Report on

PC LOCK / UNLOCK SYSTEM USING RFID

Submitted in fulfillment for MINI PROJECT- II
in

ELECTRONICS & TELECOMMUNICATION ENGINEERING

BY

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Year 2017-18

CERTIFICATE

This is to certify that Pranay Vora and Akshay Vyas have satisfactorily completed the requirements of the Term Work of MINI PROJECT-II as prescribed by the University of Mumbai while working on project

"PC Lock/Unlock System Using RFID".

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Name :

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Date:

Place:

C O N T E N T S

ABSTRACT

Often, an individual have felt tired of typing in the password to unlock the PC/laptop every time it got locked? Users are used to locked it down quite a number of times, every day, and nothing is more annoying than typing the password/pin over and over again, every-time user want to unlock it. There is need of an easy and a cheap way to unlock users personal Computer/Laptop every time person had to lock it.

Radio Frequency Identification (RFID) is a fundamental and inexpensive technology that enables wireless data transmission . With RFID, wireless automatic identification takes a very specific form: the object, location, or individual is marked with a unique identifier code contained with an RFID tag, which is in some way attached to or embedded in the target . This system has some advantage like the data on a RFID card is readable only with special equipment, keeping the data recorded on the chip secure.

This project proposed how to make a simple RFID system that can lock/unlock windows computer with just a flick of an RFID card/tag. With this system in place no more hassles of unlocking our Laptop/PC every-time we lock it down.

CHAPTER 1: OVERVIEW

1.1 Importance Of Project:

It happens many a time that the set password is very long and uses some more special characters. Which are not simple and easy to remember and that makes typing efforts more difficult.

There are many modern systems which uses Smart and user friendly solution for locking and unlocking the PC.e.g.Facial Recognition and Fingerprint sensor. But still there are many organizations and firms which uses old system in PC which are not Compatible with modern systems e.g.Facial Recognition. Also some systems are very much costly that some can't affords .

Let's take an example of college lab, where the workshop is going on under guidance of external Professor and suddenly we need a Admin access for working of a software, then Lab Assistant have to type password for giving access in each PC. If there will be a 30 PC ,at an average of one minute we have to waste 30 minutes for just providing admin access in typing effort.

This all problems can be addressed by using RFID Card which makes system Easy,Simple,Compatible and Affordable with Arduino Micro.

1.2 Literature Survey:

This study has analyzed current lock systems that are used at present. It has been found that although these methods are helpful they are may or may not be compatible with old systems and pose much threat to security issues. They have also been identified as quiet expensive. Below is a discussion on the pros and cons of the existing systems.

A. Password-Authentication: This system stores the password of authenticated users for the purpose of validation which provides considerable security to the users. Power consumption is efficient and usage is user-friendly. However, unauthorized users can easily acquire passwords through different methods (hacking, guessing and so on.).
B. RFID reader authentication :Radio Frequency Identification (RFID) is a fundamental and inexpensive technology that enables wireless data transmission.With RFID, wireless automatic identification takes a very specific form: the object, location, or individual is marked with a unique identifier code contained with an RFID tag, which is in some way

attached to or embedded in the target. This system has some advantage like the data on a RFID card is readable only with special equipment, keeping the data recorded on the chip secure. RFID systems can be easily duplicated or cards can fall into the wrong hands

C. Face detector lock: These systems have difficulty in recognizing a face from images captured from two drastically different views and under different illumination conditions. It is questionable whether the face itself, without any contextual information, is a sufficient basis for recognizing a person from a large number of identities with an extremely high level of confidence.
D. Retinal scanner :The retinal vasculature is rich in structure and is supposed to be a characteristic of each individual and each eye. The image acquisition requires a person to peep into an eyepiece and focus on a specific spot in the visual field so that a predetermined part of the retinal vasculature could be imaged.This device is frequently used for security purpose. The false acceptance and rejection rates are lower in this device. But the problem of this device is, it is not user- friendly and the equipment cost is very high.
E. Iris scanner: Iris recognition is a method of biometric authentication, based on extraction features of the iris of an individual's eyes. Each individual has a unique iris; the variation even exists between identical twins and between the left and right eye of the same person . The advantage of using iris scanner is, it has very high accuracy and the accuracy of iris scanners can be affected by changes in lighting. As iris is a small target and a scanner cannot be performed properly for multiple people of different heights. The main shortcomings with iris recognition technology, is that the iris scanners are very expensive and requires a lot of memory to store data.
F. Voice recognition: Voice recognition or speaker recognition is the problem of identifying a speaker from a short utterance . This biometric technology uses the acoustic features of speech that have been found to differ between individuals. These acoustic patterns reflect both anatomy (e.g., size and shape of the throat and mouth) and learned behavioral patterns (e.g., voice pitch, speaking style) [9]. A disadvantage of voice-based recognition is that speech features are sensitive to a number of factors such as background noise .

1.3 Scope Of The Project:

We can implement this system with Multi user environment, where one can Add, Delete and Reset the Card for providing Authorized access. As the world is connected with 50 billion devices, by 2025 using Internet of Things. Using IOT we can track the user in Real time.

CHAPTER 2: PROPOSED WORK.

2.1 Problem Definition:

- Users are used to locking our PC down quite a number of times, every day, and nothing is more annoying than typing the password/pin over and over again, every-time we want to unlock it.
- There are Modern systems which uses Facial Recognition and Fingerprint sensor for Lock and Unlock the PC. But this system is not compatible with Old and existing system also these are usually Costlier for implementation.

2.2 CONCEPT MAP For IDEA Conceptualization, Implementation:

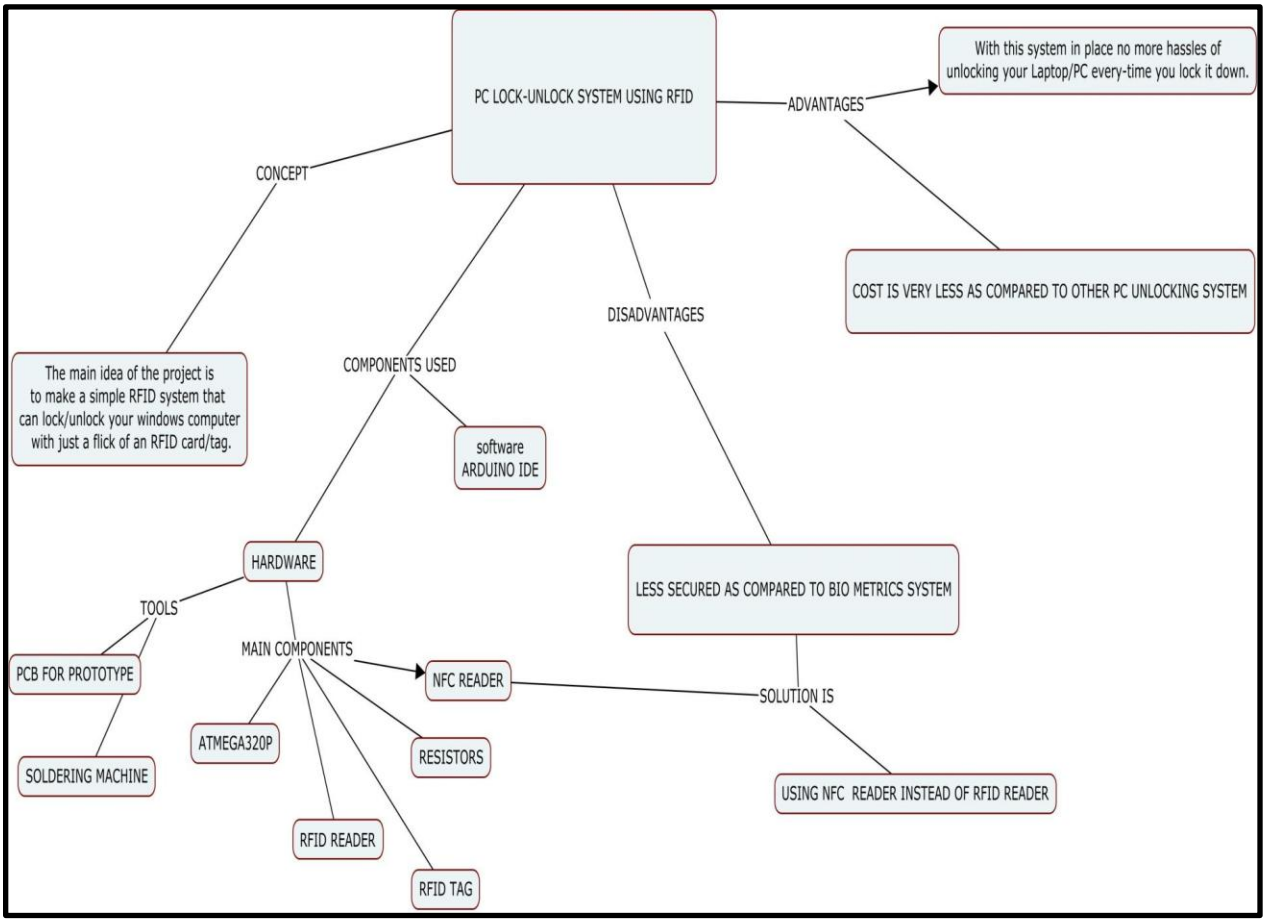

Figure (2.1) : C-MAP Diagram

We can observe that the project can be mapped into three sections.

a) Construction:

Here the hardware and software used for the system are described.

b) Objectives:

To make a low-cost device for locking/unlocking the PC systems using RFID module.

c) Applications:

This section talks about its applications. This section also gives explanation about the disadvantages of the projects and the alternatives to solve it.

