Attendance System Based on Radio Frequency Identification Technology

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Abstract:

Attendance is an important aspect in every educational institute or workplace. Most universities are still using the paper based attendance system. This paper presents an effective approach to improve the processes of attendance system using Radio Frequency Identification (RFID) technology.The design of software tools was implemented by using Visual Basic 6.0 for interfacing and a database for persons' information include RFID tags identification (IDs). The proposed design has Liquid Crystal Display (LCD) to get message from the application when the identification is done, and pass information back to the micro controller to send this information to LCD to be displayed.

نظام متابعه الحضور بالاعتماد على تقنية التعرف بالترددات الراديوية

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الخلاصة:

يعتبر نظام متابعة الحضور جانب مهما في كل مؤسس ة تعليمية او اي مكان عمل. معظم الجامعات ما زالت تتبع نظام متابعة الحضور الورقي . يطرح هذا البحث طريقة فعاله لتحسين عمل نظام متابعة الغياب باستعمال تقنية التعرف بواسطة الترددات الراديوية .لقد تمت عملية تصميم الادا ة البرمجية باستعمال الفيجوال بيسك لعمل واجهة وقاعد ة بيانات لمعلومات الاشخاص تحتوي على رقم معرف بطاقة التعرف الراديوي. يحتوي التصميم المقترح على شاشة لتاخذ الرسالة التي تتم عرضها من التطبيق عندما تتم عملية التعرف بحيث ان المعلومات ممكن ان ترسل الى (المسيطرات المايكروية) لكي يقوم بارسالها الى الشاشة لكي يتم عرضها.

1. Introduction:

Radio Frequency Identification (RFID) is a very fast emerging technology for applications demanding identification or tracking of objects. In contrast to other identification technologies, such as the magnetic strip or the barcode, no line of sight connection is required to identify an item, and multiple goods can be inventoried almost simultaneously [1].

Complete RFID combines the technology of the tags and readers with access to database. The reader sometimes called an interrogator or scanner; it sends and receives RF data to and from the tag via antennas. A reader may have multiple antennas that are responsible for sending and receiving radio waves. The data acquired by the readers is then passed to a host computer, which may run specialist RFID software or middleware to filter the data and route it to the correct application [2]. RFID tags can be classified to passive and active depended on the power transmission and its applications.

1.1. RFID System Components:

There are three basic components of an RFID system, as shown in Figure (1):

- The Tag:
  Sometimes called a transponder, which is composed of a semiconductor chip, an antenna, and sometimes a battery. The basic function of RFID tag is to store data and transmit data to the interrogator. At its most basic, a tag consists of an electronics chip and an antenna encapsulated in a package to form a usable tag [2]. It is often advantageous to eliminate the radio transmitter and battery from an RFID tag to save money and space. The presence or absence of these components forms the basis of means of classifying RFID systems, by the power source and capabilities of the tags, [3]. This is what differentiates active tags from passive tags [2].

- **The Interrogator:**

  Sometimes called a reader or a read/write device, which is composed of an antenna, an RF electronics module, and a control electronics module. RFID interrogator acts as a bridge between the RFID tag and the controller [2].
  Various types of interrogators exist on the commercial market. They differ not only by their function, but also by their form, design, and suitability for specific applications. The main kinds are:

  ### (a) Fixed Interrogators

  Fixed interrogators are intended to be mounted onto a portal or a wall. They need to be locally connected to a power source and often to a network through appropriate cables [4].

(b) Mobile Interrogators

In general, RFID tags tend to be mobile and readers are stationary. This is the typical architecture for the well-known RFID application such as supply chain management. However, there may be RFID applications that both of RFID tags and readers to be mobile [5]. Mobile interrogators are specially designed to be "on the move" often with interfaces that support wireless communication. Mobile interrogators can be vehicle mounted, handheld, or come in various forms such as small Personal Digital Assistants (PDAs) or cell phones [4].

- **The Controller**

Sometimes called a host, which most often takes the form of a PC or a workstation running database and control (often called middleware) software [2].

1.2. Basic Operations of RFID:

In figure (1) the basic operations of RFID System is as follows:

- The tag enters RF field of the reader.
- RF signal powers the tag.
- The tag transmits its data.
- The reader captures data.
- The reader sends data to computer.
- The computer sends data to the reader.
- The reader transmits data to the tag.

