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Implementation of Low Cost RF Based Attendance Management System Using PSOC 5 and GSM Module

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ABSTRACT
An Attendance Management System (AMS) based on TCP/IP protocol is designed and realized. This paper expounds the principle of the RFID reader device in AMS, its hardware and software design. The reader device takes ARM LM3S9B90 as the core and Philips's MFRC531 as the transceiver chip of RFID reader. In application, the system works stable and has good real-time performance.
Keywords- *TCP/IP protocol; ARM; Attendance Management System (AMS)*

I. Introduction

The main objective of our project is to manage the student's attendance by using RF ID cards and updating it to the student or parent through sms by using GSM module.

Another most interesting aspect of our project is that whenever a period is completed the details of the students who have entered into the classroom are entered and updated to an ip address by communicating it through GPRS. Taking this advantage, we design and implement an efficient and reliable Attendance Management System (AMS).AMS is a smart staff management system which includes Reading or writing non-contact smart IC card, remote automatic control, network communication, and intelligent analysis and calculation. The managerial function of AMS includes the collection and storage of staff personal information, statistics and analysis of attendance information. With real-time calculating and accurate attendance recording, AMS can generate the analytical information, such as the working hours, working overtime, the staff whether be late or not and so on, which offers significant improvement for staff management in the aspect of software. In the hardware aspect, AMS based on TCP/IP protocols achieve remote automatic control through the Internet, which is convenient to configure and control the device remotely.

II. SYSTMEN DESIGN

According to the function and the deploying place of system module, AMS can logically be divided into three parts: RFID reader, information database and PC manager. They can be connected with each other through the Internet .The RFID reader is the device that can read or extract information stored inside tags which are the smart IC cards in AMS. This part is deployed in the different departments where the staff attendance needs to be recorded.

The information database is designed to store the staff personal information and attendance records; The PC manager is a set of software running in a computer, whose function is to operate the information database and control the RFID reader. It sends commands to the RFID reader, and receives feedback data, then processes the data and stores them into the database.

By considering the security of the data transmission, AMS encrypts the data before transmission. At the same time, the information database and the PC manager are placed in the same intranet to get better real-time performance. The architecture of AMS is shown in Fig. 1.

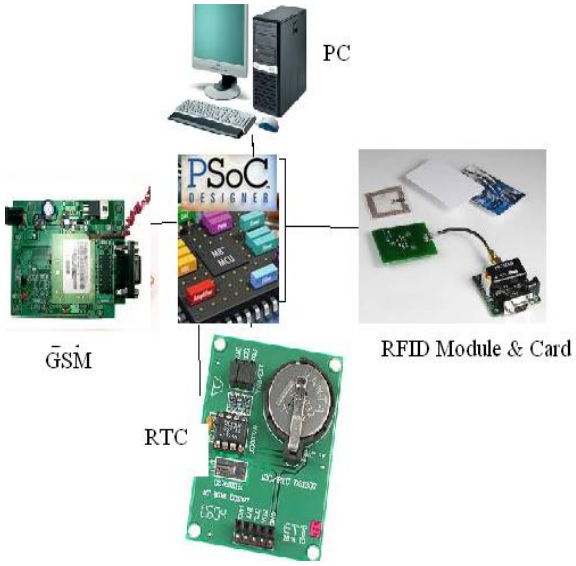


Figure:1- Block diagram

Firstly our project deals with the management of a class attendance and it is done with the help of a PSOC 5 microcontroller, GSM module and it is updated with a TCP connection. When a student swipes his RF ID card the door automatically opens and when he passes through the IR counters and presses the button the count of the students get increased by one.

At the end of the period all the details of the students and the total count of the students in the classroom are displayed so that any mismatch of the students and the cards are calculated.

At the end of every period the details of the students are automated in the server which we give an unique IP address. If any student wants to know his attendance a message including his RF ID number has to be sent and his attendance will be sent in reply.

III. HARDWARE DESIGN

RFID reader is the major hardware that needs to be designed and fabricated in AMS. The RFID reader consists of the circuit unit and the antenna.