CHAPTER 3: ANALYSIS AND PLANNING.

3.1 DESCRIPTION AND BLOCK DIAGRAM:

3.1.1 Description:

The system uses MFRC 522 RFID Module which works on SPI protocol with Microcontroller. It uses Arduino Micro as a Microcontroller with HID protocol, as a keyboard attached to PC. The user will scan the RFID card to MFRC 522 Scanner and the scanned UID is recorded within microcontroller. Which checks the scanned UID is authenticated or not. On successful scan PC will be get Locked or Unlocked.

3.1.2 Block Diagram:

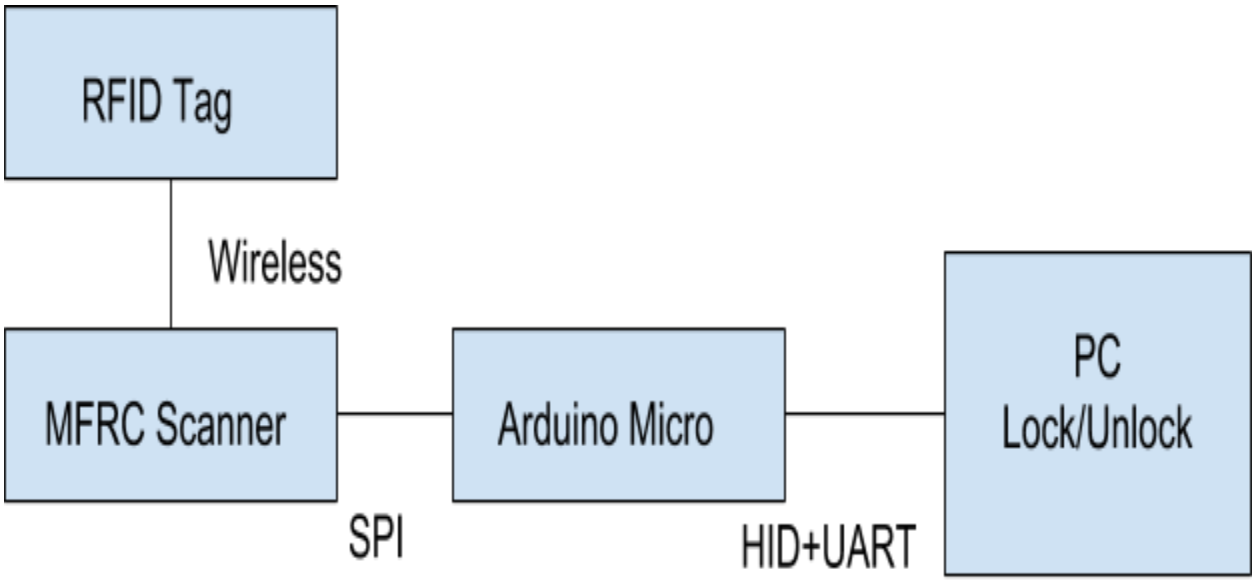

Figure (3.1) : Concept diagram

3.2 Interfacing:

1. MFRC522 is interfaced to Arduino micro with the help of SERIAL PERIPHERAL INTERFACE PROTOCOL(SPI).

- SPI protocol consists of four wires such as MISO, MOSI, CLK, SS used for master/slave communication. The master is a microcontroller, and the slaves are other peripherals like sensors, GSM module and GPS modem, etc. The multiple slaves are interfaced to the master through a SPI serial bus. The SPI protocol does not support the Multi-master communication and it is used for a short distance within a circuit board.

2. SPI Lines:

- MISO (Master in Slave out): The MISO line is configured as an input in a master device and as an output in a slave device.

- MOSI (Master out Slave in): The MOSI is a line configured as an output in a master device and as an input in a slave device wherein it is used to synchronize the data movement.

- SCK (serial clock): This signal is always driven by the master for synchronous data transfer between the master and the slave. It is used to synchronize the data movement both in and out through the MOSI and MISO lines.

