IoT based Automatic Attendance Management System

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***Abstract*—In recent days, we have seen a sudden increase in the usage of Radio Frequency Identification(RFID) systems in the fields of industrial technologies, health, agriculture, transportation, etc. Also, Internet of Things is blooming parallely. Therefore, using these, an attempt has been made to solve the attendance management and monitoring problems. Attendance Management System is the implementation of Internet of Things through Raspberry Pi 3 and RFID Technology in order to reduce the time consumed by the traditional system of recording daily attendance in schools and institutions. So everything here in turn gets automated. An attempt has also been made to develop an Android application(app) and help the students' to view their attendance anywhere, anytime.**

Keywords—RFID, RFID Reader and Tags, Internet of Things(IoT), Raspberry Pi , PIR Sensor

INTRODUCTION

Since olden days, the method of recording attendance is always manual. Even though this develops the student-teacher relationship and binds them together, it is time consuming and prone to human errors. This also becomes stressful at times. In order to make it error free and reduce the wastage of time, it is necessary to implement Automatic Attendance Management System thus making it more efficient and effective.

STRATEGIES AND TERMINOLOGIES

Radio Frequency Identification (RFID)

The technology that rightfully favors our requirements is the RFID Technology. It is an automatic data identification and collection technology. Even though it's not a new one, it has gained interest recently in computing fields. RFID involves radio frequencies and microchip technologies to develop a system that can be used to identify, monitor, secure and do object inventory. It consists of a chip that contains unique details which can be used as identification when detected by a RFID Reader.

RFID consists of 3 components namely RFID Reader, RFID card/tag and the computer with specific database created. RFID allows the transfer of data from the card to the reader over a distance of about 10 meters depending on the type of tags/cards used. Here the information is transferred using Radio waves and many number of tags can be read simultaneously. RFID technology has already found usage in person identifications, passports, in grocery stores, shopping malls, finding lost pets, household material placements, etc.

Internet of Things(Iot)

The Internet of Things (IoT) is the inner connection or network of various physical devices like vehicles, apartments, which are embedded with sensors, softwares, electronics and connectivity that helps to retrieve and exchange information. It allows the objects to be sensed and controlled through the available network infrastructure resulting in the integration of physical environment and its objects with the computer systems. It offers advanced connectivity among devices and systems that go beyond a machine-to-machine relationship.

SYSTEM REQUIREMENTS

Creation of an IoT based automatic Attendance Management System had led us through the analysis and literary survey about knowing how to tackle with the necessities and requirements. To make it cost-effective and user-friendly, the required components are listed as follows,

Raspberry Pi 3

Official Raspberry Pi Adapter

40 Pin GPIO

HDMI Cable

LCD Display

Memory Card (Class 10, Minimum of 10GB)

978-1-5386-3243-7/17/$31.00 ©2017 IEEE

RFID Card

RFID Reader

Buzzer

Connecting Wires and Cables

PIR sensors

System Operation

The entire working of this Attendance system can be divided into two phases namely:

1. Registration Phase: This phase consists of collecting the details of the student such as Name, USN(University Serial Number), subjects registered during the semester, etc. This will be fed into the computer's memory and a corresponding RFID card with unique identification(UID) will be issued per student.
2. Recognition Phase: This phase comes into picture when the student wants to attend the lecture. All he has to do is to tap his/her RFID card on the RFID Reader. The reader will recognize the card and thereby record the attendance in the concerned faculty's database. This is done using IoT synchronized Raspberry Pi3 and the required information is made to display using a LCD Display.

Raspberry Pi 3

The figure 1 below is of Raspberry Pi 3 which we have used in this system. It consists of a 40 pin extended GPIO, 4x 2 USB ports, 10/100 LAN, microSD card slot, microUSB power supply and many more slots.

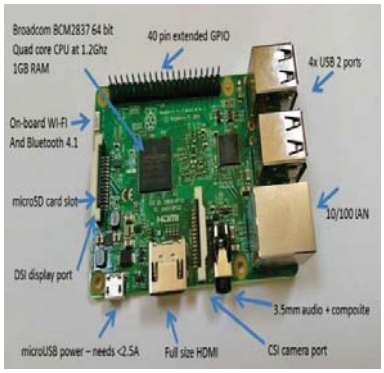

Fig 1. Raspberry Pi 3

WHY RASPBERRY PI 3?

