Office Security System Using STM32 Microcontroller

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Synopsis

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3. Choice of hardware
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5. Conclusion
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Introduction

- With advances in technology, safety and security gained equal importance.
- Access control system: powerful tool meeting the vulnerabilities in security system
- Security guidelines are useful in revamping the system to unerring.

Problem statement

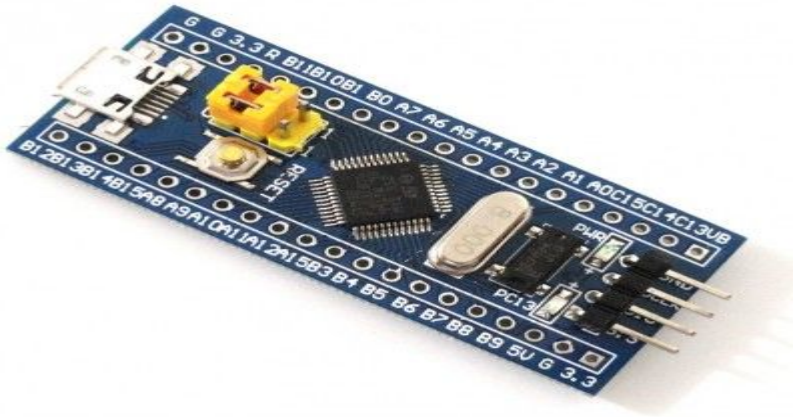
Developing a fail-proof security system that authenticates the identity of the user and cross references against a database to attain access authorisation level. The predominant factor is to ensure repeatability of the systems for fail-proof design.

Implementation features:

- Microcontroller selection
- Access control mechanism
- Fail-proof back-up system (future research)

STM32F1 features:

- A member of the **STM32** family of ARM **Cortex**-M3 core, 32-bit microcontroller.
- It runs at a clock frequency between 24 and 72MHz.



STM32F1 features:

- Each chip is encrypted with 96-bit unique number.
- Oscillator source: RC (8MHz,40kHz), HSE (4-24MHz), LSE(32-1000kHz)
- Connectivity options:
  - Compatible with Bluetooth, Wifi, NVRAM, built-in SPI, I2C and uart interfaces.
- Memory:
  - Static SRAM: 4 to 96KB
  - Flash: 16 to 256kB

Chosen Microcontroller: STM32F103

- Selection process of a board requires a command of following metrics:
  - **Computing power:** Since this is not the main requirement, mainstream line of stm32 can be chosen
  - **Connectivity requirement**: peripheral interfacing through uart shall suffice the objective.
  - **Easy development phase**: USB to PC connection rather than RS-232
  - **Operating voltage :** 3.3V and 5V
  - **Cost**

Why STM32F103? contd...

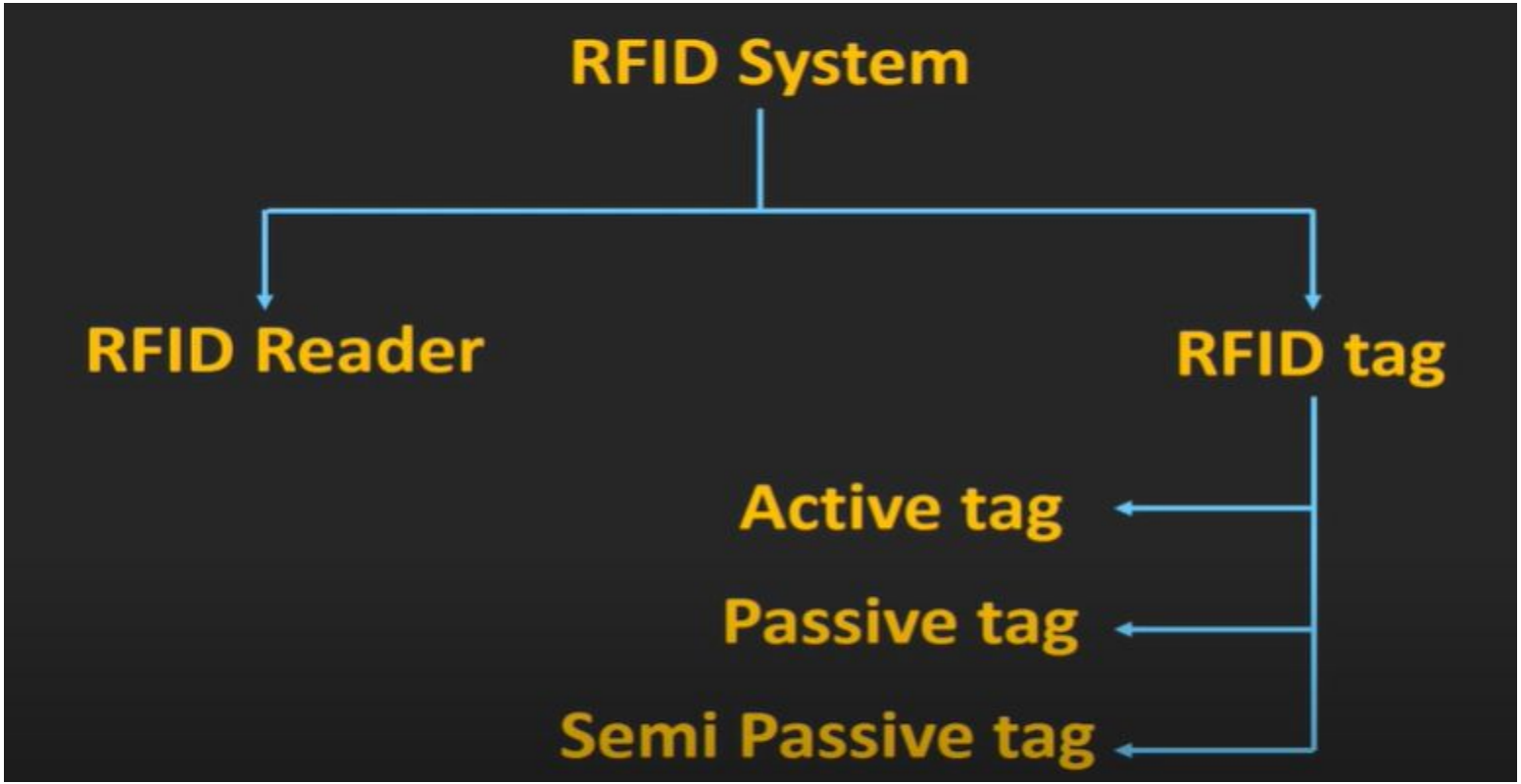
- Best low-power models in the Cortex-M MCU space. Other manufacturers rely on DC-DC converters to improve datasheet power metrics,
- Advantage includes OTA programming for small sketches (<1MB)