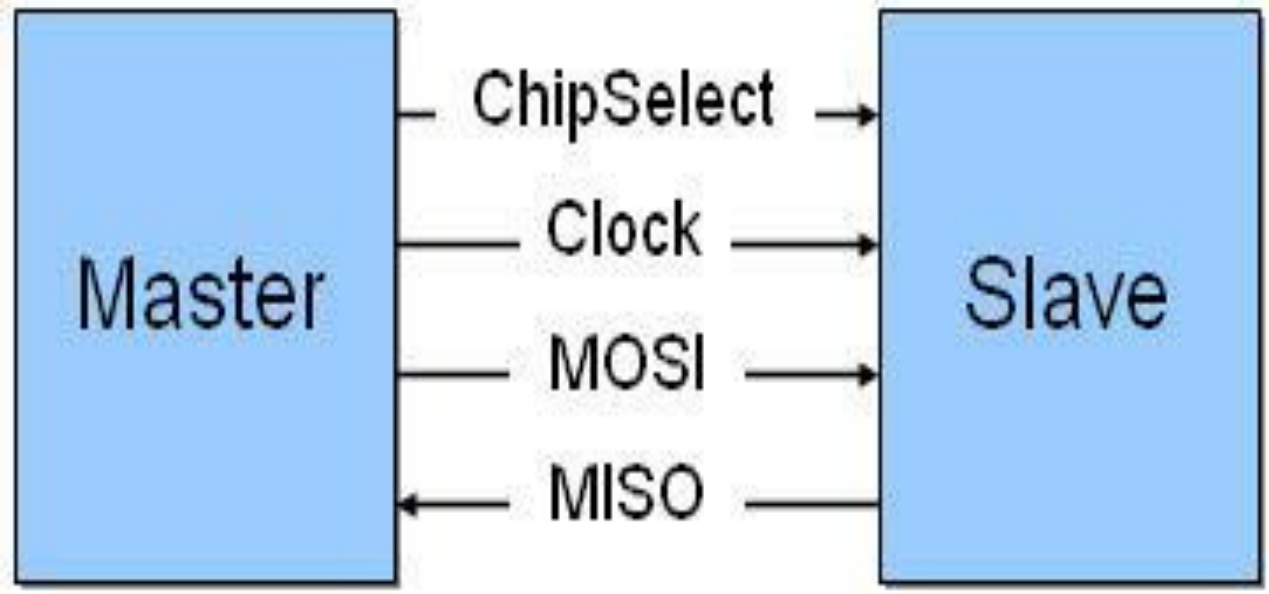

Figure (3.2) : Master-Slave Interfacing diagram

3.3 Program For Interfacing:

```
#include <Keyboard.h>
#include <SPI.h>
#include <MFRC522.h>
#define SS_PIN 10
#define RST_PIN 6
#define KEY_RETURN 0xB0                //The hex value for the return key is 0xB0.
MFRC522 mfrc522 ( SS_PIN, RST_PIN ) ;
char Enter = KEY_RETURN;               //Return key is declared as Enter.
String readid;
String card1="2bc676a9";               //Change this value to the UID of your card.
int Red=3;
int Green=4;

void setup( )
{
 Serial.begin(9600);
 Keyboard.begin();
 SPI.begin();
 pinMode(Red, OUTPUT);
 pinMode(Green, OUTPUT);
 mfrc522.PCD_Init();
}

void temp(byte *buffer, byte bufferSize)//function to store card uid as a string datatype.
{
  readid="";
  for(byte i = 0;i<bufferSize; i++)
  {
    readid=readid+String(buffer[i], HEX);
  }
}
void loop( )
{
 if(!mfrc522.PICC_IsNewCardPresent())
 {
  return;
 }
 if(!mfrc522.PICC_ReadCardSerial())
 {
```

```
 return;
 }
 mfrc522.PICC_DumpToSerial(&(mfrc522.uid));  // Display card details in serial Monitor.
 temp(mfrc522.uid.uidByte, mfrc522.uid.size);
  Serial.print(readid);
 if(readid==card1)
 {
  Serial.print(readid);
  Keyboard.press(KEY_LEFT_GUI);            //Press the left windows key.
  Keyboard.press('l');                     //Press the "l" key.
  Keyboard.releaseAll();                   //Release all keys.
  delay (100);
  Keyboard.press(Enter);                  //Press the Enter key.
  Keyboard.release(Enter);                 //Release the Enter key.
  delay(100);
  Keyboard.print("prashant14");            // Change this value to your Windows PIN/Password.
  Keyboard.releaseAll();
  delay(100);
  Keyboard.press(Enter);
  Keyboard.releaseAll();
  digitalWrite(Green,HIGH);
  delay(1000);
  digitalWrite(Green,LOW);
  delay(1000);
 }
 else
 {
  digitalWrite(Red,HIGH);
  delay(500);
  digitalWrite(Red,LOW);
 delay(500);
 return;
 }
}
```

NOTE: - Verify that all these libraries mentioned in the program should be already downloaded in the library folder of Arduino.

3.4 WORKING OF CIRCUIT:

3.4.1 CIRCUIT DIAGRAM :

The connections are described below. On the Arduino many of the pins are not changeable. As this device uses the SPI bus, it does not allow switching pins, pins 14,15 and 16 must remain as shown. RST and SDA are user specified.

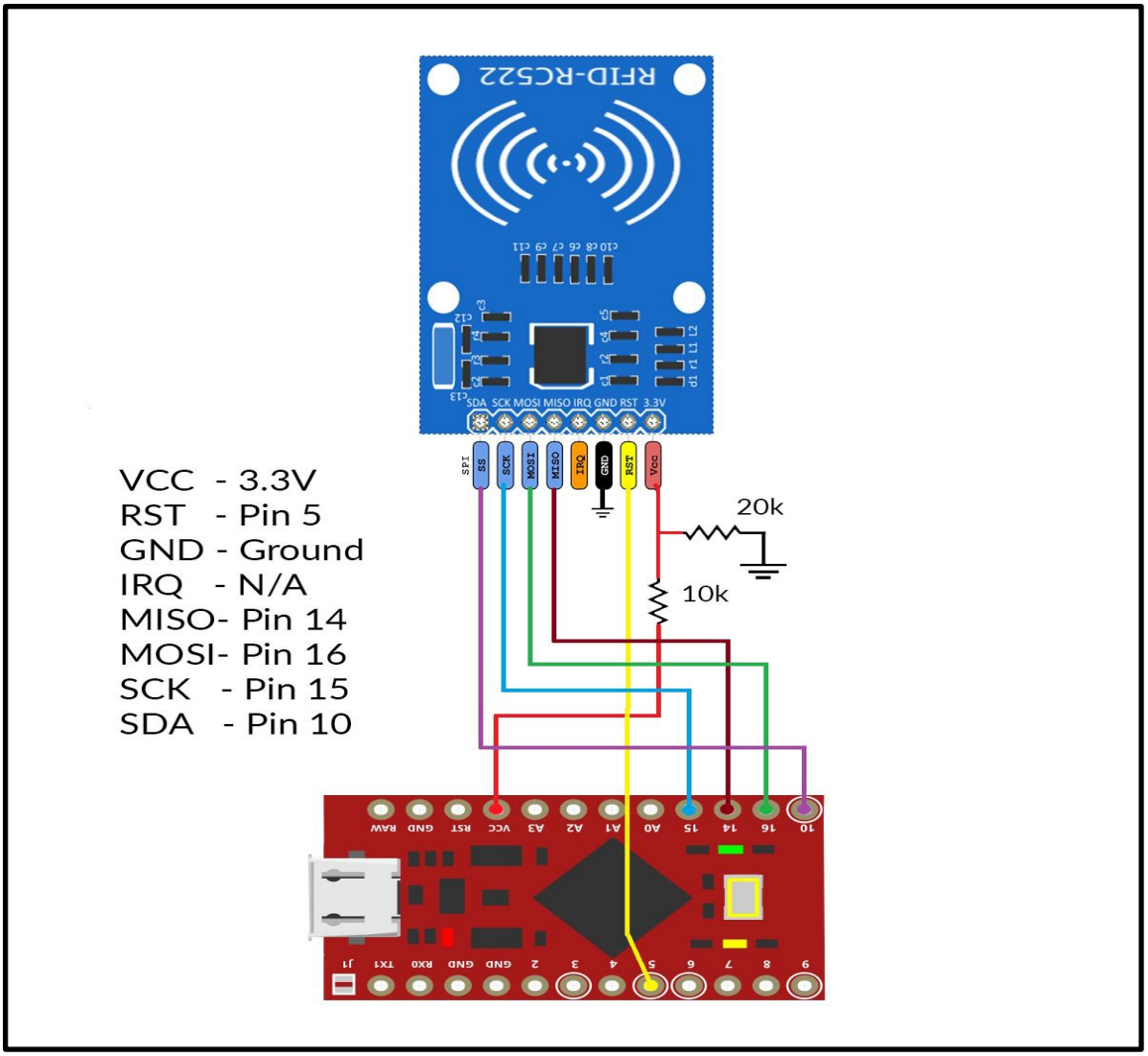

Figure (3.3) : Circuit Diagram

3.4.2 Working:

- The Arduino Leonardo/Micro with the ATmega32u4 chip has a built-in USB communication. This allows the Leonardo/Micro to appear to a connected computer as a mouse or a keyboard.
- We use the keyboard.h core library to make the arduino send the keystrokes to a connected computer.
- The UID of your RFID card/tag and our windows password/PIN is stored in the code.
- When the right card is shown to the RFID reader, the arduino will send keystrokes for locking the windows and your password for unlocking the windows simultaneously.
- If the windows is in a locked state, the keystrokes for locking it won't have any effect and the command will unlock the locked computer.
- Or else if the windows is already unlocked, the commands will lock it. (The unlock code is also coming simultaneously, but as there is only a pinch of a delay between the lock and unlock keystrokes, Windows goes into executing the lock command and will not read the unlock code command coming at that time.)
- Connect the prototype to the computer.
- Launch the Arduino IDE and open the code I've given here.
- From the toolbar go to tools -> Board and Select Arduino Leonardo for both Arduino Pro micro and Arduino Leonardo.
- Check whether the COM port is selected.

