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Electronic Attendance Management System

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Abstract: *One of the major problems in our educational institutions is the process of taking manual attendance which is very much time consuming. It is difficult to manually take and then maintain the attendance of such a large number of students efficiently in a school or a college. Also there is a greater possibility of providing a fake attendance by a student which is many a time inconvenient to figure out. Thus, there are various technologies available for developing a well organized attendance management system to minimize these issues. This includes Barcode, Smart card, Biometric and Radio Frequency Identification (RFID) technologies. Out of them RFID is comparatively faster than barcode and smart card system and cheaper than biometric system. Thus, our main goal is to solve the problems by developing an Electronic Attendance Management System using RFID. RFID technology is an automatic wireless identification system that operates with the help of active and passive cards and a RFID reader. This system will help the concerned authority to manage the attendance system in a more organized, efficient and time saving manner. The proposed technique will be implemented in a prototype model. The applications using RFID are increasing nowadays and are being applied in various fields such as transportation, agriculture and industries. This is an identification technology used for retrieving or storing data using RFID tags without any physical contact. In order to be fully functional, the system is to be integrated with RFID database. The Electronic Attendance Management System will mark the attendance of individual students by using information extracted from the RFID database. This system will fetch the appropriate data from the RFID database in order to execute the attendance taking process.*

Keywords: *RFID Tags and RFID Reader, Intel Edison with Arduino Breakout Board, Node Express Server, MongoDB Database*

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I. Introduction

Electronic Attendance Management System is a project of IoT. The Internet of things(IoT) can be described as the network of physical devices and other items embedded with electronics, software, sensors and connectivity which enables them to connect, collect and exchange data for more direct integration of the physical world into computer-based systems, resulting in efficiency improvements, economic benefits and reduced human exertions. Embedded with technology, these devices can communicate and interact over the Internet and can be remotely monitored and controlled.

The designing of an Electronic Attendance Management System requires hardware components such as an Intel Edison Board, RFID Reader, RFID Tags**,** Micro-B USB to Standard Type-A USB cables and Power Adapter along with some jumper wires for connection. Also it uses certain Intel drivers and software tools.

In section-2 we have described as how our project can be useful. Intel Edison used in our project is a 32-bit Intel Atom Processor, which is described in section-3. In section-4, we have described the Arduino Expansion Board, which consists of all the necessary ports required for the operation of our Electronic Attendance Management System. These sections are followed by Result, Conclusion, Future Work, Acknowledgement and References with their respective sections.

II. Implementation of Electronic Attendance Management System

In today's time, one of the concerns in our educational institutions is the ongoing process of manual attendance. It is time consuming and also due to the attendance collection of such a huge group of students in the institutions it is not accurate enough. Also such an approach is unable to detect any form of fake or proxy attendance incase provided by the students.

Hence, in order to solve such issues we are going to develop an Electronic Attendance Management System using Radio Frequency Identification (RFID). RFID technology is an automatic wireless identification

system that operates with the help of active and passive cards and a RFID reader. Here in this project we are using passive RFID tags. This system will help the concerned authority to manage the attendance system in a more organized, efficient and time saving manner. The system is then integrated with RFID database. The Electronic Attendance Management System will mark the attendance of individual students by using information extracted from the RFID database. This system will fetch the appropriate data from the RFID database in order to execute the attendance taking process.

III. Intel Edison

The Intel Edison is an ultra small computing platform. The Edison has a host of features including WiFi (802.11a/b/g/n), Bluetooth (4.0 and 2.1 EDR), UARTs, I^2C, SPI, USB, and 40 GPIO. It is driven by a 32-bit Intel Atom Processor clocked at 500MHz, supported by 1GB of LPDDR3 RAM and 4GB eMMC flash memory. To top it off, it is housed in a tiny 35.5 x 25.0 x 3.9 mm module. The module is equipped with a Linux OS based on Yocto, so we can compile C/C++ files or run Python, Node.js, and other scripts.

The Intel Edison packs a robust set of features into its small size and thereby delivers great performance, durability and a broad spectrum of I/O and software support. Those versatile features help meet the needs of makers, inventors and beginners. Its low power and small footprint makes it ideal for the projects that needs a lot of processing power but do not have the ability to be near a larger power source or have a large footprint.

3.1 Interface Connector

The connector on Intel Edison is a Hirose 70-pin DF40 Series "header" connector. It exports many signals (USB, GPIOs, SPI, I²C, PWM, etc.). The mating Hirose connector on an expansion board is the "receptacle" connector and is available in three different heights (1.5 mm, 2.0 mm, 3.0 mm). Table below shows the pin assignment of the 70 pin connector.