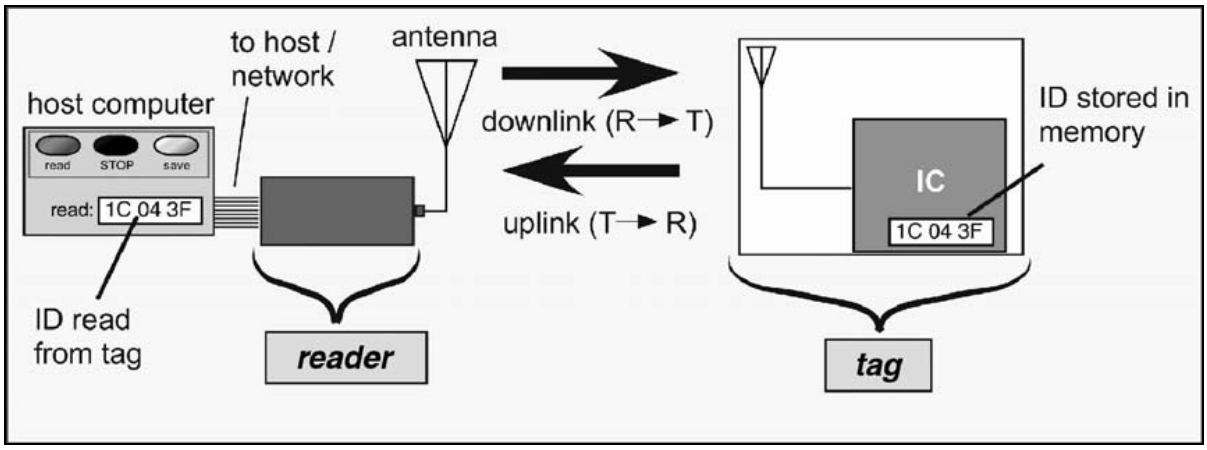

Figure (1) Basic Operations of RFID [3]

1.3. Applications of RFID:

Applications fall into two principal categories: firstly, short range applications where the reader and tag must be in close proximity (such as in access control) and secondly, medium to long application, where the distance may be greater (such as reading across a distribution center dock door) [6].

There are several applications which have integrated RFID technology into their business models such as:

- **Defense and Military:** The US Department of Defense (DOD) is investigating a new active tag which has the ability to access and communicate via satellites. This new tag, known as the "Third Generation Radio Frequency Identification with Satellite Communications (3G RFID w/SATCOM)", is expected to be used to increase the visibility of the DOD's supply chain and, in turn, increase the confidence of shipments to various war-torn regions [7].
- **Animal Tracking:** Using RFID tags to track animals is not a new application, but it has evolved from the usage of detecting the missed cattle to the tracking of its movements and behavior. The RFID tags are even used to control out-breaks of animal diseases [8].
- **Postal Package Tracking:** The postal service has been found to incorporate RFID worldwide with the primary goal of increasing the effectiveness of tracking packages and parcels thereby increasing customers' property security [7].
- **Payment by Mobile Phones:** Starting from summer 2009, two credit card companies have been working with Dallas, Texas-based Device Fidelity to develop specialized microSD cards. When inserted into a mobile phone, the microSD card can be both a passive tag and an RFID reader. After inserting the microSD, a user's phone can be linked to bank accounts and used in mobile payment. Diaryqueen in conjunction with Vivotech has also begun using RFIDs on mobile phones as part of their new loyalty and rewards program. Patrons can ask to receive an RFID tag to place on their phone. After activation, the phone can receive promotions and coupons, which can be read by Vivotech's devices. Similarly, Nokia's 2008 device, the 6212, also has RFID capabilities [9].
- **Health Care:** The RFID tag is also used in the health care industry; where it is used to store the patient's medical history and can be scanned each time to know the developments and changes of the patient's health condition and medication [8]. The Taiwanese Chang-Gung Memorial Hospital has been monitoring surgical patients with RFID wristbands in

order to ensure maximum care is given where needed. The features available in the wristbands include the ability to decrypt data, obtain read-only static fields (such as blood-types) and read/write dynamic fields which may be updated and modified by medical staff [7].

1.4. RFID Frequencies

RFID systems use different frequency bands for communication as shown follows:

- Low Frequency LF (125/134 kHz).
- High-Frequency HF (13.56 MHz).
- Ultra High-Frequency UHF (860 MHz to 960 MHz).