Access control mechanism : RFID

What is RFID?

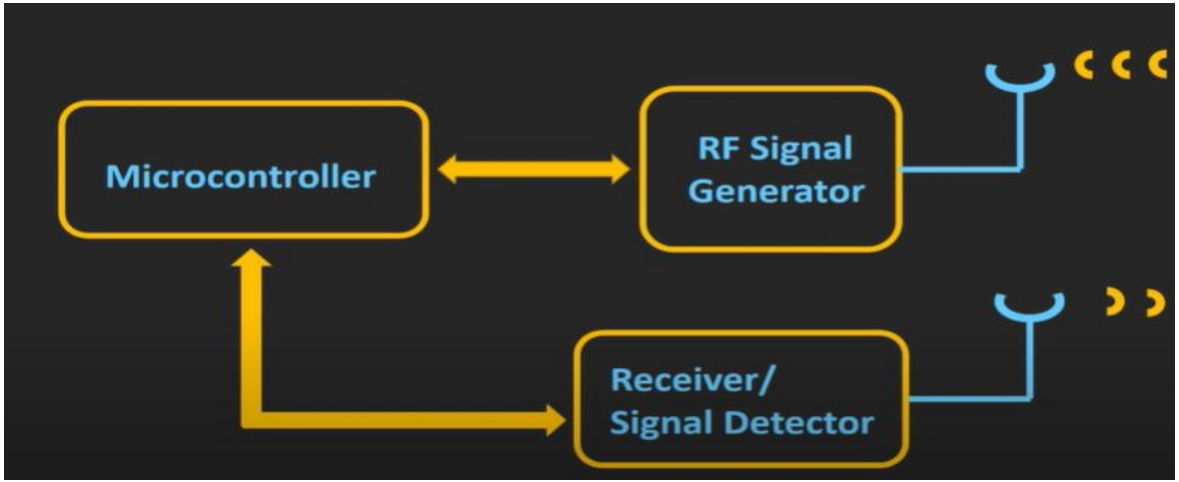
- RFID is a technology which works on radio frequency of radio waves.
- This technology is used to identify or track different objects.

