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Smart Card System using NFC

E.Kavitha[1] | K.Tarangini[2] | H.Roopak[3]

[1,2,3] Assistant Professor, Department of ECE, VJIT, Hyderabad, India.
[3]UG Student, Department of ECE, VJIT, Hyderabad, India.

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ABSTRACT

A novel attendance system for members of the industry using NFC (Near Field Communication) is proposed. This work uses NFC readers to read the NFC cards. The system was built using Arduinouno. ATMEGA328 microcontroller is heart of entire system for which PN532 (NFC module) is interfaced and then a buzzer sound is given uniquely to differentiate the cards and 16x2 LCD is also interfaced for the purpose of display.

*The system was tested on three group of workers with three sets of NFC cards. Results shown that the system was accurate and operational. This system uses NFC module (PN532), microcontroller Arduino UNO (ATMEGA328), 5V regulated supply, 16*2 LCD display, Buzzer and relay circuit.*

Keywords-*PN532 NFC module, Arduinouno ATMEGA 328, Near field communication*

I. INTRODUCTION

Attendance of the workers in the industry is a big task and to motivate them to come in punctual is also an issue for the management. In olden days manual attendance by signing in the attendance register was a time taking process. Later system was bundy clock, in which every employee has a punch card when he slot into the bundy clock, the bundy clock will print the date, time in and time out onto the punch card. Now, in the biometric attendance system, the unique finger print pattern of the employee is recognized by the system. The next one is a smart card attendance system in which, each employee is issued with a contactless RFID/NFC card which stores information about the employee. The employee will scan the card over a reader which reads the employee information and transmit to the database. In this work, using NFC card the group of employees can be Recognized with three different sets of NFC cards. These NFC tags are designed just like a RFID tag to be used at 13.56 MHz. When employee tag is brought near to the NFC reader, both are inductively coupled resonance at 13.56MHz as shown in fig.1. During the operation, other communication frequencies are disabled which allows very fast communication between coupled resonances.

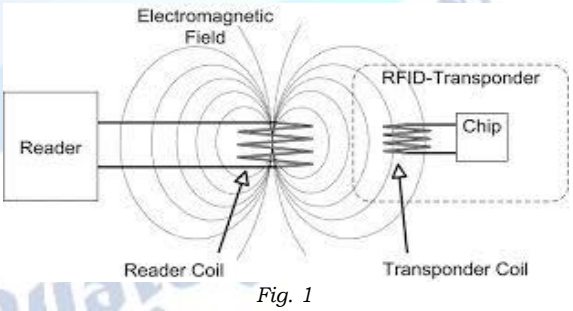

Fig. 1

In this work, the NFC Shield PN532 (which is equipped with an antenna of 10cm range at 13.56 MHz including micro controller functionality based on 80C51 core) is used to read the tag ID's. This shield supports to use I2C or SPI communication protocols. The data is transmitted with a rate of 106, 212 or 424kb/s within the distance of 10 cm range

II. System Introduction

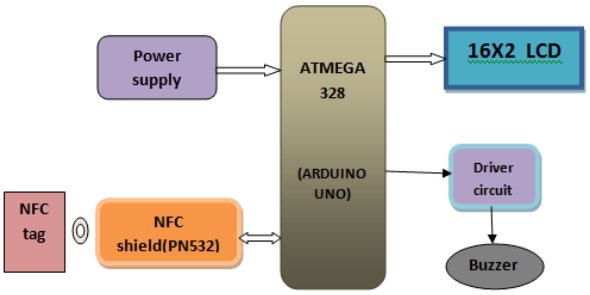

Fig 1: Block diagram of project module

The major modules in our project is NFC shield(PN532) and ArduinoUNO

PN532

The PN532 is a highly integrated transmission module for contactless communication at 13.56 MHZ including micro-controller functionality based on an 80C51 core. The transmission module utilizes an outstanding modulation and demodulation concept completely integrated for different kind of passive contactless communication methods and protocols at 13.56 MHZ..

To make information exchange to the host systems several interfaces are implemented:

- SPI interface
- I^2C interface
- Serial UART (similar to RS232 with 0 and PVDD voltage levels)

The PN532 embeds a low dropout voltage regulator allowing the device to be connected directly to a battery as well as a medium power switch to supply and control the power of the companion secure chip.

Arduino

- Arduino is an open-source prototyping platform based on easy-to-use hardware and software.
- Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message and turn it into an output - activating a motor, turning on an LED, publishing something online.
- These systems provide sets of digital and analog I/O pins that can interface to various expansion boards (termed shields) and other circuit.

Arduino provides an integrated development environment(IDE) based on a programming language named Processing, which also supports the languages C and C++.

