Smart Student Detector

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This report is presented in Partial Fulfillment of the Requirement for the Degree of bachelor of science in Computer science and engineering

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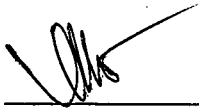Daffodil International University

DAFFODIL INTERNATIONAL UNIVERSITY

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APPROVAL

This Project/internship titled **"Smart Student Detector"**, submitted by Foysal Ahmed, ID No: 152-15-5738; Tanvir Anjum, ID No: 151-15-5158; Nadim Mahmud, ID No: 152-15-5772; Hasan Ahmed Khan, ID No: 152-15-5587 to the Department of Computer Science and Engineering, Daffodil International University has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of B.Sc. in Computer Science and Engineering and approved as to its style and contents. The presentation has been held on 2nd May 2019.

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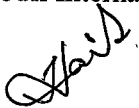Faculty of Science & Information Technology
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We hereby declare that, this project has been done by us under the supervision of Fahad Faisal, Senior lecturer, Department of Computer Science and Engineering, Daffodil International University.

We also declare that neither this project nor any part of this project has been submitted else where for award of any degree or diploma.

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Finally, we must acknowledge with due respect the constant support and patience of our parents.

Abstract

This project aims at making a student ID card smart and efficient. The whole world is moving towards smart era. Everything is becoming smart even the micro oven in our home is smart.

We're entering a new era of computing technology that many are calling the Internet of Things (IoT). Machine to machine, machine to infrastructure, machine to environment, the Internet of Everything, the Internet of Intelligent Things, intelligent systems—call it what you want, but it's happening, and its potential is huge. We see the IoT as billions of smart, connected "things" (a sort of "universal global neural network" in the cloud) that will encompass every aspect of our lives, and its foundation is the intelligence that embedded processing provides Keeping these phenomena in mind the authors of this project took initiative to make school/college/University environment smart. Primarily this project targets Daffodil International University but it can be implemented in various places and environments. The creativity of this new era is boundless, with amazing potential to improve our lives. The following thesis is an extensive reference to the possibilities, utility, applications and the evolution of the Internet of Things.

Raspberry Pi is used as the heart of this project. RFID technology is implemented to smartly recognize students.

TABLE OF CONTENTS

Contents	PAGE

CHAPTER

iv

List of Figure

List of Table

Chapter 1

Introduction

1.1 Introduction

The project "IoT Based Smart Student Detector" is a state of the art project which aims to make a educational institute smart, efficient and helpful for the authority. In reality this is a very big project which has numerous numbers of module. This project is a cool circuit and opens up a wide range of different projects from using it as attendance system and detect student information. The RFID RC522 is a very low - cost MFRC522-based RFID reader and writer. This microcontroller affords its statistics through the spi procedure and works by constructing a 13.56mhz radiofrequency field that it deploys to transmit with the RFID tag. We will show how to wire up the RFID RC522 as well as how to write Python scripts to interact with the chip so that we can both read and write were RFID tags. We are also using Raspberry pi to show some information to the user.

1.2 Motivation

The reasons for making this project are for student safety. Many parents are job holder and they are thinking about if their child go out in the school. This system can be a solution of this problem. This system ensures student safety. Besides our future plan are convert this project to attendance system, send parents message about their child information.

We also want to digitalize the school system with safety and make the whole process smarter than today. We are trying to reduce the time consuming things out of the class and the teachers can spend their full time to teach the students.

1.3 Objective

Every project need to have some objectives. Without any objective no project cannot be done. Our project also has 2 major objects.

- Smart attendance system.
- Make the education system more efficiencies.
- Ensure student safety.
- Reduce time wasting things during class.

If the project is used, then the attendance of the student can be taken very easily. It will give efficient service to the authority.

1.4 Expected outcomes

The project has several outcomes which are very beneficial for the educational institution.

- Detect Students
- Ensure Student safety
- Easy Attendance system

The full system runs automatically after implementing this. When students come to the school RFID tag automatically detect the student & store the student information in the database. The authority has nothing to do like checking or take attendance manually. When student leave the school the system automatically detect this student & keep record this data.