IV. Arduino Expansion Board

It is a bigger Edison base board with headers broken out to the familiar Arduino footprint. If we plan to use the Edison with the Arduino IDE, this is the board we will want to use. It also includes an Edison. It essentially gives Edison the ability to interface with Arduino shields or any board with the Arduino footprint. Digital pins 0 to 13 (and the adjacent AREF and GND pins), analog inputs 0 to 5, the power header, ICSP header, and the UART port pins (0 and 1) are all in the same locations as on the Arduino Uno R3 (Arduino 1.0 pinout). Additionally, the Intel Edison Arduino Breakout includes a micro SD card connector, a micro USB device port connected to UART2, and a combination micro USB device connector and dedicated standard size USB 2.0 host Type-A connector (selectable via a mechanical microswitch).

Pin Number	Pin Name		Pin Number	Pin Name
1	GND		36	RESET_OUT#
2	VSYS		37	GP182_PWM2
3	USB_ID		38	Unused
4	VSYS		39	GP183_PWM3
5	GND		40	Unused
6	VSYS		41	GP19_I2C_1_SCL
7	MSIC_SLP_CLK		42	GP15
8	3.3V		43	GP20_I2C_1_SDA
9	GND		44	GP84_SD_0_CLK_FB
10	3.3V		45	GP27_I2C_6_SCL
11	GND		46	GP131_UART_1_TX
12	1.8V		47	GP28_I2C_6_SDA
13	GND		48	GP14
14	DCIN		49	Unused
15	GND		50	GP42_I2S_2_RXD
16	USB_DP		51	GP111_SPI_2_FS1
17	PWRBTN#		52	GP40_I2S_2_CLK
18	USB_DN		53	GP110_SPI_2_FS0
19	FAULT		54	GP41_I2S_2_FS
20	USB_VBUS		55	GP109_SPI_2_CLK
21	PSW		56	GP43_I2S_2_TXD
22	GP134_UART_2_RX		57	GP115_SPI_2_TXD
23	V_BAT_BKUP		58	GP78_SD_0_CLK
24	GP44		59	GP114_SPI_2_RXD
25	GP165		60	GP77_SD_0_CD#
26	GP45		61	GP130_UART_1_RX
27	GP135_UART_2_TX		62	GP79_SD_0_CMD
28	GP46		63	GP129_UART_1_RTS
29	Unused		64	GP82_SD_0_DAT2
30	GP47		65	GP128_UART_1_CTS
31	RCVR_MODE		66	GP80_SD_0_DAT0
32	GP48		67	OSC_CLK_OUT_0
33	GP13_PWM1		68	GP83_SD_0_DAT3
34	GP49		69	FW_RCVR
35	GP12_PWM0		70	GP81_SD_0_DAT1

Table 1: Pin Assignment of Edison Connector

4.1 Board Connectors

The Intel Edison board provides a wide range of functionality for communicating with the board, uploading code, updating the board OS image, and more. An overview of the various connectors available the board is shown below:

4.1.1 Barrel Connector

This connector is used for powering the board with an external power supply.

4.1.2 Standard Type-A USB Port

This port is used for regular connections of USB peripherals such as mice, keyboards and more.

4.1.3 Micro switch

We can switch between USB host mode and USB device mode using the microswitch.

In device mode, we can use the board as a computer peripheral using a micro-USB cable. In device mode, we can program the board over USB, mount the on-board flash memory like a disk drive. For details regarding the connection of the board as a computer peripheral, it is explained under the section Programming, Powering, and Writing to the On-board Flash Memory.

In host mode, we can plug USB peripherals with a standard-sized USB cable (such as mice, keyboards, and the like) in to the board. In details it is explained under Attaching USB Peripherals to our Board.

4.1.4 Middle USB Port

This port is used for powering through USB Ethernet over USB, uploading Arduino sketches and code samples and updating the OS image by using the board as a storage device like a flash drive.

4.1.5 Edge Port (Micro-B Type)

This port is used to create a terminal connection by serial over USB only. This is used for establishing serial communications with the board.

We can send serial commands to the board via Terminal or PuTTY using the edge micro-type B USB port. We can use these commands to flash the OS image, configure Wi-Fi settings, or identify the IP address of the board.

V. Working Principle

Following is the block diagram of the project, the various blocks of which are described accordingly.