A. RFID READER MODULE

Reader Module is the first low-cost solution to read passive RFID transponder tags up to 1¾" - 3" inches away depending on the tag (see list below). The RFID Reader Module can be used in a wide variety of hobbyist and commercial applications, including access control, automatic identification, robotics navigation, inventory tracking, payment systems, and car immobilization. Fully-integrated, low-cost method of reading passive RFID transponder tags

i. Single-wire, 2400 baud Serial TTL interface to PC, BASIC Stamp® and other processors requires single +5VDC supply
ii. Bi-colour LED for visual indication of activity
iii. 0.100" pin spacing for easy prototyping and integration.

The Parallax RFID Reader Module works exclusively with the EM Microelectronics-Marin SA EM4100-familyof passive read-only transponder tags.

A variety of different tag types and styles exist with the most popular made available from Parallax.

Each transponder tag contains a unique identifier (one of 240, or1,099,511,627,776, possible combinations) that is read by the RFID Reader Module and transmitted to the host via a simple serial connecting the Parallax RFID Reader module to the basic stamp microcontroller interface.

The Parallax RFID Reader Module can be integrated into any design using only four connections (VCC,/ENABLE, SOUT, GND). Use the following circuit for

Pin	Pin Name	Type	Function
1	VCC	P	System power, +5V DC input.
2	/ENABLE	I	Module enable pin. Active LOW digital input. Bring this pin LOW to enable the RFID reader and activate the antenna.
3	SOUT	O	Serial Out. TTL-level interface, 2400bps, 8 data bits, no parity, 1 stop bit.
4	GND	G	System ground. Connect to power supply's ground (GND) terminal.

Note: Type: I = Input, O = Output, P = Power, G = Ground

Table 1. Electrical Connections

Implementation and usage of the RFID Reader Module is straightforward. BASIC Stamp 1, 2, and SX28AC/DP code examples (SX/B) are included at the end of this documentation. The RFID Reader Module is controlled with a single TTL-level active-low /ENABLE pin. When the /ENABLE pin is pulled LOW, the module will enter its active state and enable the antenna to interrogate for tags. The current consumption of the module will increase dramatically when the module is active.

A visual indication of the state of the RFID Reader Module is given with the on-board LED. When the module is successfully powered-up and is in an idle state, the LED will be GREEN. When the module is in an active state and the antenna is transmitting, the LED will be RED. The face of the RFID tag should be held parallel to the front or back face of the antenna (where the majority of RF energy is focused).

If the tag is held sideways (perpendicular to the antenna) you'll either get no reading or a poor reading. Only one transponder tag should be held up to the antenna at anytime. The use of multiple tags at one time will cause tag collisions and confuse the reader. The two tags available in the Parallax store have a read distance of approximately 3 inches. Actual distance may vary slightly depending on the size of the transponder tag and environmental conditions of the application.

When a valid RFID transponder tag is placed within range of the activated reader, the unique ID will be transmitted as a 12-byte ASCII string via the TTL-level SOUT (Serial Output) pin in the following format.

MSB											LSB
Start Byte (0x0A)	Unique ID Digit 1	Unique ID Digit 2	Unique ID Digit 3	Unique ID Digit 4	Unique ID Digit 5	Unique ID Digit 6	Unique ID Digit 7	Unique ID Digit 8	Unique ID Digit 9	Unique ID Digit 10	Stop Byte (0x0D)

Table 2. Communication Protocol

The start byte and stop byte are used to easily identify that a correct string has been received from the reader (they correspond to a line feed and carriage return characters, respectively). The middle ten bytes are the actual tag's unique ID.

All communication is 8 data bits, no parity, 1 stop bit, non-inverted, least significant bit first (8N1). The baud rate is configured for 2400bps, a standard communications speed supported by most any microprocessor or PC, and cannot be changed. The Parallax RFID Reader Module initiates all communication. The Parallax RFID Reader Module can connect directly to any TTL-compatible UART or to an RS232-compatible interface by using an external level shifter.

Radio Frequency Identification (RFID) is a generic term for non-contacting technologies that use radio waves to automatically identify people or objects. There are several methods of identification, but the most common is to store a unique serial number that identifies a person or object on a microchip that is attached to an antenna. The combined antenna and microchip are called an "RFID transponder" or "RFID tag" and work in combination with an "RFID reader" (sometimes called an "RFID interrogator").