1.5 Report Layout

The whole project report is made up of six chapters, references. Below is a short summary of the chapters**.**

- ❖ Chapter 1 deals with the introduction, motivation, objectives and expected outcomes of the project.
- ❖ Chapter 2 first discusses the introduction to IoT, then comparative studies, the scope of the problem and challenges.
- ❖ The requirements are discussed in Chapter 3. The business process model (BPM), the analysis of requirements, the logical data model and other requirements will be discussed.
- ❖ Chapter 4 deals with design in which all the hardware and software tasks are discussed.
- ❖ Appropriate screenshots and specifications for implementation and testing are shown in Chapter 5.
- ❖ Chapter 6 concludes with suggestions for conclusion and further development.
- ❖ Appendix A concerns the project's hardware configuration.
- ❖ Appendix B concerns the project's software configuration.

Chapter 2

Background

2.1 Introduction

Internet of Things (IoT) is the networking of physical objects containing electronics embedded in their architecture for the purpose of communicating and sensing interactions between themselves or with regard to the external environment. IoT - based technology will offer advanced service levels in the coming years and will virtually change the way people lead their daily lives. Advancements in medicine, power, gene therapies, agriculture and smart homes are just a very few of the categorical examples where IoT is strongly established [1].

As this smart interconnectivity between the real world and the digital world is called, the Internet of Things (IoT) will quickly transform every aspect of how we work and do business. Businesses are able to transform their industry significantly by connecting apps with their integrated systems: almost 90 percent of all data generated by tablets, smartphones or connected appliances is never used today. Imagine we could change that. Picture we may utilize certain statistics to manufacture erudite instruments and interlinked infrastructures or sevices that must permit we to streamline and quicken wer commercial pathways [2].

Trillions of connectivity handsets manufacture terabytes of material, there is a want for heavy - productivity networks to decode these statistics and provide possible service. Worldwide robotics rulers supply publishers with networks to optimize the applicability of internet of things.

Here is the figure below. It is a prediction of the use of IoT devices in next few years.
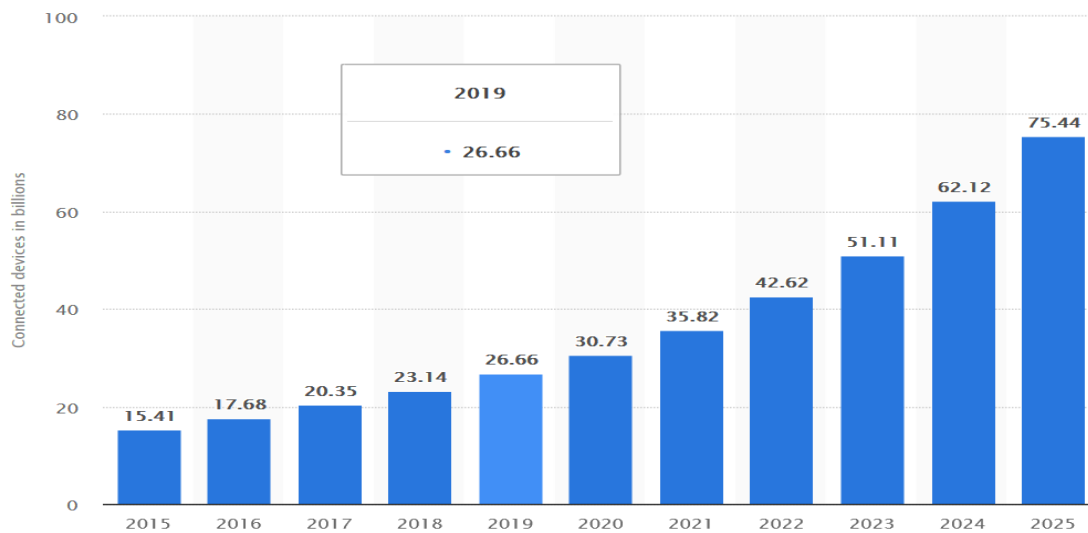

Figure 2.1: Prediction of the use of IoT devices in next few years [3].

2.2 Literature review

We reviewed various number of paper before starting this project. Some IoT based paper like smart lock, Restaurant technology system etc. Summary of the papers are given below-

Smart Locks: Lessons for Securing Commodity Internet of Things Devices.