RFID SYSTEM

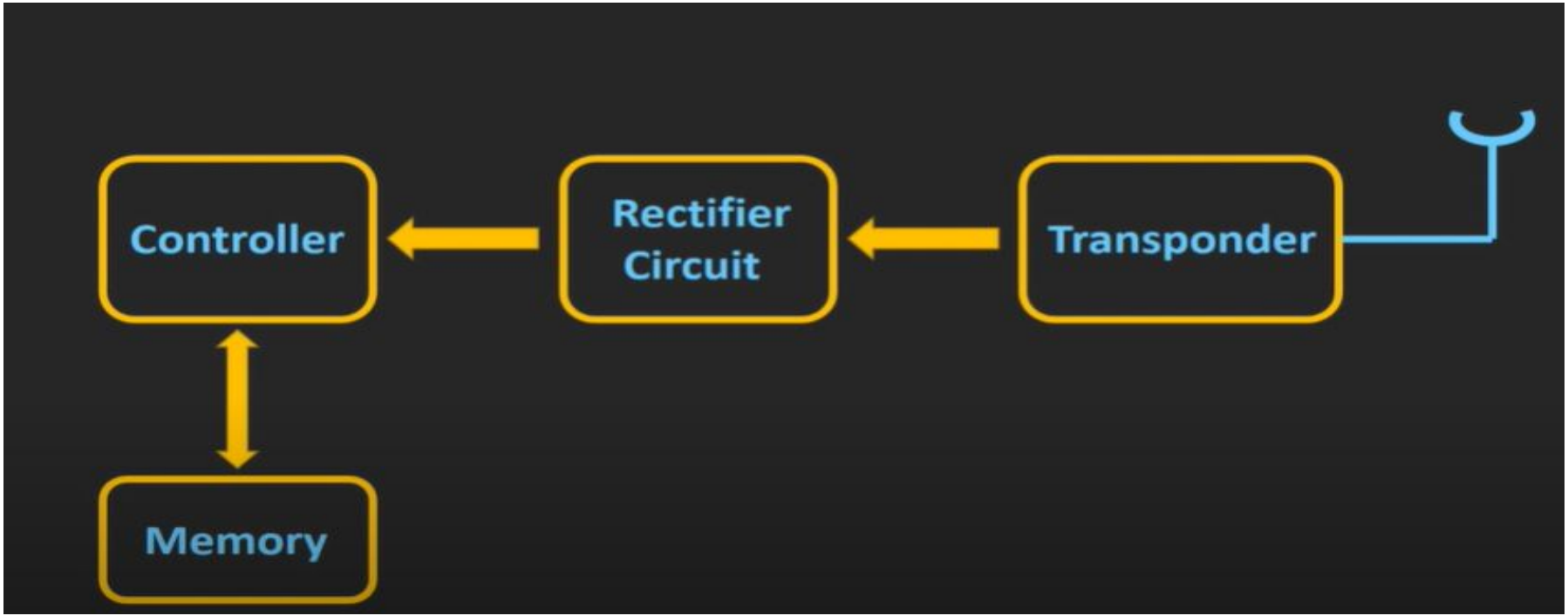

RFID System
RFID Reader
RFID tag
Active tag
Passive tag
Semi Passive tag

RFID READER:

- It generates RF signal
- It does interaction with Microcontroller for processing of the information.
- It sends feedback signal to the microcontroller after identification of object



RFID TAGS



FREQUENCY OF OPERATION

- LOW FREQUENCY RANGE:

  125KHz to 134KHz

  Range of distance: 8-12 cm

- HIGH FREQUENCY RANGE:

  13.56MHz

  Range of distance: upto 1m

- ULTRA HIGH FREQUENCY RANGE:

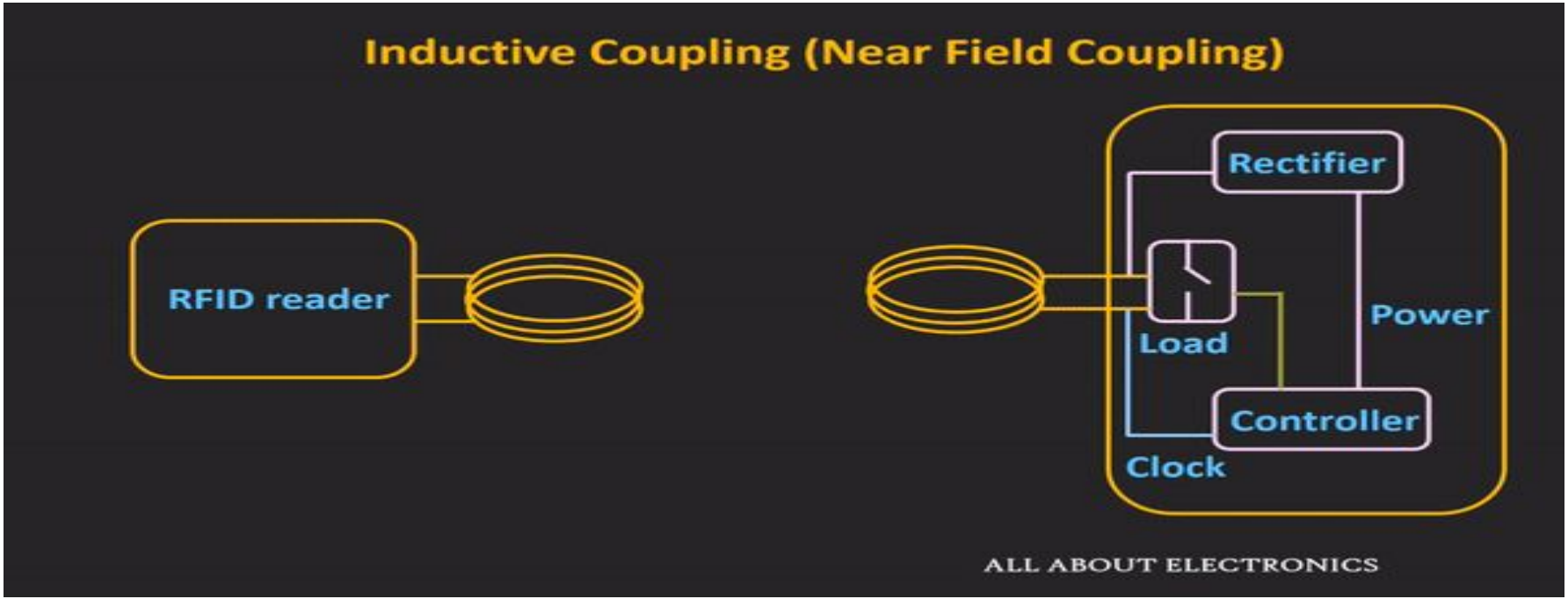
  860-960MHz

  Range of distance : 10-15m

Working Principle of RFID:

- Low frequency and High frequency works on the principle of Near field coupling.
- UHF works on the principle of Far field coupling.
- Here, LF and HF uses the Load Modulation Technique to send the data stored in the tag to RFID reader.