An RFID system consists of a reader and one or more tags. The reader's antenna is used to transmit radio frequency (RF) energy. Depending on the tag type, the energy is "harvested" by the tag's antenna and used to power up the internal circuitry of the tag. The tag will then modulate the electromagnetic waves generated by the reader in order to transmit its data back to the reader.

The reader receives the modulated waves and converts them into digital data. In the case of the Parallax RFID Reader Module, correctly received digital data is sent serially through the SOUT pin. There are two major types of tag technologies. "Passive tags" are tags that do not contain their own power source or transmitter.

When radio waves from the reader reach the chip's antenna, the energy is converted by the antenna into electricity that can power up the microchip in the tag (known as "parasitic power"). The tag is then able to send back any information stored on the tag by reflecting the electromagnetic waves as described above.

"Active tags" have their own power source and transmitter. The power source, usually a battery, is used to run the microchip's circuitry and to broadcast a signal to reader. Due to the fact that passive tags do not have their own transmitter and must reflect their signal to the reader, the reading distance is much shorter than with active tags.

However, active tags are typically larger, more expensive, and require occasional service. The RFID Reader Module is designed specifically for low-frequency (125 kHz) passive tags. Frequency refers to the size of the radio waves used to communicate between the RFID system components.

Just as you tune your radio to different frequencies in order to hear different radio station, RFID tags and readers have to be tuned to the same frequency in order to communicate effectively.

RFID systems typically use one of the following frequency ranges: low frequency (or LF, around 125 kHz), high frequency (or HF, around 13.56 MHz), ultra-high frequency (or UHF, around 868 and 928 MHz), or microwave (around 2.45 and 5.8 GHz). It is generally safe to assume that a higher frequency equates to a faster data transfer rate and longer read ranges, but also more sensitivity to environmental factors such as liquid and metal that can interfere with radio waves.

There really is no such thing as a "typical" RFID tag. The read range of a tag ultimately depends on many factors: the frequency of RFID system operation, the power of the reader, and interference from other RF devices. Balancing a number of engineering trade-offs (antenna size v. reading distance v. power v. manufacturing cost), the Parallax RFID Reader Module's antenna was designed with a specific inductance and "Q" factor for 125 kHz RFID operation at a tag read distance of up to 1¾" - 3" inches.

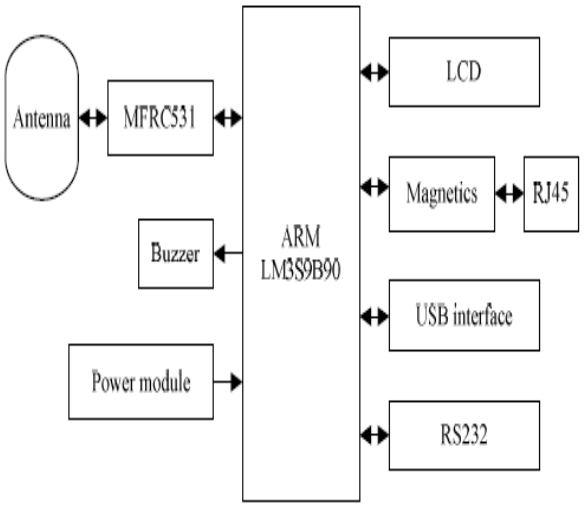


Figure 2. Block diagram of the RFID reader circuit.

B. IR SENSOR

This device emits and/or detects infrared radiation to sense a particular phase in the environment. Generally, thermal radiation is emitted by all the objects in the infrared spectrum. The infrared sensor detects this type of radiation which is not visible to human eye.

Figure: IR Sensor

The basic idea is to make use of IR LEDs to send the infrared waves to the object. Another IR diode of the same type is to be used to detect the reflected wave from the object. The diagram is shown below.