Authors: Grant Ho, Derek Leung, Pratyush Mishra, Ashkan Hosseini, Dawn Song, David Wagner

Idea: Authors examined the safety of smart home locks that can be controlled electronically by mobile devices or remote servers from the lock manufacturer. Two categories of attacks on smart locks are presented and analyzed with respect to these attacks the security of commercially available locks [4].

Restaurant Technology Systems

Author: Frederick DeMicco, Cihan Cobanoglu, Joseph Dunbar, Robert Grimes, Chen Chen, James R Keiser

Idea: This is a Restaurant Management chapter: A Book on Best Practices Approach. Authors discussed how restaurants could benefit from RFID [5].

RFID based Attendance System

Author: Prof. K.K. Pandey, Snehal Shivaji Dumbre, Ketaki Arvind Kulkarni, Janhavi Raju Raikar, Vrushali Nandkumar Uplekar

Idea: When the RFID reader detects the ID card, it sends the unique card no via serial terminal to the microcontroller. With the help of appropriate programming, we need to compare the received card number with the numbers already stored in the microcontroller or any database. Once, if any of these numbers match the received card number, the corresponding name stored in that number will be recorded in the system and the attendance for the name stored in the corresponding number will also be marked [6].

RFID based student monitoring and attendance tracking system

Author: Chatrati Sai Krisha, Naidu Sumanth, C. Raghava Prasad.

Idea: This projects describes a prototype development of maintain the record of all the students titled RFID based Tracking & Attendance with GSM Module exclusively catering the need of teachers [7].

2.3. Comparison

There are a project in our country like this named "Smart ID Card" which is recently started by Cambrian School. Both of this project based on RFID smart card theory but there is some difference between them. The Cambrian's project instrument mainly a phone type smart card which can able to detect student, make some call, can use sim card with limitation. There is some

6

costing fact in there. Some complex things are present to activate the Cambrian smart card and a little bit complex for some parents.

On the other side, we are trying to keep this id card as simple as we can and keep all the operation to our side. So that parents & student have no things to do. The student simply wears the ID card as usual and come to the school, and after the class he will return to the home. The RFID will detect his coming to school and go back to home and store information. We are using just the RFID tag in the card. Not using any complex model that can be a problem for both student and parents. Keeping the smart ID card with low price range. So many school can be implementing this project for safety their students.

2.3 Scope of problem

This project has a huge scope. The detector module is not only for educational institution; it can be implemented other places too. This project can be used in factories, hospitals or any type of offices. Currently Daffodil International University is using RFID based student ID cards. So there is a huge scope to implement these modules here.

2.4 Challenges

There are some challenges we have faced-

1. Distance measurement between RFID tag and RFID reader.
   - The main challenge is distance measurement. If the student enter the school far distance from the RFID reader some RFID module don't detect the student because many RFID has lowest distance limit.
2. Cost minimization.
   - When we try to build the system we have to think about the cost of the hardware requirements. Costs include training in hardware & software as well as the continuously high cost of maintaining and upgrading infrastructure. RFID reader requires not only tags and readers, but also additional database servers. The total cost difference can be real if all equipment and students are tagged.

3. Read & write operation during detect the card.
4. Privacy concern.
   - The benefits of using RFID are only when the student is confident that the data being transmitted will not be misused. When a RFID tag is associated with a student card, it contains the unique identification number associated with any type of personal information, such as student name, ID.
5. Finding suitable RFID reader model.

Chapter 3

Requirements for Proposed System

3.1. Business Processing Model

We are using a raspberry pi 3 for implementing this project. As we want to detect the student is passing through the gate or not, we need a gadget for this detection. After some searching we have found that RFID will be the best option. So we are implementing the RFID tag to the student's ID card. There are also a RFID reader connect to the raspberry pi, which detects the RFID tag, and also counted the student information. We are setting the system beside the institute gate and when the student passes the gate in the class time or before ending the time period, the RFID reader detect the student and warn everybody by starting an alarm.

3.2. Requirement Analysis

In this section we will identify the requirements for our project for implementing this system in school or any institute. Our project is for student safety during the school time. So we focused on how accurately we detect the student's movement when crossing the gate. The full system is automatic and the authority just have to set up the system in the gate.