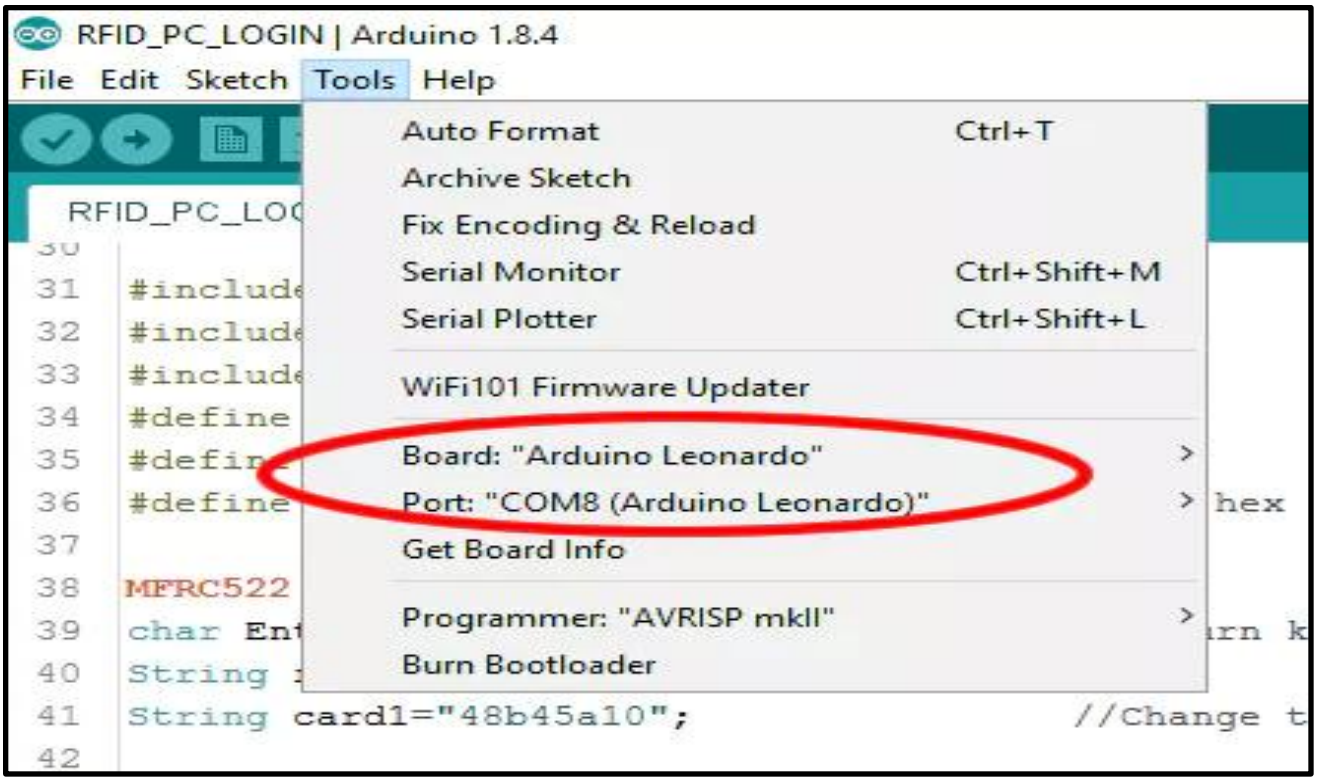

Figure (3.4) : Arduino IDE

- Upload the code to the arduino.
- Open the Serial Monitor (Ctrl+Shift+M).
- Scan your Card/tag.
- The first line of the output shown in the serial monitor is the UID of your card/tag. Note down this value.

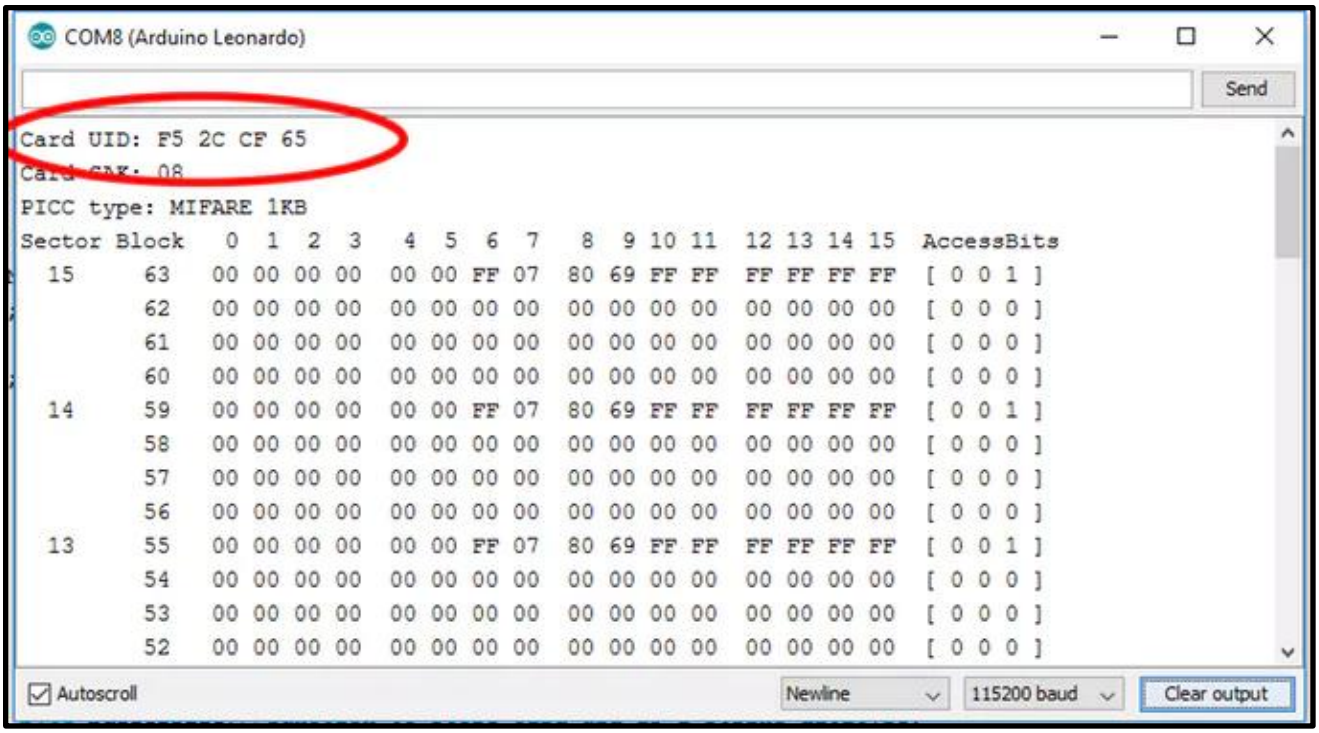

Figure (3.5) : IDE Serial Monitor

- Now go back to the code editor and change the value of string "*card1*" to the UID you've just noted (In my code, you can find it in line 41).
- Go to the last part of the code and you'll find a line which says "*Keyboard.print("PASSWORD");*" (Line number 80 in the code.). Change this value to your windows unlock code.
- Now upload the modified code into the arduino..

