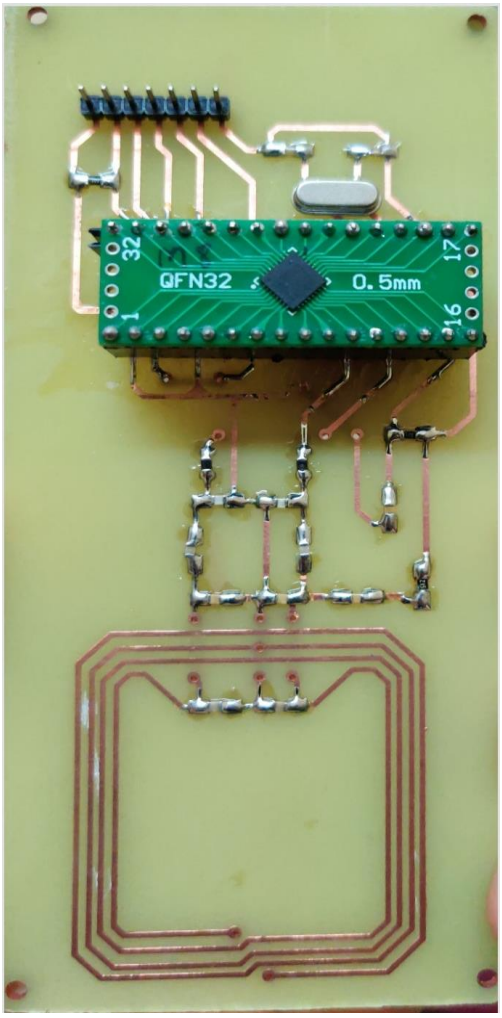
Block Diagram for the Attendance system:



Block Diagram for the Registration system:




Think it. Make it. Prove it.
20D070008
Attendance Done.


QFN32
0.5mm
32
17
1
16

BILL OF MATERIALS (BOM)

Sr. No.	Component	Quantity	Price
1.	Tiva C TM4C123GH6PM	1	Was available in the lab
2.	RC522 HF RFID Reader	3	Rs. 315
3.	MFRC522 Reader Chip	2	Rs. 209
4.	QFN Breakout board	2	Rs 140
5.	LCD Module	1	Was available in the lab
			TOTAL: Rs. 664

FUTURE WORK SCOPE

Enhancing security:

- Enhancing the security of our RFID-based attendance system by implementing measures such as multi-factor authentication, encryption, and regular security audits.
- we can explore the use of biometric authentication, such as facial recognition or fingerprint scanning, to further enhance the accuracy and security of your RFID-based attendance system.
- Our system is mostly based on single-factor template based, which pose a security fault line. Next phase would be the development of a multifactor attendance system that employs the flexibility of RFID technology and the security of fingerprint biometrics to manage student's attendance record.

Portability and easy use:

- We could add SD-card for recording time stamps and data of particular students or staff to be stored, thus using it as a database, or else we could implement wireless protocol to communicate with database server thus making it more portable and easier to use for different locations.

Integration with access control:

- We can integrate our RFID-based attendance system with access control systems to ensure that only authorized personnel can enter restricted areas. This can improve overall security and reduce the risk of unauthorized access.

Expanding functionality:

- we can expand the functionality of your RFID attendance management system to cover additional areas such as Inventory management. For instance, you can use RFID tags to track the movement of assets within your organization, such as vehicles or equipment inside Lab.

LINK TO DEMO VIDEOS

- Python Script File
- Testing of Attendance system
- Testing of Registration system
- Testing of De-registration system

CONCLUSIONS

We completed our project according to the requirements given. Which includes the attendance system of students with a tag, registration system for a new student, de-registration system and showing the results on LCD and our database. We have generated an automatic excel sheet which contains the timings and information about scanned tags. There are some points to improve in terms of security of our module which may be implemented as next part of the project.

We have tested our project for a sample size of 20 cards and it gave accurate results for 95% of samples in registration mode.

Our project is ready to implement in practical situation for a large class.