1.We use Raspberry pi 3 as the main element for our project. The other elements will be assembled with Raspberry pi. We install Raspbian OS in the Raspberry pi.

2.The other most important equipment are RFID tag and RFID reader. The RFID tag will be in the student's ID card. So when the student will reach the door, the RFID tag will send waves which is catched by the RFID reader. The RFID tag also gives us the student information.

3.We use Led light and Buzzer for alarming everybody.

4.We also use monitors to visualize the process or do any command to the system through the monitor.

9

5.Other equipment's used here are breadboard for connecting elements, heat sink for cooling the raspberry pi, male to female wires, charger for powering the Raspberry pi.
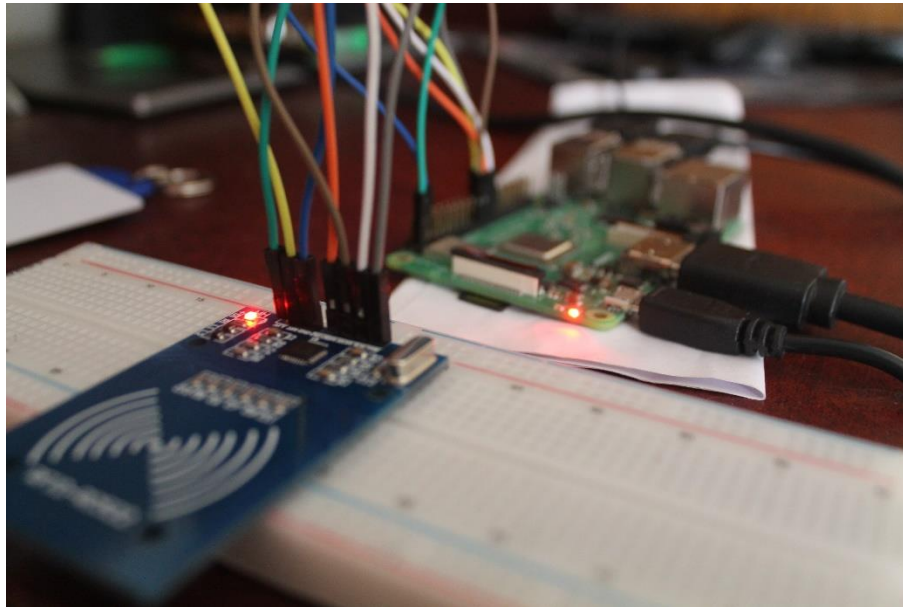

Figure 3.1: Interfacing with Raspberry pi with RFID RC522

Raspberry Pi

The Raspberry Pi is a series of small single - board computers developed by the Raspberry Pi Foundation in the United Kingdom to promote basic computer science teaching in schools and developing countries. The original model has become much more popular than expected, selling for uses such as robotics outside its target market. It does not include peripherals (such as mouse and keyboards) or cases. However, several official and unofficial bundles have included some accessories [8].

Raspberry pi 3 B+ has 1.4GHz 64-bit quad-core processor, dual-band wireless LAN, Bluetooth 4.2/BLE, faster Ethernet, and Power-over-Ethernet support Raspbian is the suggested working framework for ordinary utilize on a Raspberry Pi.

Figure 3.2: Raspberry Pi 3 B+ [9].

RFID RC522

The RFID RC522 is a very low - cost RFID reader and writer based on the microcontroller of MFRC522. This microcontroller provides its data through the SPI protocol and works by creating an electromagnetic field of 13.56MHz which it uses to communicate with RFID tags. Make sure the tags we buy for wer RFID RC522 are running on the 13.56MHz frequency, otherwise we won't read them.

Figure 3.3: RFID RC522 [10].

Buzzer

A buzzer or beeper is a mechanical, electromechanical or piezoelectric audio signaling device. Typical uses include alarm devices, timers, and user input confirmation such as a mouse click or keystroke [11].

Figure 3.4: Buzzer [12].