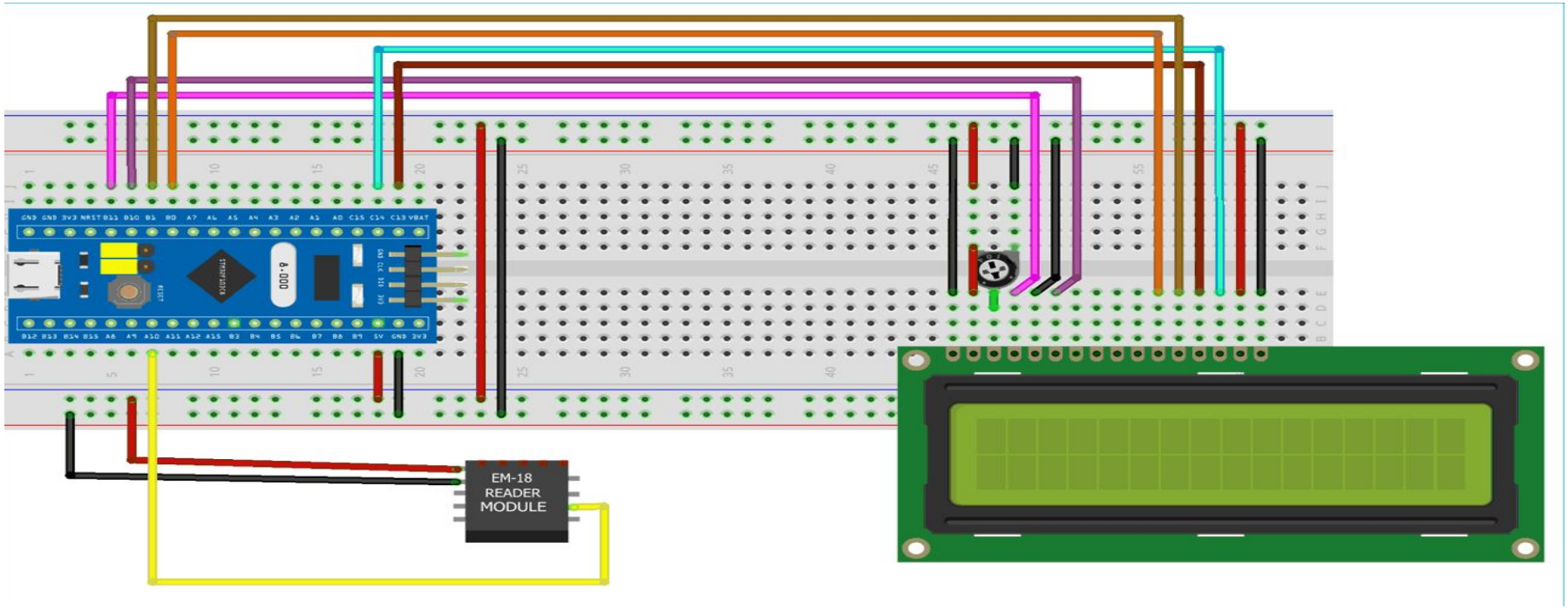
LOAD MODULATION TECHNIQUE:



Materials Required:

- STM32F103C8 (Blue Pill Board)
- EM-18 RFID Reader Module
- RFID Cards
- 16x2 LCD Display Module
- Bread Board
- Connecting Wires

Circuit Diagram and Connections



Connections between STM32F103C8 & 16x2 LCD

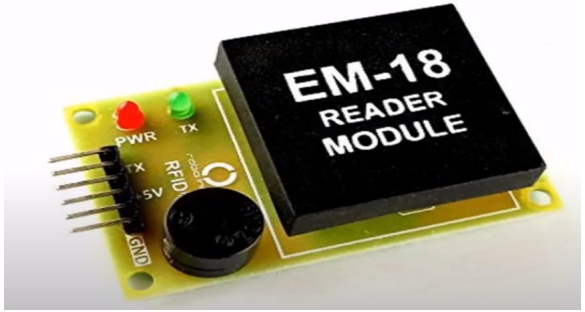
- 4 bit operation mode of LCD

Data Bit 4 (DB4)	PB0
Data Bit 5 (DB5)	PB1
Data Bit 6 (DB6)	PC13
Data Bit 7 (DB7)	PC14
LED Positive	5V
LED Negative	Ground (G)

EM-18 Reader Module

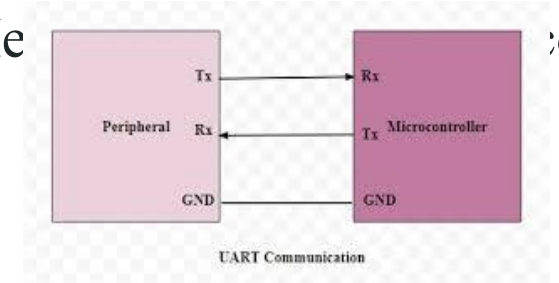
EM18 RFID reader module is an easy to use RFID Reader with on board antenna. It is used to read RFID cards which work at 125 kHz.