CHAPTER 4: RESULTS

4.1 Circuit Output:

4.1.1 Breadboard Implementation:

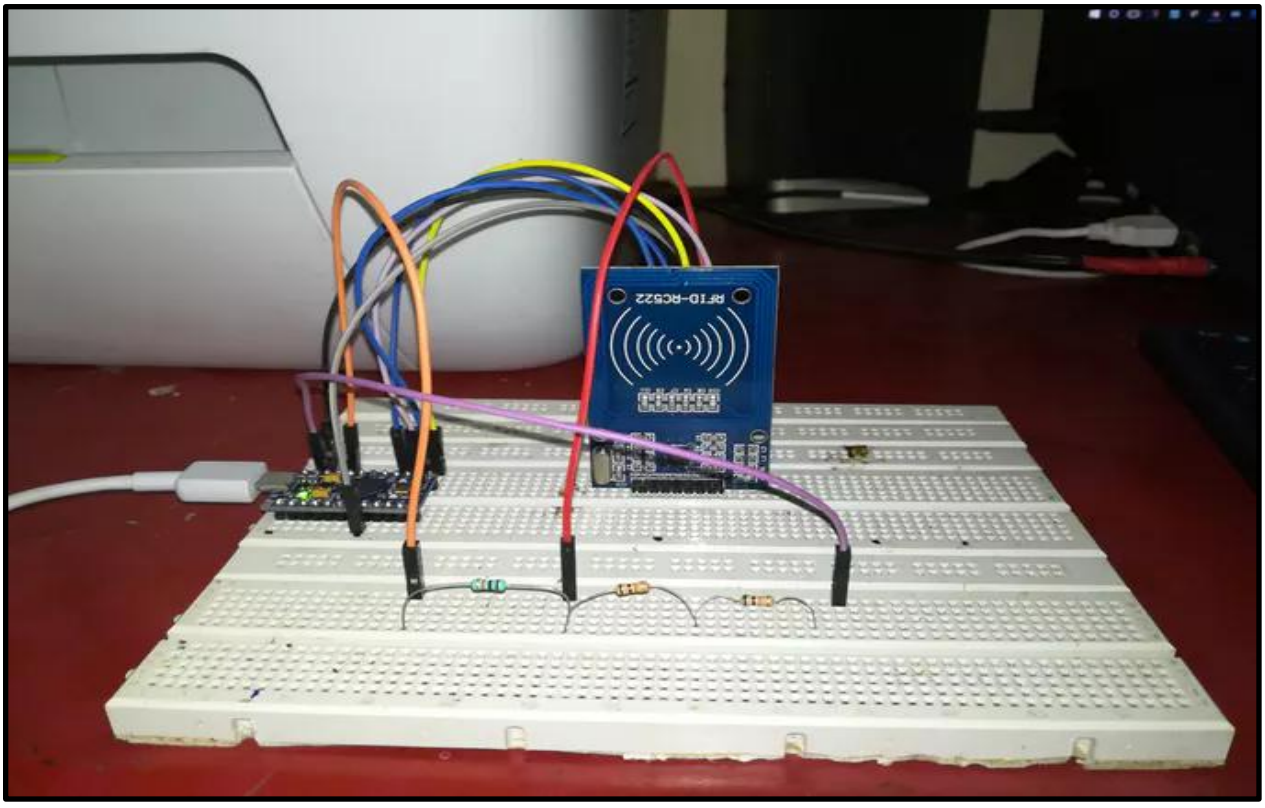

Figure (4.1) : Breadboard Implementation

4.1.2 Final Prototype:

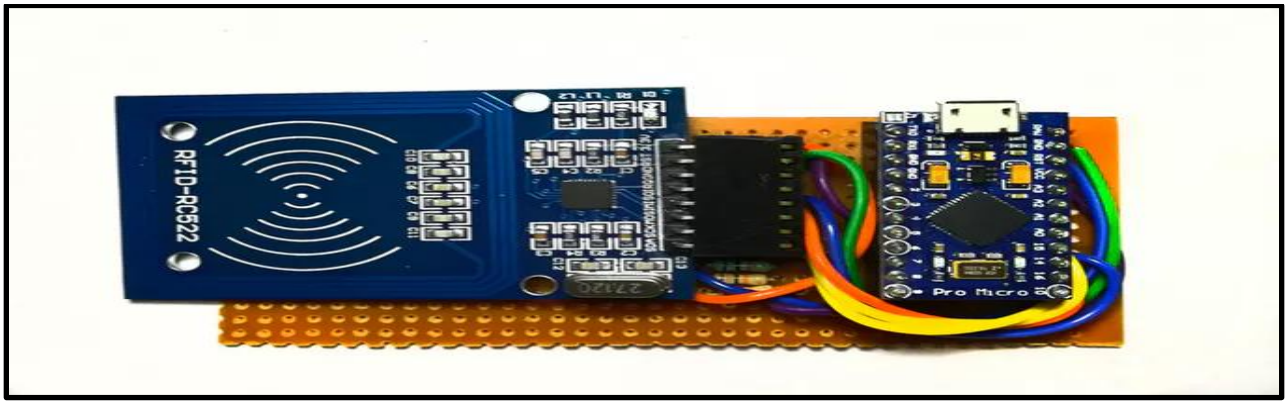

Figure (4.2) : Final prototype

4.1.3 WINDOW PC in LOCK mode:

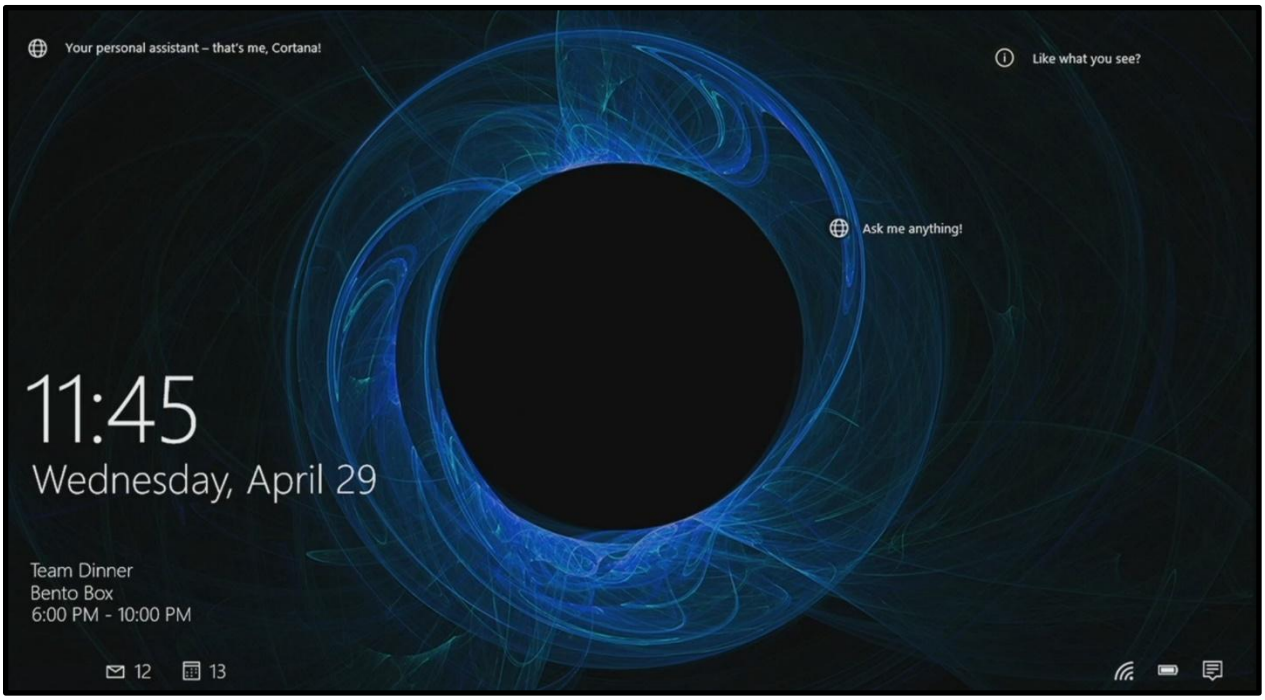

Figure (4.3) : Lock mode

4.1.4 WINDOW PC in UNLOCK mode:

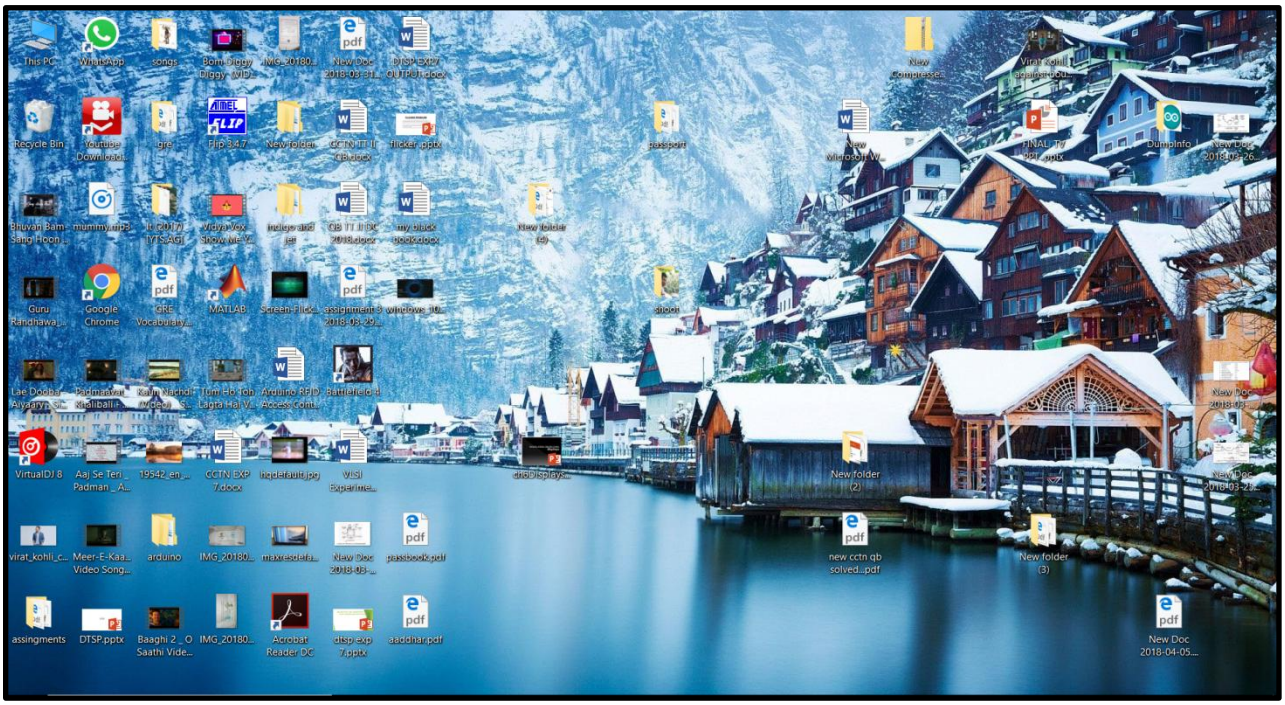

Figure (4.4) : Unlock mode

4.2 Observation:

From the above image we can observe that,

- Whenever user want to Unlock the PC, user will flick the Authenticated RFID tag and PC will unlock and will glow Green LED as an Acknowledgement.
- Whenever user want to Lock the PC, user will flick the Authenticated RFID tag and PC will unlock with concept of Pressing WINDOWS KEY+L and will glow Green LED as an Acknowledgement.
- If any Unauthenticated user attempts to lock/unlock the PC, system will alert the user with glow of Red LED and a Buzzer.