3.3. Use case modeling
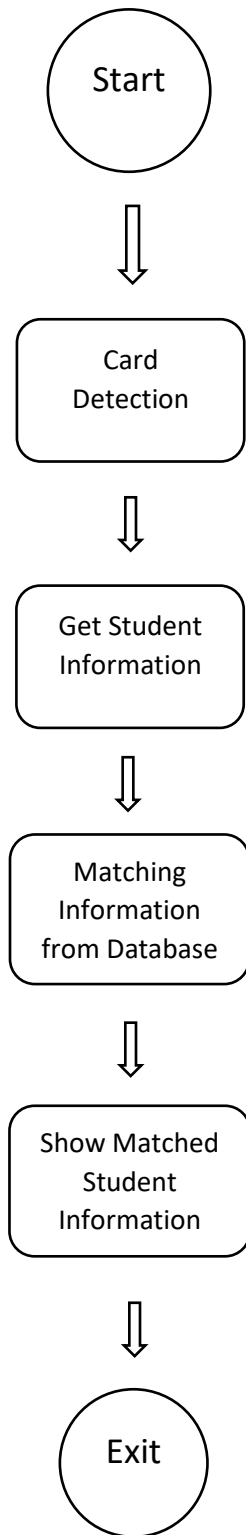
Figure 3.4: Use Case Model

3.4. Design Requirements

Wiring RFID with Raspberry pi 3 is simple, with it requiring to connect 7 Raspberry pi pin directly with the RFID RC522 reader. In RFID RC522 reader we use some pin like SDA, SCK, MOSI, MISO, 3.3v, GND, RST. Wiring between RFID with Raspberry pi given below-
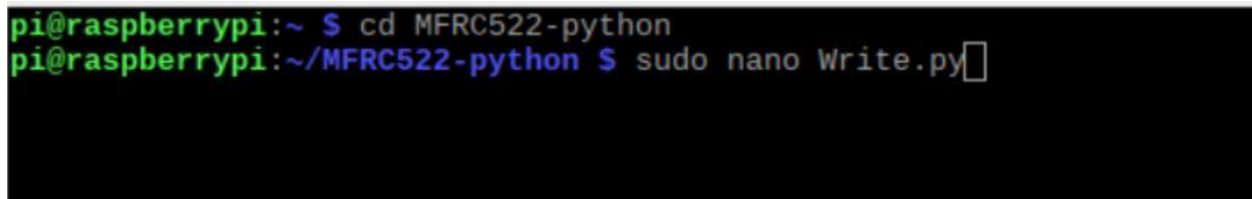
Table 3.1: Pin Configuration

RFID RC522	Raspberry pi 3 B+
SDA	PIN 24
SCK	PIN 23
MOSI	PIN 19
MISO	PIN 21
GND	PIN 6
RST	PIN 22
3.3V	PIN 1

Chapter 4

4.1 Offline Front-end
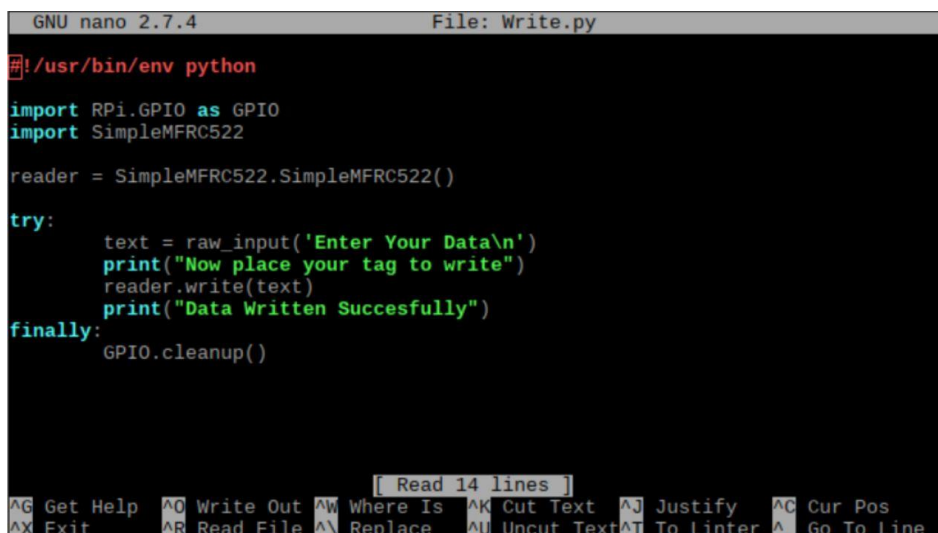
Offline front-end is only for students. A Linux shell will be shown in the screen where students will be asked to swipe their ID cards on the RFID reader for detect student & collect student information.