Features :



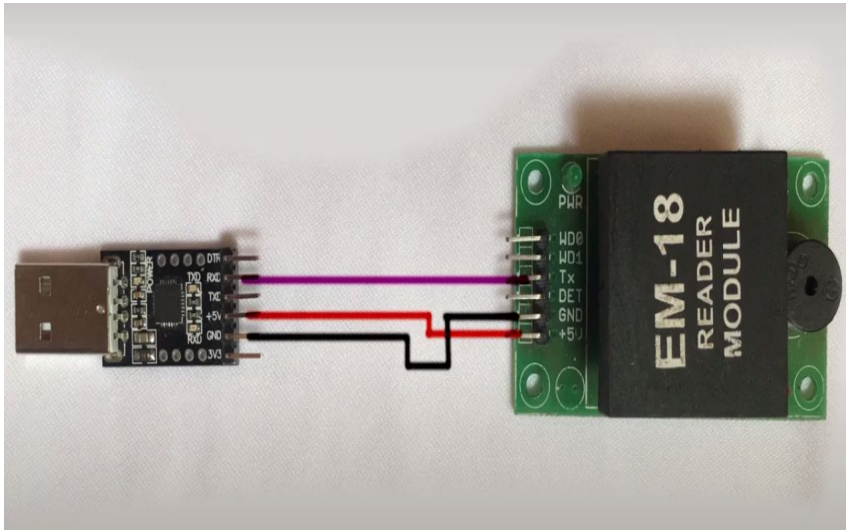
- Operating Frequency is 125 KHz.
- Range is 5–8 cm.
- 5V supply

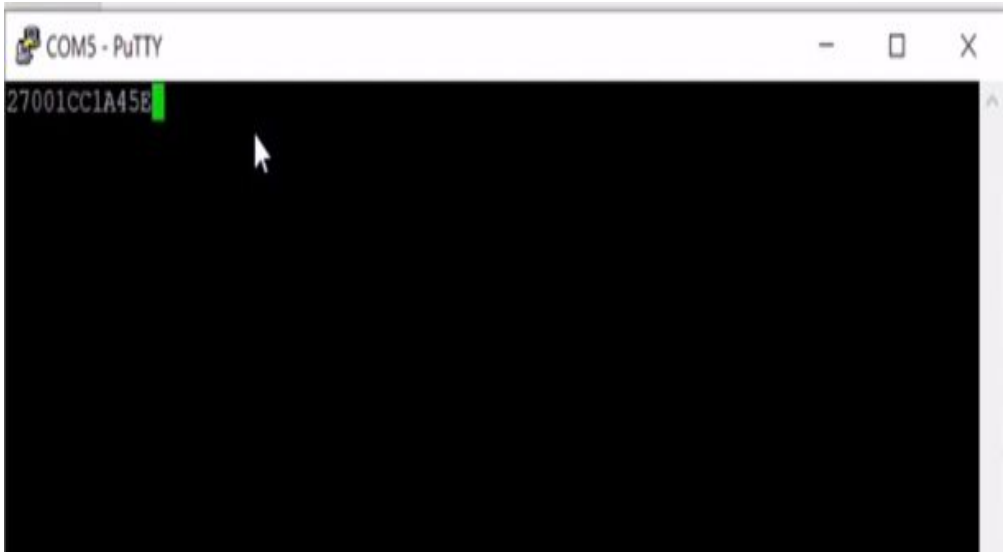
He ommunication b l Bluepill



EM-18 Reader Module	STM32F103C8
VCC	+5V
GND	GND
TX	PA10

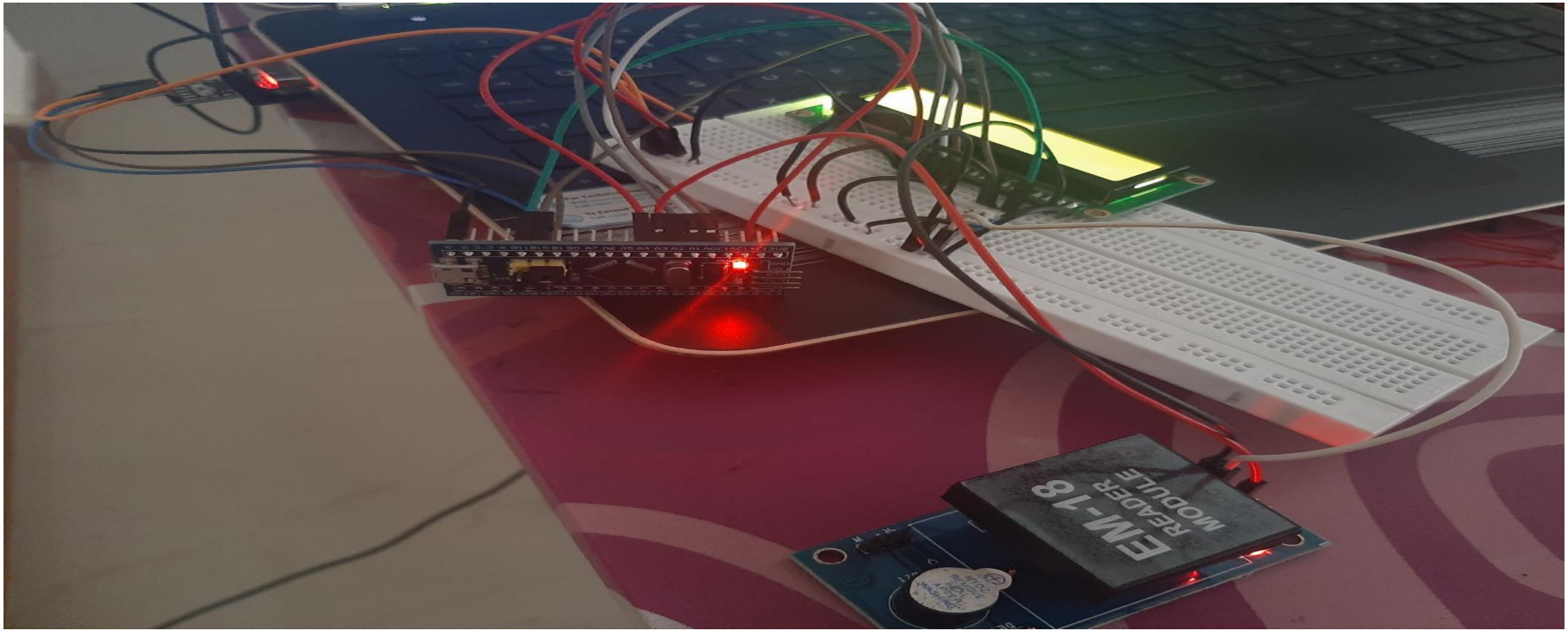
- Serial communication parameters are 9600bps, 8 data bits, 1 stop bit.
- Output provides 12 Bytes of data,in which last 2 bytes are used for checksum.
- Here,The desired Tag UID must be registered with the system(In buit code),inorder to provide access granted to it.
- 12 bytes UID are encrypted by manufacturers.So,inorder to obtain the data,we use serial terminal method to extract 12 byte UID data from tag,with help of **USB-TTL converter and Putty,**as shown below.