Basically, the processor of the Arduino board uses the Harvard architecture where the program code and program data have separate memory. It consists of two memories such as program memory and data memory. Wherein the data is stored in data memory and the code is stored in the flash program memory.

The Atmega328 microcontroller has 32kb of flash memory, 2kb of SRAM 1kb of EPROM and operates with a 16MHz clock speed.

The ATmega328 on the Uno comes preprogrammed with a boot loader that allows you to upload new code to it without the use of an external hardware programmer. It communicates using the original STK500 protocol

Connect the circuit for respective pins which are given below

1. NFC shield pin connections to Arduino
   1. SCK-D13
   2. MISO-D12
   3. MOSI-D11
   4. SS-D10
   5. GND-GND
   6. VDD-VDD or +5v

2. LCD pin connections to Arduino
   1. Pin 10 (D4)-D4
   2. Pin 11(D5)-D5
   3. Pin 12(D6)-D6
   4. Pin 13(D7)-D7
   5. Pin 3(RS)-D8
   6. Pin 5(RW)-D9
   7. Pin 0,15-GND
   8. Pin 1,14-VDD or +5v

3. Potentiometer connections to Arduino
   1. ground pin -D2
   2. input pin-VDD or +5v
   3. output pin-GND

III. System Implementation

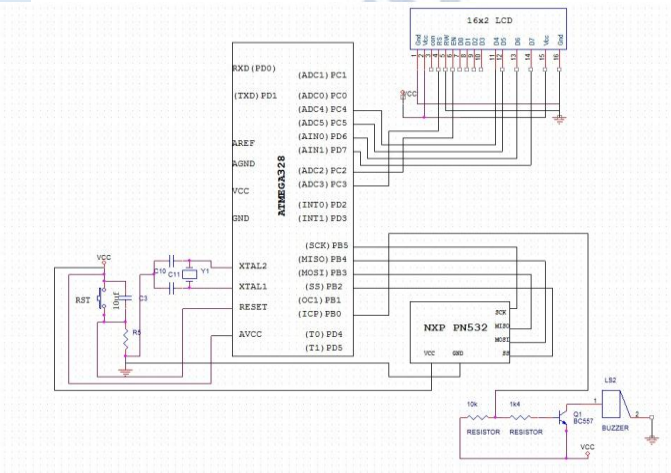

Fig 2: Circuit Diagram

4. Connect Arduino pin D8 to base of the transistor

A. FLOW CHART:

Our Concept for our program would group the NFC ID in to three groups and separate each group with the melody

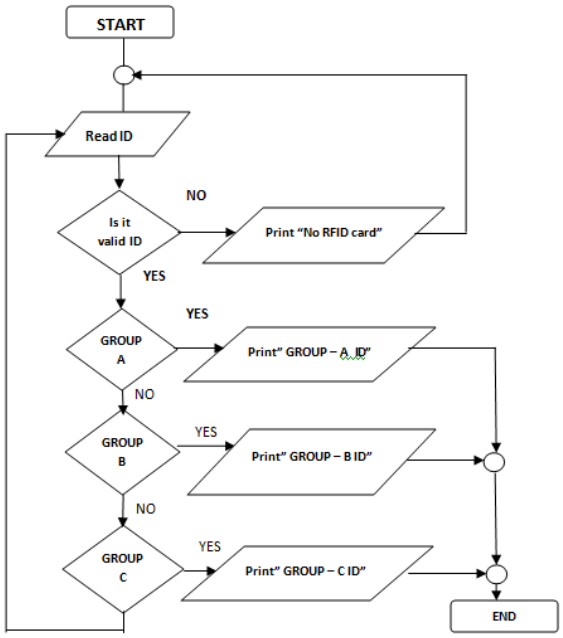

Fig 3: Working Flow Chart

The software would read the NFC ID from the NFC card, and then it checks ID which it belongs to. Then Play the melody corresponding to each group of the ID that had been read. On LCD, It also displays the ID of NFC card.

IV. EXPERIMENT RESULTS

a) when we apply 0 volts or when we off the power supply, we will not get any beep sound and display

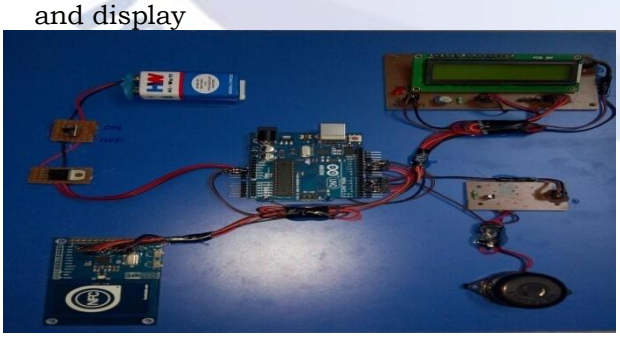

Fig 4: When no power is supplied

b) when we power on the supply we will have display on LCD screen (i.e. no RFID card is placed), we won't get any beep sound