Figure 4.1: Create new folder & writing python script

In figure 4.1 when we write that script that means we create new folder & start writing our Write.py Python script.
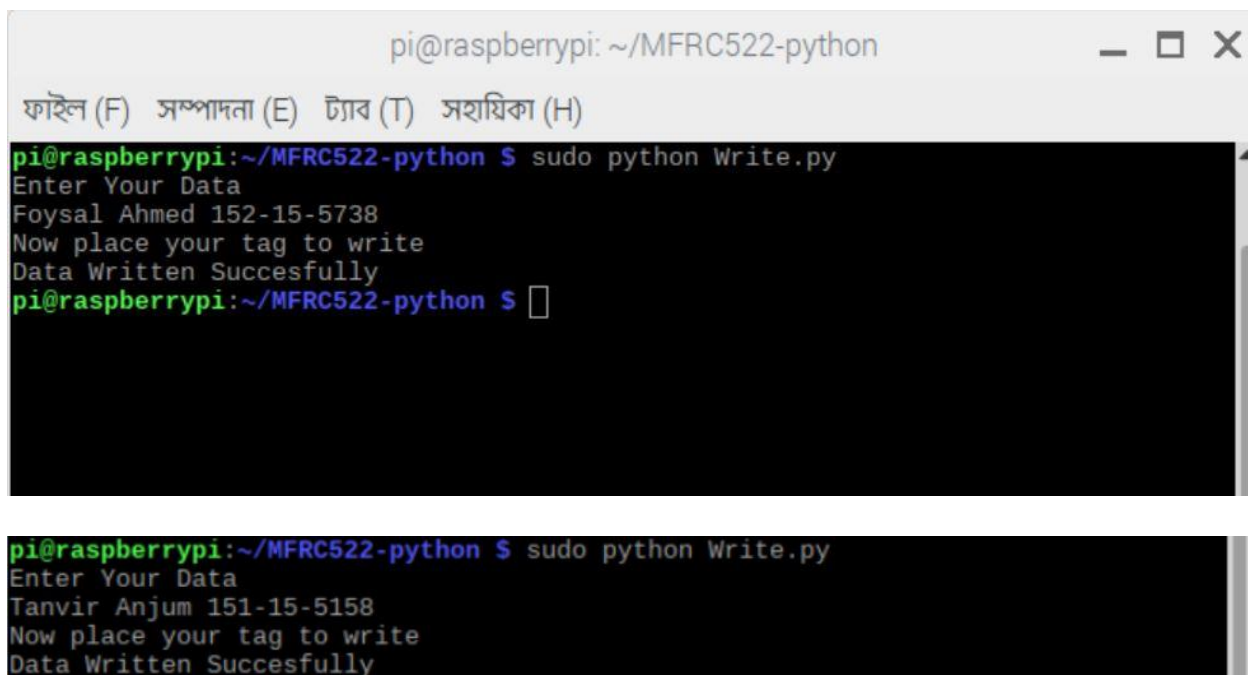
Figure 4.2: Data Writing screen

In figure 4.2 This code will fundamentally inquire us for content to input and after that type in that content to the RFID Tag. The primary line of this portion of code makes a difference tell the terminal how to translate the record, and it lets it know that it ought to utilize Python when executing it and not something else such as Bash. Our to begin with import, RPi.GPIO has all the capacities required to connected with the GPIO Pins, and we require this to create beyond any doubt they are cleared when the script wraps up running. Then other imports in our SimpleMFRC522 library, usually what we are going utilize really to conversation with the RFID RC522, it incredibly streamlines managing with the chip compared to the base MFRC522 library. Finally, we use GPIO.cleanup() function. This function use for significant as coming up short to clean up can avoid other scripts from working accurately.

Figure 4.3: Data written script screen

In figure 4.3 when we write writing python script then they asked us to write enter the data after that asked for RFID tag to write data to the RFID tag. When we should see 'Data Written Successfully' in our command line if it is successful. we have effectively composed our Write.py script.