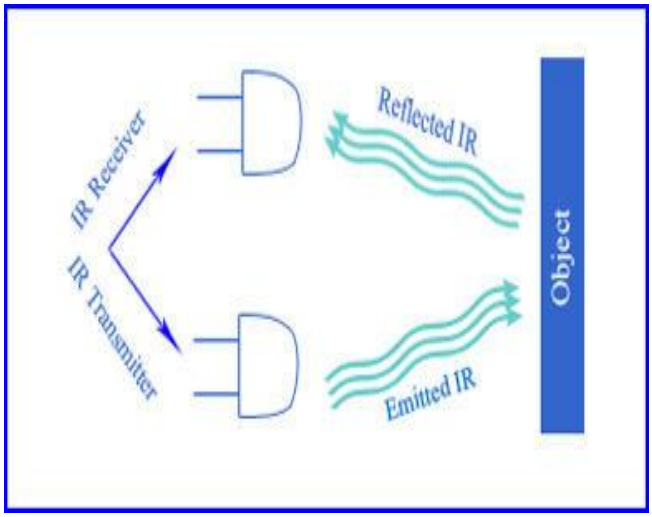


Figure: 3 Working of IR sensor

When IR receiver is subjected to infrared light, a voltage difference is produced across the leads. Less voltage which is produced can be hardly detected and hence operational amplifiers (Op-amps) are used to detect the low voltages accurately.

Measuring the distance of the object from the receiver sensor the electrical property of IR sensor components can be used to measure the distance of an object. The fact when IR receiver is subjected to light, a potential difference is produced across the leads.

IV. Software implementation of project: PSOC PROGRAMMER:

The host programmer can be the MiniProg3 Programmer Supplied by Cypress, a third party programmer or a hardware device such as a microcontroller or FGPA. MiniProg3 programmer is used in the prototype stage of application development for programming and debugging PSoC 5 in large numbers.

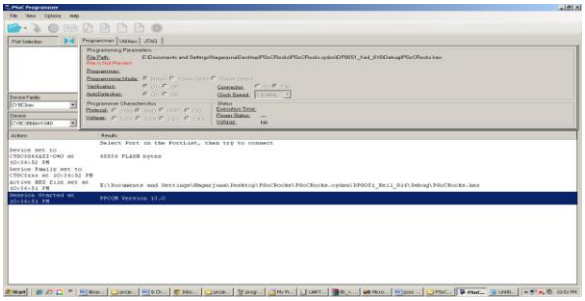
They are used when the design is finalized and the application needs to go in for mass production. Apart from this, custom developed host programmers such as FGPA or external microcontroller can be used to perform in-system programming for PSoC 5 device either for complete programming or partial firmware upgrade.

The host programmer programs the PSoC 5device with the program image contained inthe <Project_Name>.hex file, Which is generated by PSoC Creator Software.

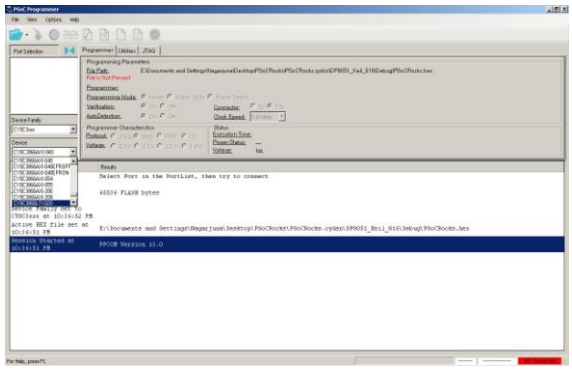
See the general PSoC Programming web page for complete information on PSoC 5 Programming related documents, software, and a list of supported third party programmers.

PROCEDURE:

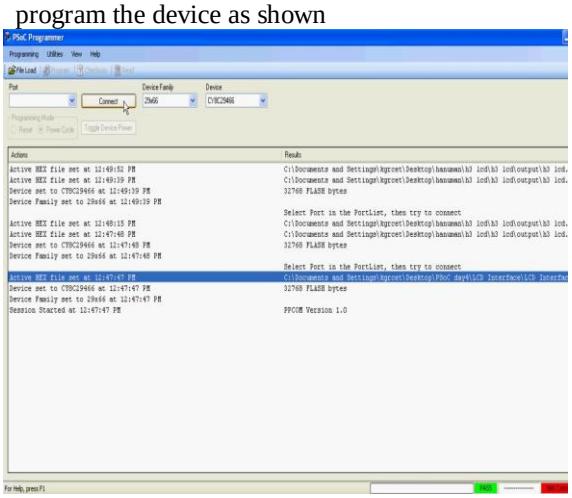
1. Now open the PSoC Programmer 3.17 in the start button from the taskbar.