Figure (2) illustrates the different frequencies that are used for RFID [2].

UHF has better read rate and large number of UHF tags can be recognized at one time. It has also good better read range and three times with high frequency, it is capable to read tags up to three meters. However, the range can be reduced in wet environment. It works between 860-930 MHz frequencies [10]

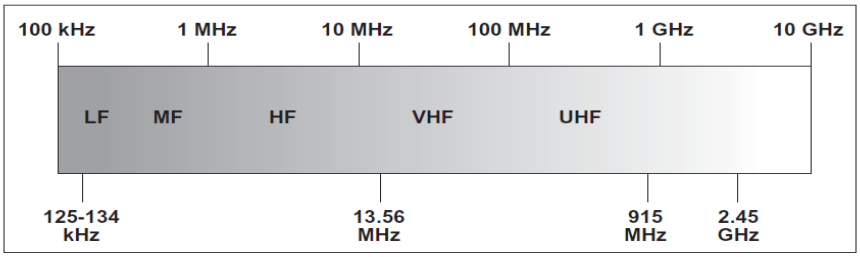

Figure (2) RFID Frequencies [2]

2. The Microcontroller [11]:

The AT89C51 is a low-power, high-performance CMOS 8-bit micro controller with 4K bytes of Flash programmable and erasable read only memory (PEROM). The device is manufactured using Atmel's high-density nonvolatile memory technology and is compatible with the industry-standard MCS-51 instruction set and pin out. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional nonvolatile memory programmer. By combining a versatile 8-bit CPU with Flash on a monolithic chip, the Atmel AT89C51 is a powerful microcomputer which provides a highly-flexible and cost-effective solution to many embedded control applications.

The device is manufactured using Atmel's high-density nonvolatile memory technology and is compatible with the industry-standard MCS-51 instruction set and pin out and has the following features:

- Compatible with MCS-51™ Products
- 4K Bytes of In-System Reprogrammable Flash Memory
- Endurance: 1,000 Write/Erase Cycles
- Fully Static Operation: 0 Hz to 24 MHz
- Three-level Program Memory Lock
- 128 x 8-bit Internal RAM
- 32 Programmable I/O Lines
- Two 16-bit Timer/Counters
- Six Interrupt Sources
- Programmable Serial Channel
- Low-power Idle and Power-down Modes.

3. Hardware Implementation:

The proposal is to implement RFID to check if the person has a record (data) and registered in database by interfacing the design circuit to PC. The schematic circuit of the RFID is used main microcontroller EM4095, as shown in **figure (3)**.

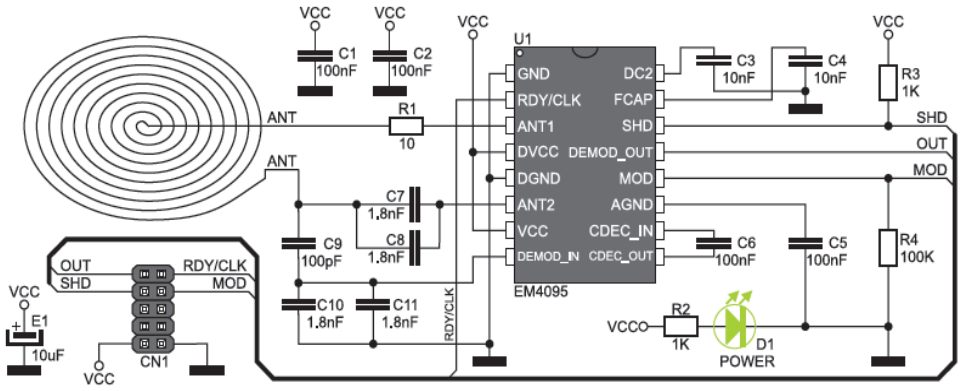

Figure (3) schematic circuit of RFID

4. Software Simulation:

Microsoft Visual Basic serial object (MSCOMM.ocx) has been used to receive the stream of data from the hardware, and collected this stream as one packet. First of all, it is need to connect to the circuit by specify the number of the serial port (com) number, as shown in **figure (4).**