Hence, we can Lock or Unlock the PC using RFID.

CHAPTER 5: CONCLUSION

5.1 Conclusion:

Hence, by designing this system we are using the power of RFID and Arduino Micro as HID keyboard which provides following advantages.

- No need of typing the password or Pin any more.
- It save the power to a great extent.
- Easy to operate the System.
- Cheaper as compared to Fingerprint sensor and other available systems.
- Mostly compatible with all existing Windows systems.

REFERENCE

Websites:

- https://github.com/NicoHood/HoodLoader2
- https://support.microsoft.com/en-in/help/12445/windows-keyboard-shortcuts
- https://www.arduino.cc/en/Guide/ArduinoLeonardoMicro

Paper:

- Juan-hua, Zhu; Ang, Wu; Kai, Guo, " PC Lock Software Design Based On Removable Storage Device and Dynamic Password" , 2nd International Conference on Computer Engineering and Technology Journal VOL. 3, year 2010.
- "Windows Growing Security",Published by Vishal Mali in IRJET journal,On March 2016.

DATA SHEET

Appendix A:Arduino Micro

1.Arduino Micro:

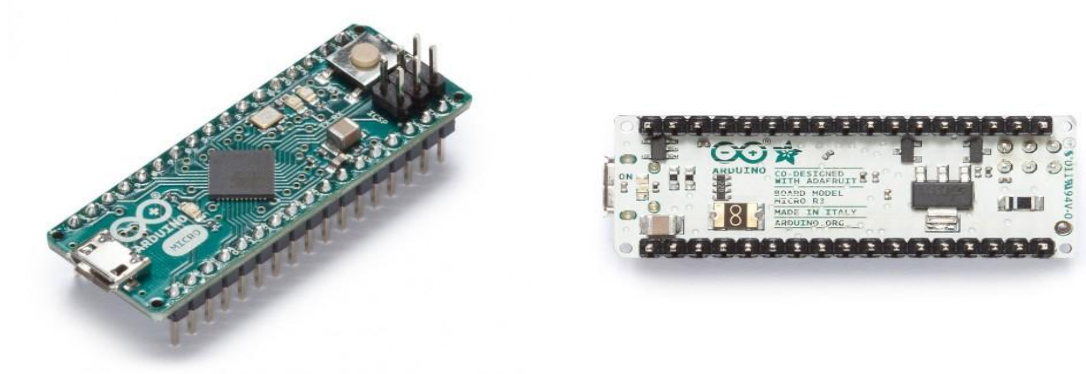

Figure (A1) : Arduino Micro

The Micro is a microcontroller board based on the ATmega32U4 (datasheet), developed in conjunction with Adafruit. It has 20 digital input/output pins (of which 7 can be used as PWM outputs and 12 as analog inputs), a 16 MHz crystal oscillator, a micro USB connection, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a micro USB cable to get started. It has a form factor that enables it to be easily placed on a breadboard.

The Micro board is similar to the Arduino Leonardo in that the ATmega32U4 has built-in USB communication, eliminating the need for a secondary processor. This allows the Micro to appear to a connected computer as a mouse and keyboard, in addition to a virtual (CDC) serial / COM port. It also has other implications for the behavior of the board.

1.1 Features Of Microcontroller ATmega16U4/ATmega32U4:

- • High Performance, Low Power AVR® 8-Bit Microcontroller
- • Advanced RISC Architecture
- – 135 Powerful Instructions
- – Most Single Clock Cycle Execution
- – 32 x 8 General Purpose Working Registers
- – Fully Static Operation

- – Up to 16 MIPS Throughput at 16MHz
- – On-Chip 2-cycle Multiplier
- • Non-volatile Program and Data Memories
- – 16/32KB of In-System Self-Programmable Flash
- – 1.25/2.5KB Internal SRAM
- – 512Bytes/1KB Internal EEPROM
- – Write/Erase Cycles: 10,000 Flash/100,000 EEPROM
- – Data retention: 20 years at 85C/ 100 years at 25C(1)
- – Optional Boot Code Section with Independent Lock Bits In-System Programming by On-chip Boot Program True Read-While-Write Operation Parts using external XTAL clock are pre-programed with a default USB bootloader
- • USB 2.0 Full-speed/Low Speed Device Module with Interrupt on Transfer Completion
- – Complies fully with Universal Serial Bus Specification Rev 2.0
- – Supports data transfer rates up to 12Mbit/s and 1.5Mbit/s
- – Endpoint 0 for Control Transfers: up to 64-bytes
- – Crystal-less operation for Low Speed mode
- • Peripheral Features
- – On-chip PLL for USB and High Speed Timer: 32 up to 96MHz operation
- – One 8-bit Timer/Counter with Separate Prescaler and Compare Mode
- • Operating Voltages – 2.7 - 5.5V
- • Operating temperature – Industrial (-40°C to +85°C)
- • Maximum Frequency – 8MHz at 2.7V
- - Industrial range – 16MHz at 4.5V