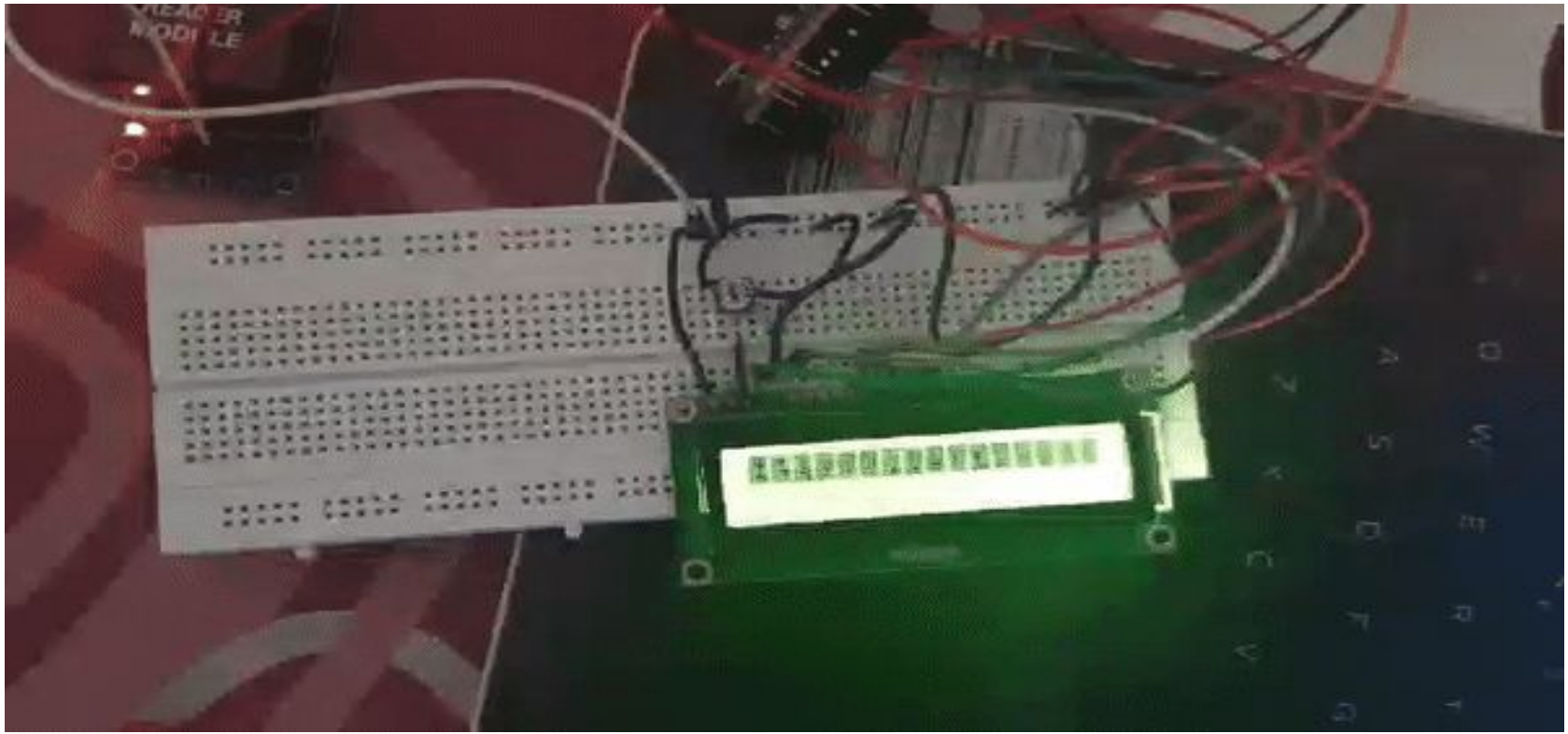
PROJECT DEMONSTRATION

THE ACTUAL CONNECTIONS



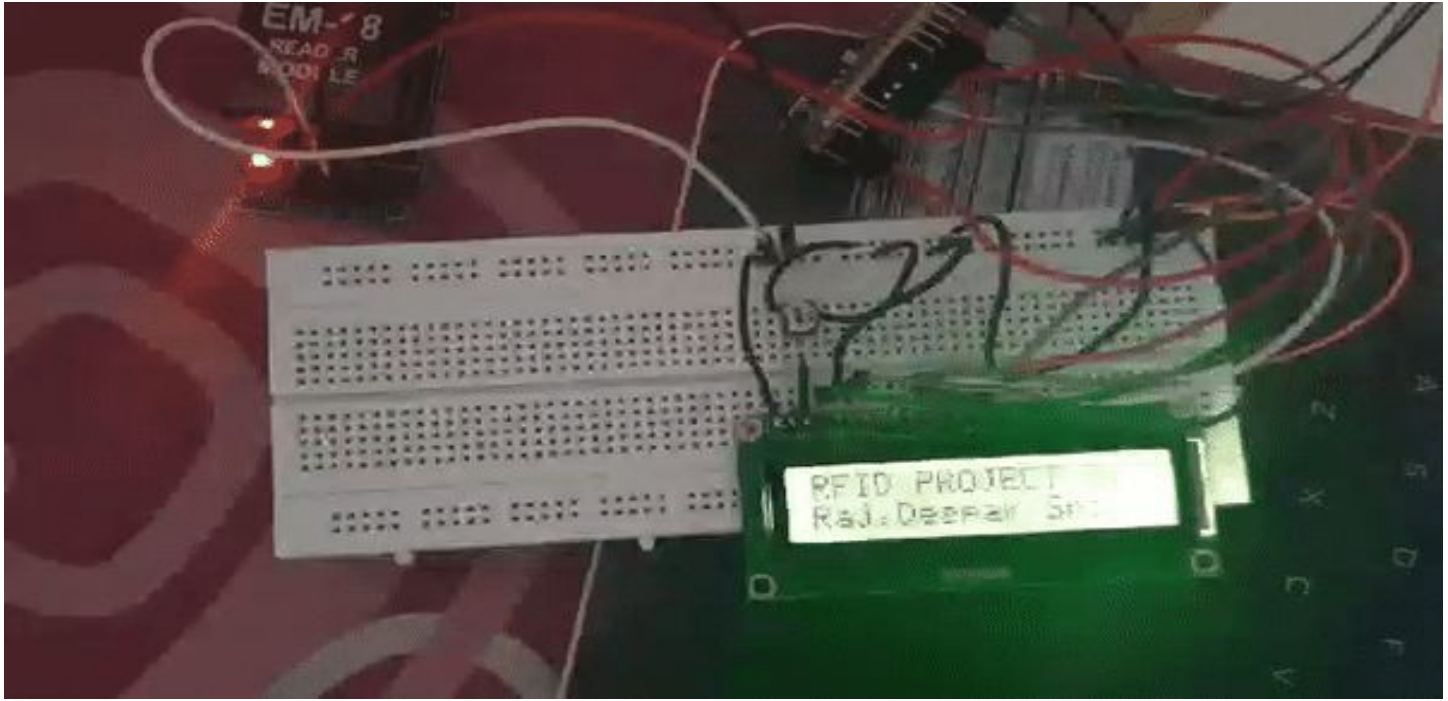
INTRO PART

Before autentication phase,A welcome note will be displayed by LCD as shown below