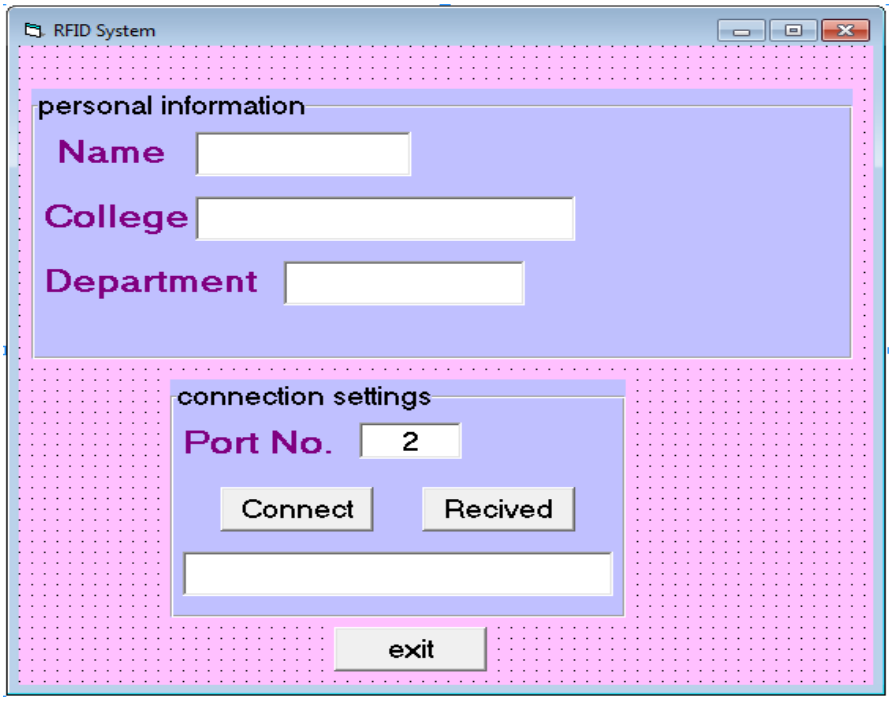

Figure (4) define the serial port number

When circuit supplied with power, the RFID and other components will be run, after that the software check with database if the ID (data stream) has been found or not. If the tag ID found, other data (picture, name, and other information) will be displayed, as shown in figure (5).

Figure (5) Software Identification Information displayed

During the identification process, and exactly when ID has found, the software will pass information (name of person) back to circuit via serial port to microcontroller which last one will pass it to LCD to be displayed, as shown in **figure (6).**

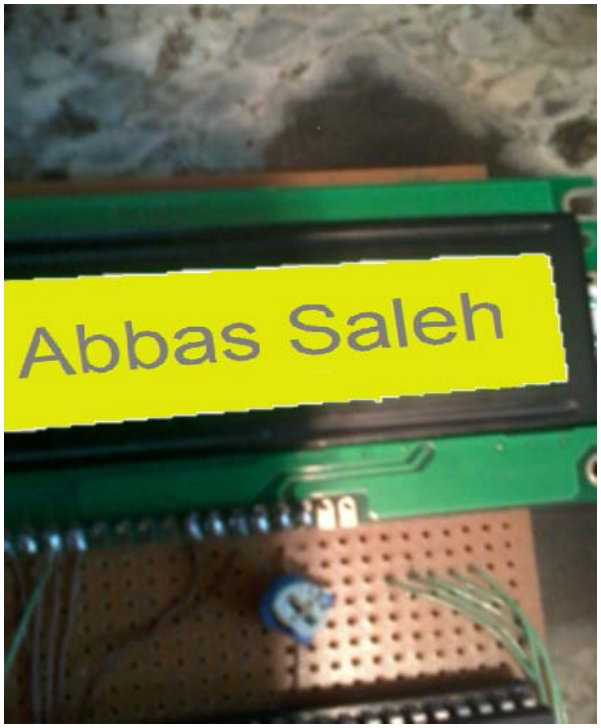

Figure (6) Name of Person Displayed During Identification

5. Conclusion

This project proposed a solution to address the issue of detecting a person's information based on RFID by interfacing with PC, in addition to that, the software was done by using Visual Basic 6.0 for interfacing, and this application has a database for person's information and include RFID tags' IDs. The proposed design has LCD to display the information, when the identification is done, information pass back to microcontroller to send it to the LCD to be displayed. The proposed solution produced effectively system for the identification purposes.

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