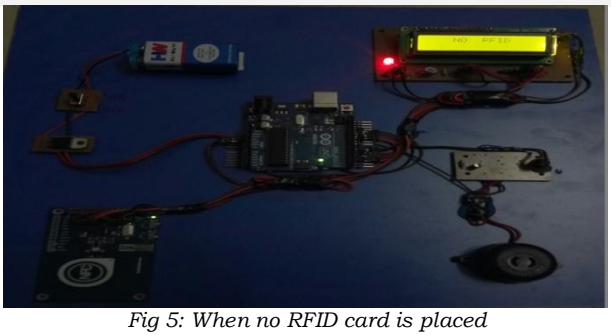

Fig 5: When no RFID card is placed

c) when place a RFID card or NFC tag on the NFC shield then we will get display on LCD screen and we also get respective beep sounds

1. When we place 'group A' RFID card then it will display the group of the RFID card and RFID card ID (849881894), we get one beep sound for card

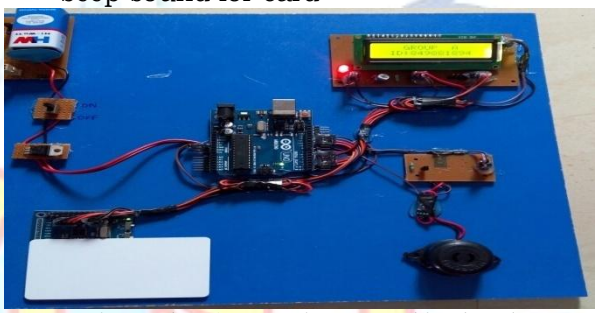

Fig 6: When 'Group A' RFID card is placed

2. When we place 'group B' RFID card then it will display the group of the RFID card and RFID card ID (1914927150), we get two beep sounds for card B.

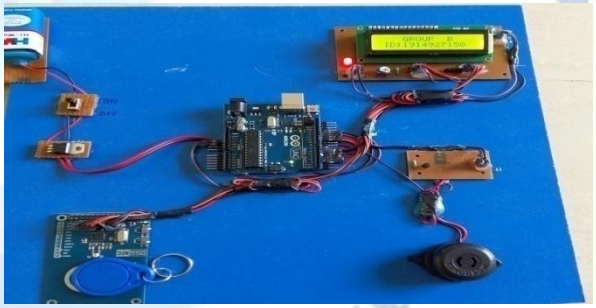

Fig 7: When 'Group B' RFID card is placed

3.When we place 'group C' RFID card then it will display the group of the RFID card and RFID card ID (1653057202), we get three beep sounds for card

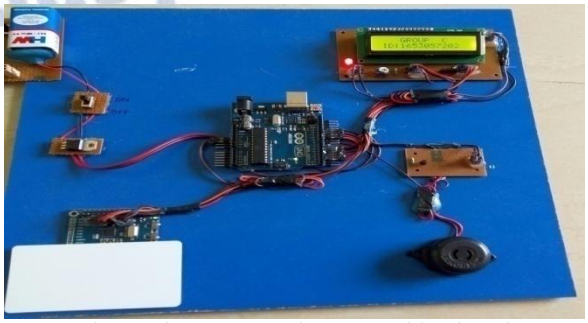

Fig 8: When 'Group C' RFID card is placed

V. APPLI CATIONS

a. Build visiting card sharing system.
b. Build attendance systems
c. Design authentication systems
d. Read Smart Posters
e. Securely exchange small data with other NFC devices
f. Use with Arduino ADK Main Board for creating mobile NFC applications.
g. It could be used as your bus or train ticket
h. It can help with the problem of bills
i. It can remember passwords for you
j. Family and friends file sharing
k. Build attendance systems
l. Smart band system
m. Driving
n. Smart payment system

VI. CONCLUSION

This paper has proposed a design of NFC card system, as main module of design PN532 and Arduino were introduced respectively. The main aim of the paper is to read ID of the NFC tag and separate the tags based on their ID's as A, B, C and play melody sound according to it, which can be used in many applications like office entry, attendance system Etc. In place of LCD and Speaker we can use different modules for different application

The significant advantage of all types of NFC systems is the non-contact, non-line-of-sight nature of the technology. Tags can be read through a variety of substances such as snow, fog, ice, paint. Hence, this project can be very much useful and can be implemented in real time applications

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