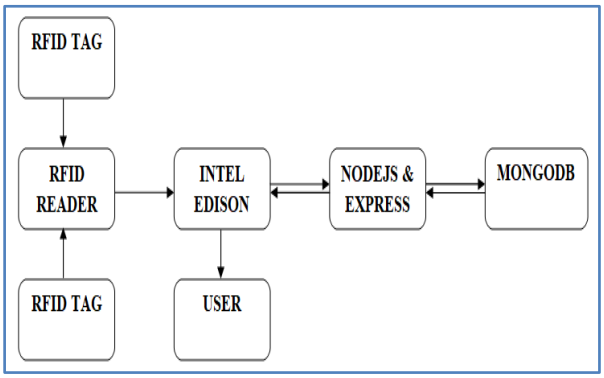

Figure 1: Block Diagram Representation of the Model

5.1 RFID tags and RFID reader

An RFID system uses tags or labels attached to an object to be identified. Here, the RFID reader sends signal to the tag using an antenna. The tag receives this information and resends this information along with the information in its memory. The reader receives this signal and transmits to the processor for further processing. In our Project, we have used a Near-field communication mechanism between the RFID reader and tags. The Faraday's principle of magnetic induction is the basis of near field coupling between a reader and a tag. The range for which we can use magnetic induction approximates to $c/2\pi f$, where c is a constant (speed of light) and f is the frequency. Thus, as the frequency of operation increases, the distance over which near-field coupling can operate decreases.

5.2 Intel Edison as Gateway

A gateway is basically a physical device or sometimes a software program that serves as the connection point between the cloud and controllers. Here, in this project we are using Edison as a gateway. Another benefit is that it can provide additional security for our IoT network and data it transports. It performs several critical functions such as device connectivity, protocol translation, data filtering and processing, security, updating, management and more.

5.3 Node Express Server

Node Express Server is a basic Express Server in Node.js. Express is a web application framework for Node.js that allows us to spin up robust API's and web servers in a much easier and cleaner way. It is a lightweight package that does not obscure the core Node.js features. It facilitates the rapid development of Node based Web applications.

5.4 MongoDB database

MongoDB stores data as documents in a binary representation called BSON (Binary JSON). Related information is stored together for fast query access through the MongoDB query. MongoDB is an object oriented, simple, dynamic and scalable NoSQL database. We are using MongoDB because it has the ability to handle large unstructured data and it is more sensitive to workload

5.5 User access

User access is basically the procedure in which a system administrator sets up an information access control over the users. Users thus can access the resources including software and data in a consistent and simple manner on a web based Graphical User Interface. It also grants access to the relevant operations to update and manage.

VI. Result

Thus, we have developed an accurate attendance monitoring system to authenticate each student individually using their radio frequency based unique ID cards. It also ensures real time attendance data storage in the server resulting in reduced time consumption. Embedded with technology, this device can communicate and interact over the internet and it can be remotely monitored and controlled.

VII. Conclusion

Thus, we have developed the prototype model of "Electronic Attendance Management System". At the beginning we started with figuring out the hardware components required for building such a system. The designing of an Electronic Attendance Management System requires hardware components such as an Intel Edison Board, 12V-2A DC Power Adapter, Grove-125KHz RFID Reader, 125 KHz RFID tags and Micro-B USB to Standard Type-A USB cables along with some jumper wires for connection. Then we went on to choose the software tools that are compatible with Intel Edison Board to develop a database application. This also includes certain Intel drivers. Node.js is one of the key tool among them and is pre-installed with Edison. We have also installed Express JS and MongoDB manually. Node.js, Express JS and MongoDB works well with each other. Express JS is a light weight Web Framework to develop web applications very easily and quickly in Node JS Platform. MongoDB is a popular open-source NoSQL database program which best fits with Node.js.

VIII. Future Work

Furthermore, in the next semester we will be modeling a two-way student counter to double check the number of students present in a class. By comparing these values with the ones already stored in the database of the Electronic Attendance Management System we can minimize the risk of a possible proxy attendance. Any change in the number of students can be detected by the faculty and subsequent steps can be taken by the concerned authority to catch the offender. The mechanism will be such that it will consist of two IR sensors which will count the number of students passing across them and will display it in a LCD screen. Since it is a bidirectional counter it will both increment and decrement the count. If a student is entering the room and passing from sensor 1 to sensor 2, the counter will increment the count but if the student is exiting the room and passing from sensor 2 to sensor 1, the counter will decrement.

Acknowledgement

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