2. In the window, open the .hex file. select the device family and the device from the drop-down list as shown below

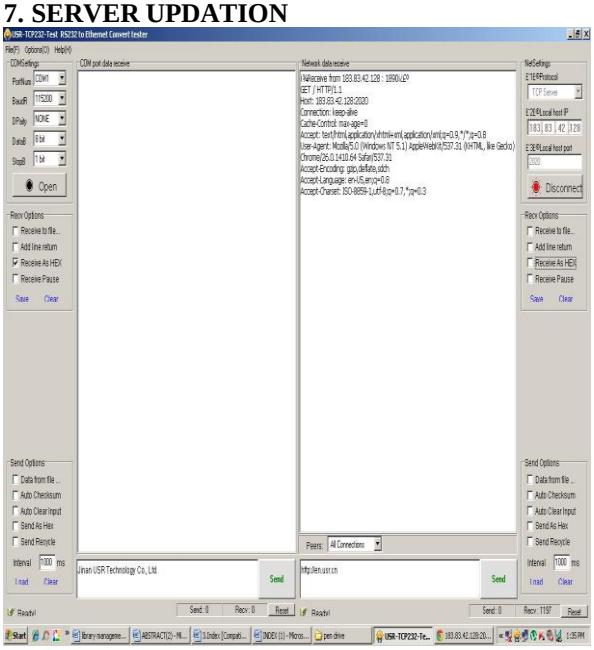


3) Now Connect the device to the system and then program the device as shown



4.Now the code is successfully programmed.
5.By these two ways we can program PSoC devices.
6. The IR count and card count get tally.

7. SERVER UPDATION



V. CONCLUSION

Hence by our project we can conclude that the tedious job of automation can be reduced by using this project. Update can be sent easily to the parents by gsm server. Automatic updation can be done using TCP and gprs. This forms a simple method for calculating the attendance and storing the details of the students. The PSOC microcontroller is a low power controller; hence it can be applied under low power conditions also.

By interfacing it with an external memory access we can implement it for higher levels of attendances and calculations of various parameters.

This can be further extended for marks, news and validation purpose. We can use bio-metric and image processing techniques for further up gradations. By interfacing external memory to the controller this can be used for classrooms with more strength.

By interfacing it with an external mini printer the attendance can be obtained in a printed format. By accessing it with a gsm server and using TCP we can update the attendance directly to the websites required. By using photo scanners and counters we can avoid duplications and we can use it for pure security applications and database management systems for colleges especially.

REFERENCES

[1] Sedra and Smith, Microelectronic Circuits, fourth edition, Oxford University Press, 1998.
[2] R.S. Sedha, 2002. A Text Book of Applied Electronics, S. Chand and Company Ltd., New Delhi
[3] Theodore S. Rappaport, Wireless Communications, second edition, PHI. New Delhi,Draft EN (GSM 03.40) v6.0.0
[4] Ali M. F. M., Younis M. I., Zamli K. Z., Ismail W. (2010) Development of Java based RFID application programmable interface for heterogeneous RFID system. The Journal of Systems and Software 83(11): 2322–2331
[5] Anagnostopoulos A., Soldatos J., Michalakos S. G. (2009) REFiLL: A lightweight programmable middleware platform for cost effective RFID application development. Pervasive and Mobile Computing 5(1): 49–63
[6] Balitanas M. O., Kim T. (2010) Review: Security threats for RFID-sensor network anti-collision protocol. International Journal of Smart Home 4(1): 23–36
[7] Bondi, A. B. (2000). Characteristics of scalability and their impact on performance.
[8] Bubak M., Albada G. D. V., Sloot P. M. A., Dongarra J. J., Abawajy J. H. (2004) Dynamic parallel job scheduling in multi-cluster computing systems. LNCS 3036: 27–34
[9] Chen M., Gonzalez S., Zhang Q., Li M., Leung V. (2010) A 2G-RFID based E-healthcare system. IEEE Wireless Communications Magazine 17(1): 37–43
[10] SEEED RFID Reader Manual, www.seeedstudio.com
[11] Smart License May Cut Car Theft ,http://www.rfidjournal.com/article/view/89.

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