1.2 Pinouts:

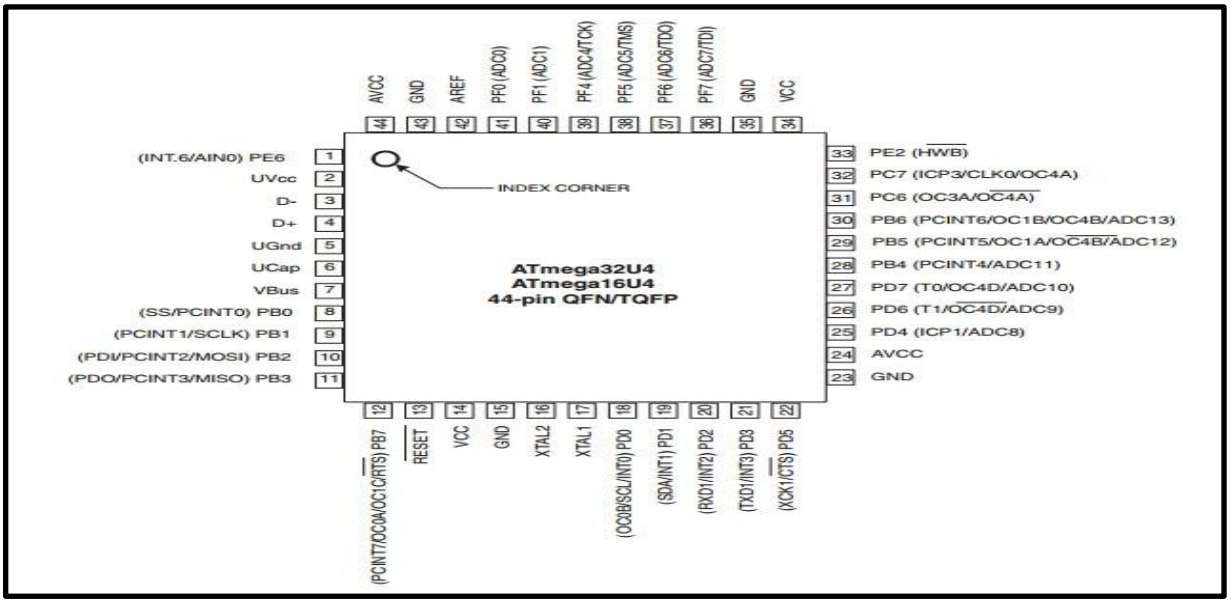

Figure (A2) : Pinning diagram of ATmega32

1.3 Pin Diagram Of Arduino Micro Microcontroller:

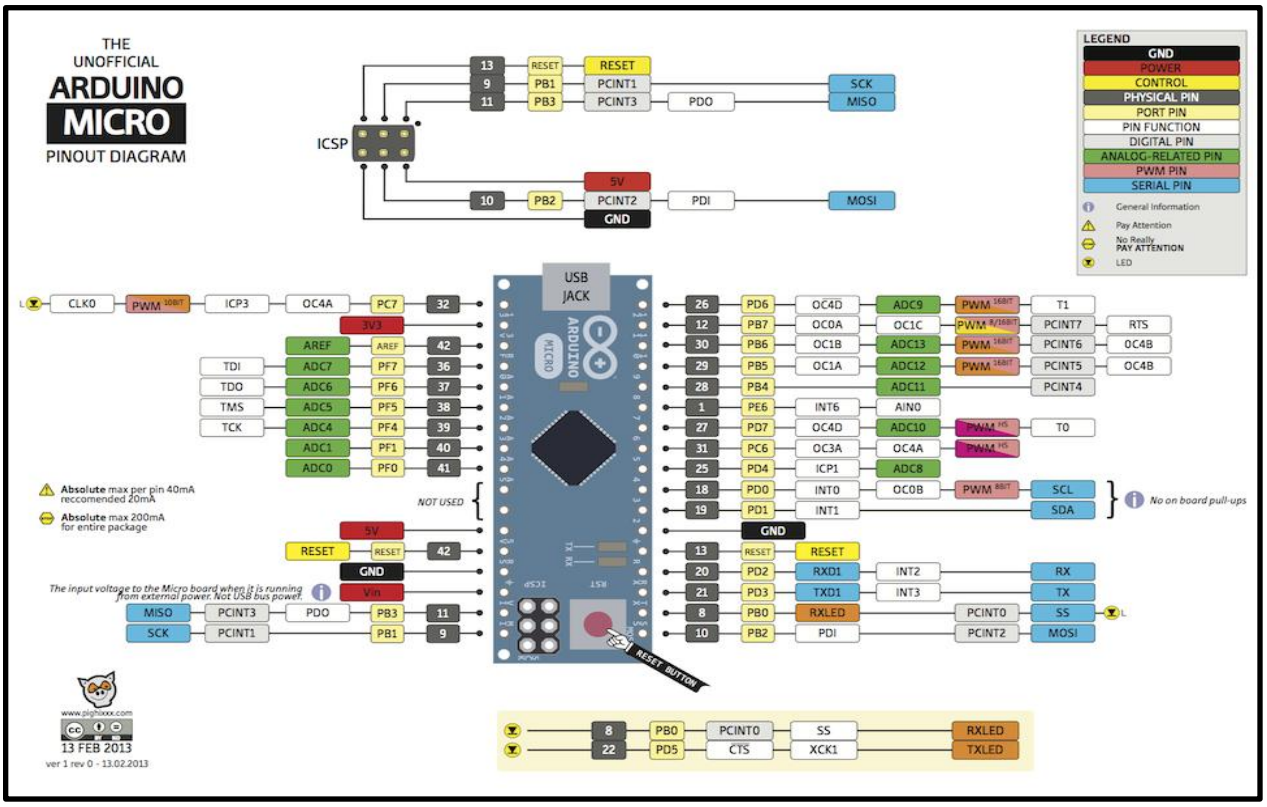

Figure (A3) : Pin diagram of 32u4 Microcontroller

1.4 Description Of 32u4 Controller:

1.4.1 Programming

The Micro board can be programmed with the Arduino Software (IDE). Select "Arduino/Genuino Micro from the Tools > Board menu.

The ATmega32U4 on the Micro comes preprogrammed with a bootloader that allows you to upload new code to it without the use of an external hardware programmer. It communicates using the AVR109 protocol.

You can also bypass the bootloader and program the microcontroller through the ICSP (In-Circuit Serial Programming) header using Arduino ISP.

1.4.2 Warnings

The Micro has a resettable polyfuse that protects your computer's USB ports from shorts and overcurrent. Although most computers provide their own internal protection, the fuse provides an extra layer of protection. If more than 500 mA is applied to the USB port, the fuse will automatically break the connection until the short or overload is removed.

1.4.3 Power

The Micro can be powered via the micro USB connection or with an external power supply. The power source is selected automatically.

External (non-USB) power can come either from a DC power supply or battery. Leads from a battery or DC power supply can be connected to the Gnd and Vin pins.

The board can operate on an external supply of 6 to 20 volts. If supplied with less than 7V, however, the 5V pin may supply less than five volts and the board may become unstable. If using more than 12V, the voltage regulator may overheat and damage the board. The recommended range is 7 to 12 volts.

The power pins are as follows:

VI. The input voltage to the MICRO board when it's using an external power source (as opposed to 5 volts from the USB connection or other regulated power source). You can supply voltage through this pin.

5V. The regulated power supply used to power the microcontroller and other components on the board. This can come either from VIN via an on-board regulator, or be supplied by USB or another regulated 5V supply.

3V. A 3.3 volt supply generated by the on-board regulator. Maximum current draw is 50 mA.

GND. Ground pins.

1.4.4 Memory

The ATmega32U4 has 32 KB (with 4 KB used for the bootloader). It also has 2.5 KB of SRAM and 1 KB of EEPROM (which can be read and written with the EEPROM library).

1.4.5 Input and Output

See the mapping between Arduino pins and ATmega 32U4 ports, and the Pin Mapping of the Arduino Micro:

Each of the 20 digital i/o pins on the Micro can be used as an input or output, using pinMode(),digitalWrite(), and digitalRead() functions. They operate at 5 volts. Each pin can provide or receive 20 mA as recommended operating condition and has an internal pull-up resistor (disconnected by default) of 20-50 k ohm. A maximum of 40mA is the value that must not be exceeded to avoid permanent damage to the microcontroller.
In addition, some pins have specialized functions:

1. Serial: 0 (RX) and 1 (TX). Used to receive (RX) and transmit (TX) TTL serial data using the ATmega32U4 hardware serial capability. Note that on the Micro, the Serial class refers to USB (CDC) communication; for TTL serial on pins 0 and 1, use the Serial1 class.

2. TWI: 2 (SDA) and 3 (SCL). Support TWI communication using the Wire library.
External Interrupts: 0(RX), 1(TX), 2, 3 and 7. These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value. S

3. PWM: 3, 5, 6, 9, 10, 11 and 13. Provide 8-bit PWM output with the analogWrite() function.

4. SPI: on the ICSP header. These pins support SPI communication using the SPI library. Note that the SPI pins are not connected to any of the digital I/O pins as they are on the Uno, they are only available on the ICSP connector and on the nearby pins labelled MISO, MOSI and SCK.

RX_LED/SS This is an additional pin compared to the Leonardo. It is connected to the RX_LED that indicates the activity of transmission during USB communication, but is can also used as slave select pin (SS) in SPI communication.

5. LED: 13. There is a built-in LED connected to digital pin 13. When the pin is HIGH value, the LED is on, when the pin is LOW, it's off.

6. Analog Inputs: A0-A5, A6 - A11 (on digital pins 4, 6, 8, 9, 10, and 12). The Micro has a total of 12 analog inputs, pins from A0 to A5 are labelled directly on the pins and the other ones that you can access in code using the constants from A6 trough A11 are shared respectively on digital pins 4, 6, 8, 9, 10, and 12. All of which can also be used as digital I/O. Each analog input provide 10 bits of resolution (i.e. 1024 different values). By default the analog inputs measure from ground to 5 volts, though is it possible to change the upper end of their range using the AREF pin and the analogReference() function.

There are a couple of other pins on the board:

7. AREF. Reference voltage for the analog inputs. Used with analogReference().

Reset. Bring this line LOW to reset the microcontroller. Typically used to add a reset button to shields which block the one on the board.

1.4.6 Communication

The Micro has a number of facilities for communicating with a computer, another board of the Arduino & Genuino family, or other microcontrollers. The 32U4 provides UART TTL (5V) serial communication, which is available on digital pins 0 (RX) and 1 (TX). The ATmega32U4 also allows for serial (CDC) communication over USB and appears as a virtual com port to software on the computer. The chip also acts as a full speed USB 2.0 device, using standard USB COM drivers. On Windows, a .inf file is required . The Arduino Software (IDE) includes a serial monitor which allows simple textual data to be sent to and from the board. The RX and TX LEDs on the board will flash when data is being transmitted via the USB connection to the computer (but not for serial communication on pins 0 and 1).

A SoftwareSerial library allows for serial communication on other Micro's digital pins.

The ATmega32U4 also supports I2C (TWI) and SPI communication. The Arduino Software (IDE) includes a Wire library to simplify use of the I2C bus For SPI communication, use the SPI library.

The Micro appears as a generic keyboard and mouse, and can be programmed to control these input devices using the Keyboard and Mouse classes.

1.4.7 Physical Characteristics

The maximum length and width of the Micro PCB are 4.8cm and 1.77cm respectively, with the USB connector extending beyond the former dimension. The layout allows for easy placement on a solderless breadboard..