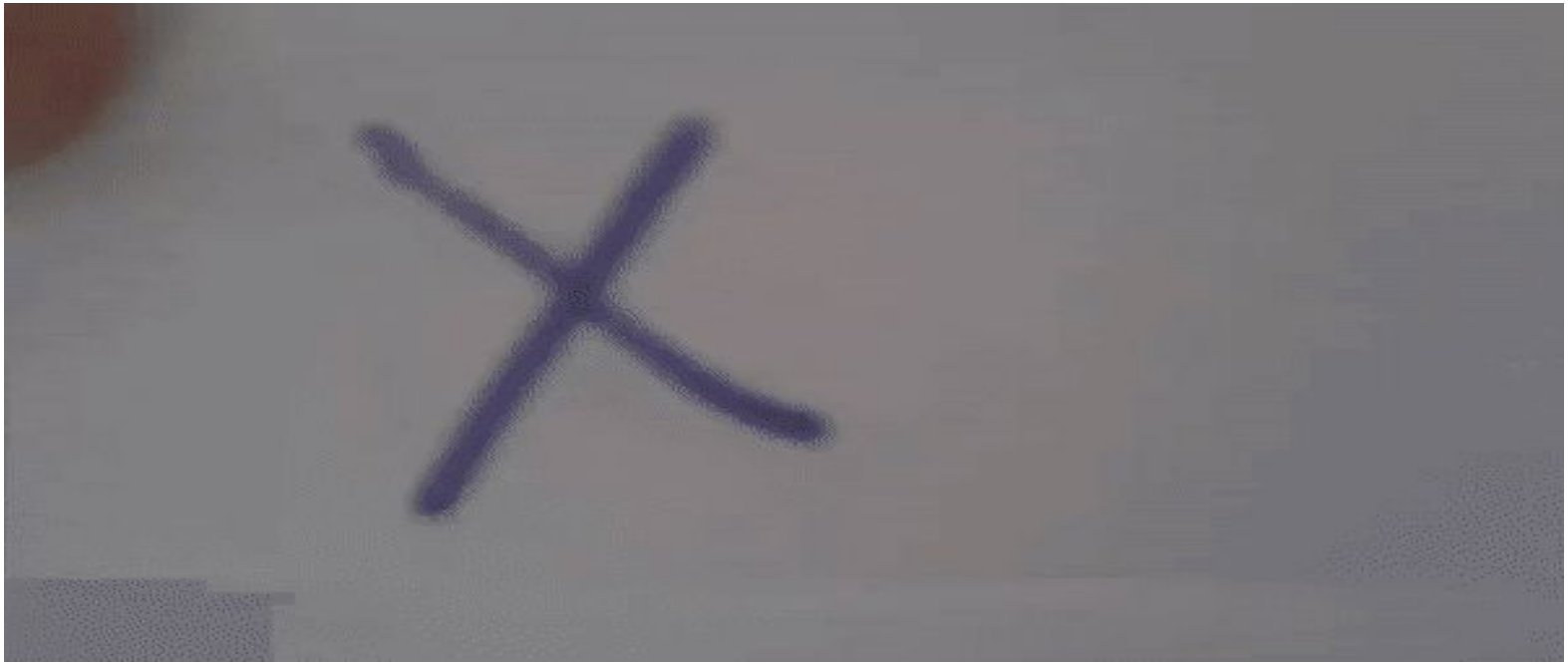
POSTIVE CASE OUTPUT

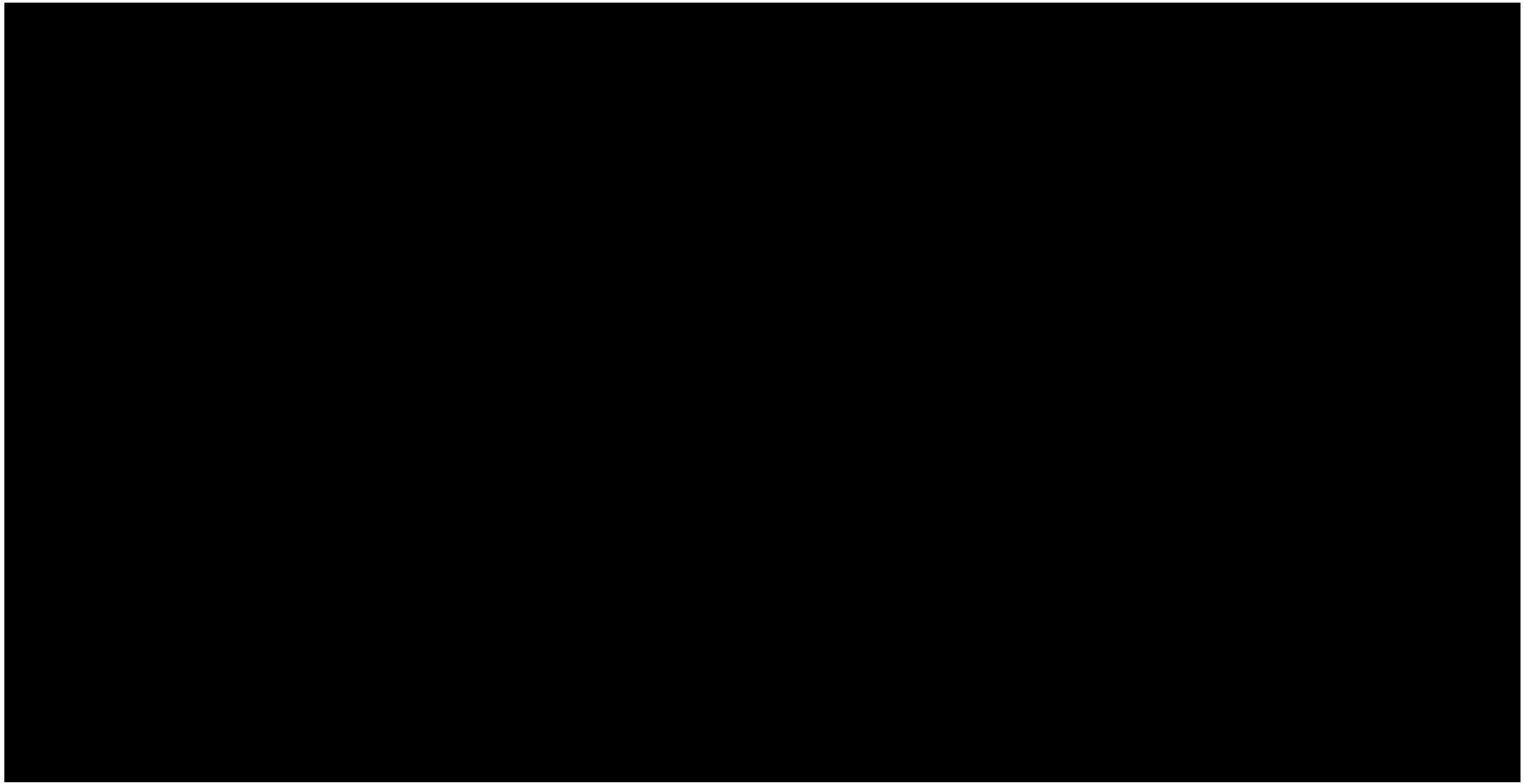
Here When correct/authenticated card is kept in proximity to reader,LCD will display **“Access Granted”**



NEGATIVE CASE OUTPUT

Here When duplicate/non registered card is kept in proximity to reader,LCD will display **“Access Denied”.**





Future Scope:

- RFID technology is tag dependent.
- To affirm infallible security system, the future research will extend in complementing the application with back-up system.
- Machine learning is looked upon to assay for FAIL-PROOF condition.

THANK YOU