The figure 2 below makes a comparison of Raspberry Pi 3 with all other existing Pi models and lists its advantages over others.

	Raspberry Pi 3 Model B	Raspberry Pi Zero	Raspberry Pi 2 Model B	Raspberry Pi Model B+
Introduction Date	2/29/2016	11/25/2015	2/2/2015	7/14/2014
SoC	BCM2837	BCM2835	BCM2836	BCM2835
CPU	Quad Cortex A53 @ 1.2GHz	ARM11 @ 1GHz	Quad Cortex A7 @ 900MHz	ARM11 @ 700MHz
Instruction set	ARMv8-A	ARMv6	ARMv7-A	ARMv6
GPU	400MHz VideoCore IV	250MHz VideoCore IV	250MHz VideoCore IV	250MHz VideoCore IV
RAM	1GB SDRAM	512 MB SDRAM	1GB SDRAM	512MB SDRAM
Storage	micro-SD	micro-SD	micro-SD	micro-SD
Ethernet	10/100	none	10/100	10/100
Wireless	802.11n / Bluetooth 4.0	none	none	none
Video Output	HDMI / Composite	HDMI / Composite	HDMI / Composite	HDMI / Composite
Audio Output	HDMI / Headphone	HDMI	HDMI / Headphone	HDMI / Headphone
GPIO	40	40	40	40
Price	$35	$5	$35	$35

Figure 2 Why Raspberry Pi 3

Block Diagram Representation

The block diagram representation of the system has been shown in below figure 3.

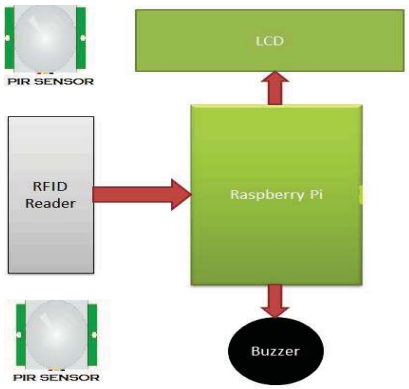

Figure 3 Block Diagram

Proxy Issue: PIR Sensor

PIR Sensor is a Passive Infrared Sensor that measures the infrared radiations in this electronic sensor's range of access/view. The amount of infrared around the sensor depends on the temperature, nature of surface etc. This variation around is detected by the sensor and is transferred in the form of electrical output voltage and triggers the detection. A normal PIR Sensor consists of a Fresnel lens surface and can be configured for about 10 meters with 180 degrees of field view. A PIR Sensor has been shown in figure 4. The 3 terminals namely Vcc, Ground and Output are also shown.

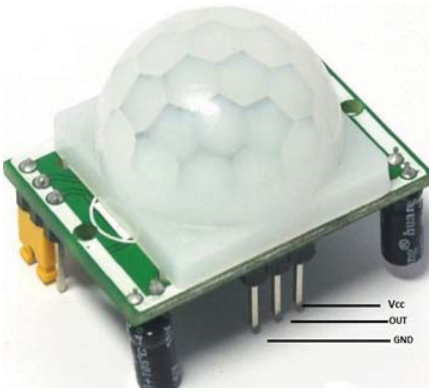

Figure 4 PIR Sensor

SYSTEM IMPLEMENTATION AND METHODOLOGY

The methodology of the project is that as soon as the PIR sensor 1 reads the person entering, the RFID reader will be activated and it will accept only one card at a time till the other PIR Sensor detects the person. That means, until PIR Sensor 2 detects the person moving inside the class, the attendance will not be updated in the database. Here we have used XAMPP software to create the database in PHP script of Apache server. The attendance will directly be updated in that page and also we have designed a basic Android Application (App) through which the students can check their attendance directly from the APP in their mobile phones.

The proposed system has been explained with the help of following steps:

Step 1: Start the RFID Reader

Step 2: Initialize the LCD Screen

Step 3: Initialize UART (Universal Asynchronous Receiver/ Transmitter)

Step 4: Send scanned UID of RFID card data to Raspberry Pi Model

Step 5: Search and match the UID and extract the relevant student information

Step 6: Compare detected student id, date and time with class time table and if match found then mark the presence.