Figure 4.4: Data Reading Screen

In figure 4.4, this script will fundamentally sit and hold up till us put our RFID tag on the RFID RC522 reader, it'll at that point output the information it reads off the tag. We use print() function to print out the information that we received from the RFID tag. It will print RFID tag ID and text which is previously written by us.

Figure 4.5: Data read script screen

In figure 4.5, in this script we need to do place our RFID tag on the RFID reader. And python script detects the RFID tag or data and successfully show the data which are set in the RFID tag previously.

4.2. Back-end Design

As described above, we used PHP, MySQL and apache in the backend to run in the Raspberry Pi for online server and Python programs.

On the other hand, Raspberry Pi runs several backend Python scripts for writing and reading process. And continue the system at a certain period of time.

<h1>Chapter 5</h1>

<h2>Implementation and Testing</h2>

5.1 Testing implementation
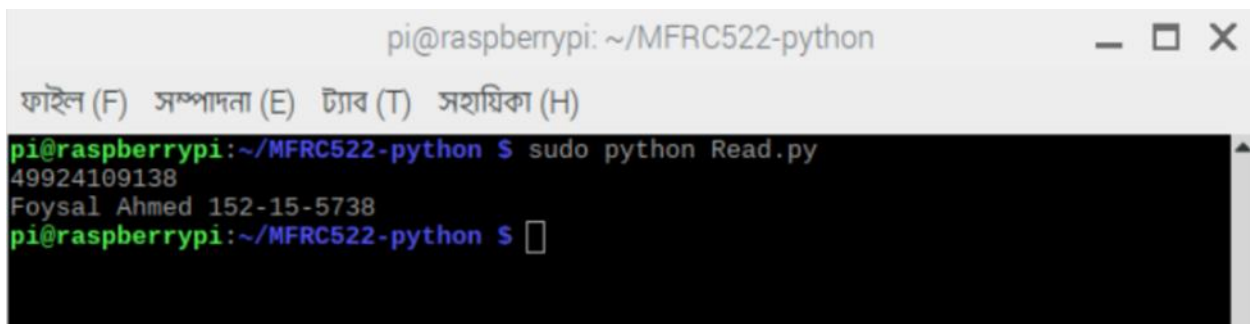
First we have to get an input. A student comes to his school swap his card on the RFID card reader. If the details of the card and the details on the database, we stored is matched then it detects the student.

The testing process given below:

1. Testing writing data and detect the tag from RFID reader.
2. Testing Reading data by scan the card and get details student information.
3. Checking the information that provided by the RFID reader which is correct or not.
4. Testing the alarm when the system detects any card.

5.2 Test result

 As we can see it is working properly without any single problem. Thus, it meets all the requirements described in requirements chapter.

Figure 5.1: Test Result Output

This figure shows that when RFID reader read the RFID tag then show the student details.

Chapter 6

Conclusion and Limitation

6.1. Advantage of RFID

- ❖ The range of RFID tags is longer than barcodes.
- ❖ RFID tags are capable of reading and writing memory while barcodes are not.
- ❖ It is easier to use RFID to identify unique items than barcodes.
- ❖ Reduces the cost of controlling and providing inventories.
- ❖ RFID technology automates data collection and reduces human effort and error significantly.
- ❖ With increased efficiency, RFID readers can simultaneously read multiple RFID tags.
- ❖ By improving stock control, RFID technologies help to reduce costs.

6.2. Future Scope

We are hoping and confident this "RFID based Smart ID card" can help student and their parents, help school to make their attendance system digital and smart.

- ❖ There is a good chance to implement this system in government schools. Because many government schools are out of using technology in the education area.
- ❖ We can also use this system in rural area. As the project price is low and affordable so any institute can agree to implement this.
- ❖ This system will help to ensure about student safety. So people will agree to use this project for another fields.
- ❖ This project will be a good example of "Digital Bangladesh".
- ❖ By using GPS, we can track student.
- ❖ Many non-government schools can also implement this.

6.3. Limitations

- RFID reader used in this system is not of high quality. More efficient one is needed.
- UI and UX should be improved
- For offline front-end a GUI should be developed
- Student location in library cannot be determined by this system

6.4. Discussion and Conclusion

This report proves that this project is very much promising in types of public and private institutions. Raspberry Pi is revolutionizing the world of IoT Based on this system we can provide new types of services to student and the consumers to make our life easier.