1.4.8 Automatic (Software) Reset and Bootloader Initiation

Rather than requiring a physical press of the reset button before an upload, the Micro board is designed in a way that allows it to be reset by software running on a connected computer. The reset is triggered when the Micro's virtual (CDC) serial / COM port is opened at 1200 baud and then closed. When this happens, the processor will reset, breaking the USB connection to the computer (meaning that the virtual serial / COM port will disappear). After the processor resets, the bootloader starts, remaining active for about 8 seconds. The bootloader can also be initiated by pressing the reset button on the Micro. Note that when the board first powers up, it will jump straight to the user sketch, if present, rather than initiating the bootloader.
Because of the way the Micro handles reset it's best to let the Arduino Software (IDE) try to initiate the reset before uploading, especially if you are in the habit of pressing the reset button .

Appendix B :MFRC522 RFID

2. MFRC522 (RFID) module Data Sheet:

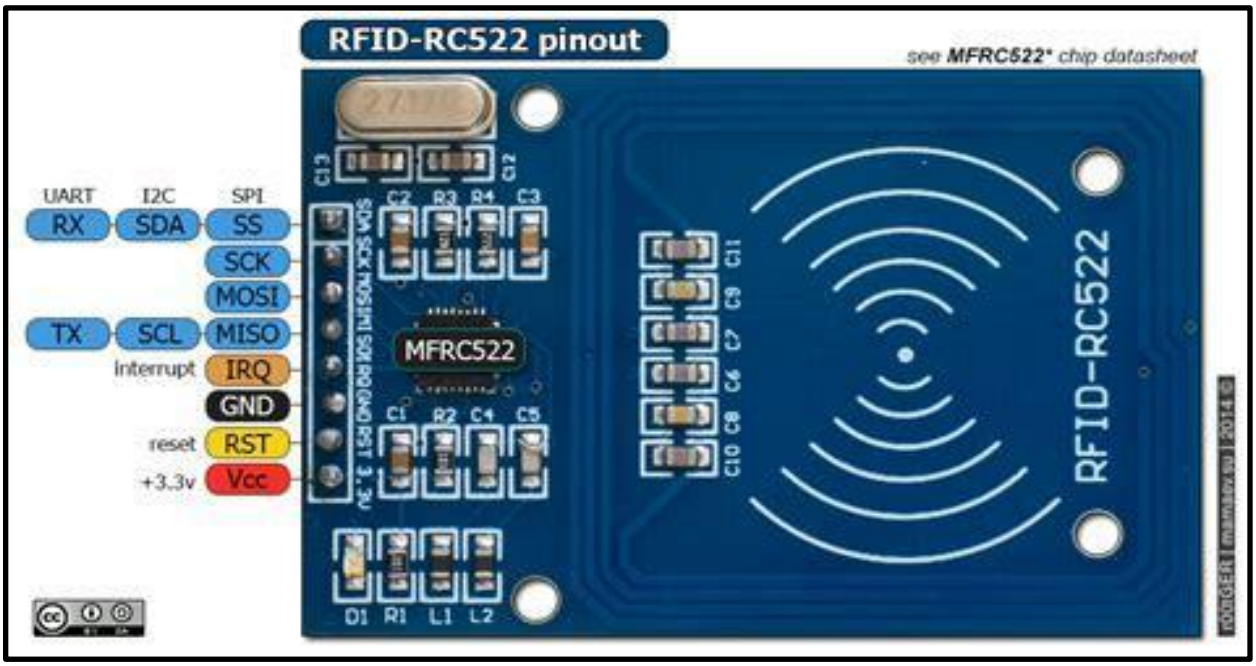

Figure (B1) : RFID MODULE pinout

2.1 General Description:

The MFRC522 is a highly integrated reader/writer for contactless communication at 13.56 MHz. The MFRC522 reader supports ISO 14443A / MIFARE® mode.

The MFRC522's internal transmitter part is able to drive a reader/writer antenna designed to communicate with ISO/IEC 14443A/MIFARE® cards and transponders without additional active circuitry. The receiver part provides a robust and efficient implementation of a demodulation and decoding circuitry for signals from ISO/IEC 14443A/MIFARE® compatible cards and transponders. The digital part handles the complete

ISO/IEC 14443A framing and error detection (Parity & CRC).The MFRC522 supports MIFARE®Classic (e.g. MIFARE® Standard) products. The MFRC522 supports contactless communication using MIFARE® higher transfer speeds up to 848 kbit/s in both directions.

Various host interfaces are implemented:

- SPI interface
- serial UART (similar to RS232 with voltage levels according pad voltage supply) • I^2C interface.

2.2 Features:

- Highly integrated analog circuitry to demodulate and decode responses
- Buffered output drivers to connect an antenna with minimum number of external components
- Supports ISO/IEC 14443A / MIFARE®
- Typical operating distance in Reader/Writer mode for communication to a ISO/IEC 14443A / MIFARE® up to 50 mm depending on the antenna size and tuning
- Supports MIFARE® Classic encryption in Reader/Writer mode
- Supports ISO/IEC 14443A higher transfer speed communication up to 848 kbit/s ④ Support of the MFIN / MFOUT
- Additional power supply to directly supply the smart card IC connected via MFIN / MFOUT
- Supported host interfaces
- SPI interface up to 10 Mbit/s
- I^2C interface up to 400 kbit/s in Fast mode, up to 3400 kbit/s in High-speed mode
- serial UART in different transfer speeds up to 1228.8 kbit/s, framing according to the RS232 interface with voltage levels according pad voltage supply

2.3 Block Diagram:

The Analog interface handles the modulation and demodulation of the analog signals.The contactless UART handles the protocol requirements for the communication schemes in cooperation with the host. The comfortable FIFO buffer allows a fast and convenient data transfer from the host to the contactless UART and vice versa.Various host interfaces are implemented to fulfil different customer requirements.

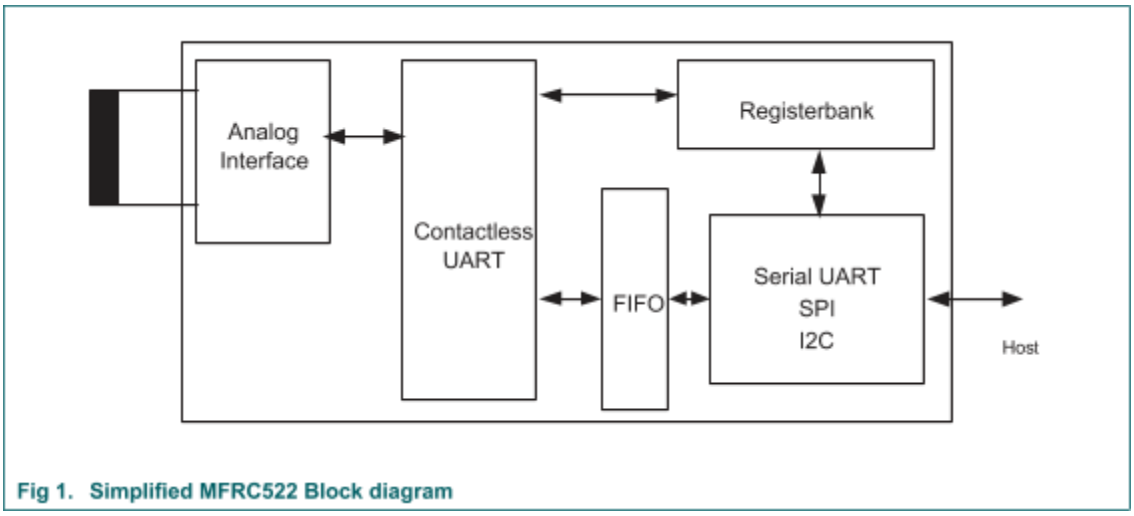

Fig 1. Simplified MFRC522 Block diagram

Figure (B2) : MFRC522 block diagram

2.4 PIN Description:

I^2C	1	I	I2C enable
PVDD	2	PWR	Pad power supply
DVDD	3	PWR	Digital Power Supply
DVSS	4	PWR	Digital Ground
PVSS	5	PWR	Pad power supply ground
NRSTPD	6	I	Not Reset and Power-down: When LOW, internal current sinks are switched off, the oscillator is inhibited, and the input pads are disconnected from the outside world. With a positive edge on this pin the internal reset phase starts.
MFIN	7	I	Mifare Signal Input
MFOUT	8	O	Mifare Signal Output
SVDD	9	PWR	MFIN / MFOUT Pad Power Supply: provides power to for the MFIN / MFOUT pads
TVSS	10, 14	PWR	Transmitter Ground: supplies the output stage Tx.