We have also used two passive infrared sensors in order to solve the problem of proxy of attendance. The first PIR sensor will first detect the motion of the person by detecting his/her body heat and it will give an output of 1. Once the PIR output is 1, the RFID Reader is such programmed that till the time the student do not cross the second PIR, the RFID reader will be able to read only one RFID Card. so at this time the student will tap only his/her card and not the one who is not present and then the student will enter the classroom, and then the second PIR Sensor will read high. Once the second PIR is high, the attendance of the student for that particular subject will be marked and the count will increase by 1. Similarly if the second PIR reads first and then the first PIR then the count will decrease by one and the faculty will know that there is a proxy since the counts will differ.

Now the data from Raspberry Pi will be updated in the teachers database directly and the need not do the hard work for entering the attendance into the merit. All teachers will have their own username and password for the database login. We have used XAMPP(X: Cross platform(WINDOWS, LINUX, MAC OS) A:Apache M:My SQL P:PHP P:PEARL) for the construction of on time database.

We have also developed an ANDROID APP for the purpose of students so that they can see their daily attendance in their mobile phone itself hence easing their work of constant check on the attendance percentage. This Android App has the details about the student, his name, USN, registered subjects, the number of classes attended, the list and number of classes taken and the eligibility status thus facilitating the student to keep a track of the attendance status and thus stay conscious. This is an open platform and can be viewed by any person just by entering the name of the student and the subject whose attendance he would like to know.

The flow of events can be depicted by a flow chart as shown in figure 5.

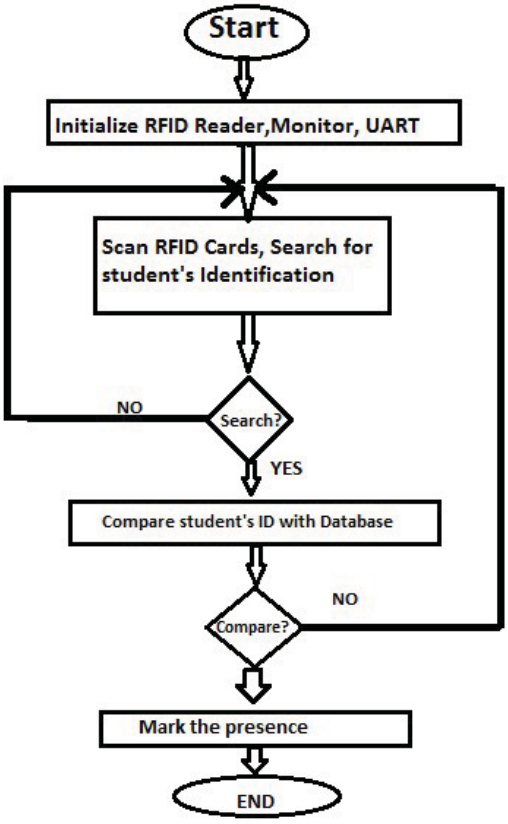

Figure 5 Flow Chart

CONCLUSION

We have finally figure out that the traditional way of recording attendance can be ruled out by this integration of

RFID Technology with Internet of Things using the Raspberry Pi 3 model.

We come across various advantages which can be listed a follows:

- This system reduces paper work thereby saving time and money.
- Eliminates repetition and duplication of recorded data.
- Eliminates error in manual attendance records.
- Easy attendance recording .
- Auto generated various types of reports of class or students attendance.
- Increased security and confidentiality.
- Ethical enhancement of staff and students.

The existing conventional attendance system of taking attendance by calling names or signing on paper is very time consuming and insecure, hence inefficient. Therefore, Raspberry Pi 3 i.e. IoT based attendance management system has been proposed. The system can be extended to more number of students and more number of classes with the database generated. It can be concluded that a reliable, secure, fast and an efficient system has been proposed by replacing a manual and unreliable system by using Raspberry Pi Model with Radio Frequency Identification (RFID). In future the work can be extended with the Web camera, Finger Print module or Retina Scanner that can automatically calculate and maintain the attendance for students in a college or an institution using an image processing.

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