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Appendix A: Hardware Configuration

Raspberry pi 3 B+

- ❖ Broadcom BCM2837B0, Cortex-A53 (ARMv8) 64-bit SoC @ 1.4GHz
- ❖ 1GB LPDDR2 SDRAM
- ❖ Gigabit Ethernet over USB 2.0
- ❖ Extended 40-pin GPIO header
- ❖ Full-size HDMI
- ❖ 4-pole stereo output and composite video port
- ❖ 5V/2.5A DC power input

RFID RC522

- ❖ Operating Frequency: 13.56MHz
- ❖ Current :13-26mA / DC 3.3V
- ❖ Module Interface SPI Parameters
- ❖ Data Transfer Rate: Max. 10 Mbit/s

BUZZER

- ❖ Sound Pressure Level: 82dB
- ❖ Frequency: 2.3kHz
- ❖ Current Rating: 30mA
- ❖ Termination: Solder Pins/Posts

Appendix B: Software Configuration

Raspberry pi

- ❖ Raspbian (OS of Raspberry pi)
- ❖ Python 3.7
- ❖ PyMySQL Library
- ❖ Rpi (Control for GPIO)

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Grant Ho, Derek Leung, Pratyush Mishra, Ashkan Hosseini, Dawn Song, David Wagner. "Smart Locks", Proceedings of the 11th ACM on Asia Conference on Computer and Communications Security - ASIA CCS '16, 2016

Chapter 1 Introduction 1.1 Introduction The project "IoT Based Smart Student Detector" is a state of the art project which aims to make a educational institute smart, efficient and helpful for the authority. In reality this is a very big project which has numerous numbers of module. This project is a cool circuit and opens up a wide range of different projects from using it as attendance system and detect student information. The RFID RC522 is a very low - cost MFRC522-based RFID reader and writer. This microcontroller affords its statistics through the spi procedure and works by constructing a 13.56mhz radiofrequency field that it deploys to transmit with the RFID tag. We will show how to wire up the RFID RC522 as well as how to write Python scripts to interact with the chip so that we can both read and write were RFID tags. We are also using Raspberry pi to show some information to the user. 1.2 Motivation The reasons for making this project are for student safety. Many parents are job holder and they are thinking about if their child go out in the school. This system can be a solution of this problem. This system ensures student safety. Besides our future plan are convert this project to attendance system, send parents message about their child information. We also want to digitalize the school system with safety and make the whole process smarter than today. We are trying to reduce the time consuming things out of the class and the teachers can spend their full time to teach the students. 1.3 Objective Every project need to have some objectives. Without any objective no project cannot be done. Our project also has 2 major objects. ? Smart attendance system. ? Make the education system more efficiencies. ? Ensure student safety. ? Reduce time wasting things during class. If the project is used, then the attendance of the student can be taken very easily. It will give efficient service to the authority. 1.4 Expected outcomes The project have several outcomes which are very beneficial for the educational institution. ? Detect Students ? Ensure Student safety ? Easy Attendance system The full system runs automatically after implementing this. When students come to the school RFID tag automatically detect the student & store the student information in the database. The authority has nothing to do like checking or take attendance manually. When student leave the school the system automatically detect this student & keep record this data. 1.5 Report Layout The whole project report is made up of six chapters, references. Below is a short summary of the chapters. ? Chapter 1 deals with the introduction, motivation, objectives and expected outcomes of the project. ? Chapter 2 first discusses the introduction to IoT, then comparative studies, the scope of the problem and challenges. ? The requirements are discussed in Chapter 3. The business process model (BPM), the analysis of requirements, the logical data model and other requirements will be discussed. ? Chapter 4 deals with design in which all the hardware and software tasks are discussed. Appropriate screenshots and specifications for implementation and testing are shown in Chapter 5. ? Chapter 6 concludes with suggestions for conclusion and further development. ? Appendix A concerns the project's hardware configuration. ? Appendix B concerns the project's software configuration. Chapter 2 Background 2.1 Introduction Internet of Things (IoT) is the networking of