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RFID Based Security Access Control System with GSM Technology

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ABSTRACT

The security challenges being encountered in many places today require electronic means of controlling access to secured premises in addition to the available security personnel. Various technologies were used in different forms to solve these challenges. The Radio Frequency Identification (RFID) Based Access Control Security system with GSM technology presented in this work helps to prevent unauthorized access to controlled environments (secured premises). This is achieved mainly through the use of a Radio Frequency Identification System with operating frequency of 125 KHz, Microcontroller programmed to send control signals, Liquid Crystal Display (LCD) and GSM. If any concerned person need to access the data, from RFID he has to get an verified access by the AUTHORISED person. By using RFID tag in which the data is been stored is brought in a range of RFID reader, once he detect the RFID tag then GSM sends the one time password (OTP) to the authorized person's mobile. once if he give the OTP through KEYPAD to the LPC2148 ARM 7's microcontroller. It will give access to the data stored in the RFID by displaying it on the LCD 20*4. buzzer turns ON for about 5seconds and GSM modem been activated to send UNAUTHORIZED, invalid user's to the security personnel. The electronic circuit was implemented, the codes for microcontroller were written in embedded C, debugged and compiled using the KEIL Micro vision 4 integrated development environment. The resultant Hex files were programmed into the memories of the microcontrollers with the aid of a universal programmer. Hardware simulation was carried out using the Proteus Virtual System Modelling (VSM) version 8.0.An importation implication of this paper is that the system is cheaper to maintain and more efficient in comparison with a manually operated type or key lock system. The RFID based access control system can be useful in providing security for medical organization, homes, organizations, and automobile terminals to increase the level of security.

Keywords : Access control, Authorized, RFID, GSM, Microcontroller, Unauthorized

I. INTRODUCTION

Security systems play an important role to prevent unknown user entry into a secured place, which may include physical and intellectual property, without being authorized. The security system is basically divided into two types; the use of normal door lock key and the use of electronic automatic identification system. In general, locks are very simple devices that are employed to address a straightforward problem. Basically, lock can be easily hacked by unwanted people thereby allowing unauthorized people into secured premises.

There are several automatic identification technologies including barcode, magnetic stripe and Radio Frequency Identification (RFID) applied in security system. Radio-Frequency Identification (RFID) is an emerging technology and one of the most rapidly growing segments of today's automatic

identification data collection industry. RFID technology, offers superior performance over other automatic identification systems. Because it is not an optical technology like bar coding, no inherent line of sight is required between the reader and the tagged RFID object [1].

The system described in this work uses an RFID tag which contains integrated circuit that is used for storing, processing unique information, modulating and demodulating the radio frequency signal being transmitted and a Global System for Mobile Communication (GSM) technology to communicate to security personnel via Short Message Service (SMS) in order to enhance the security of a conditioned environment[1][2][3][4].

II. BLOCK DIAGRAM

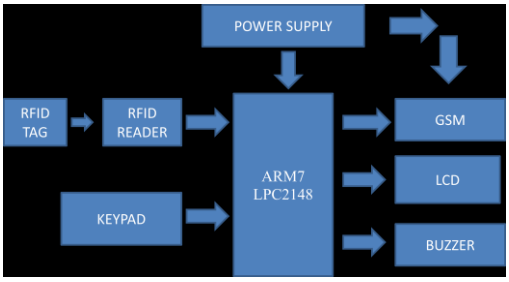


Fig: Block Diagram

This System is proposed based on the design considerations required to improve security features in various applications. To meet the design constraints such as

1. To reduce the complexity of the system.
2. To make it cost effective.
3. To reduce the time to implement.
4. To increase the speed of execution.
5. To improve security to the data.

the two components relay and DC motor are been removed to make it cost effective .

III. HARDWARE REQUIREMENTS

1. ARM7 BASED LPC2148
2. Power Supply 5v
3. GSM
4. RFID
5. 20X4 LIQUID CRYSTAL DISPLAY

LPC2148

The LPC2148 microcontrollers are based on a 32/16 bit ARM7TDMI-S CPU with real-time emulation and embedded trace support, that combines the microcontroller with embedded high speed flash memory ranging from 32 kB to 512 kB. A 128-bit wide memory interface and unique accelerator architecture enable 32-bit code execution at the maximum clock rate. For critical code size applications, the alternative 16-bit Thumb mode reduces code by more than 30 % with minimal performance penalty.

Due to their tiny size and low power consumption, LPC2148 are ideal for applications where miniaturization is a key requirement, such as access control and point-of-sale. A blend of serial communications interfaces ranging from a USB 2.0 Full Speed device, multiple UARTs, SPI, SSP to I2Cs, and on-chip SRAM of 8 kB up to 40 kB, make these devices very well suited for communication gateways and protocol converters, soft modems, voice recognition and low end imaging, providing both large buffer size and high processing power.

Pin Diagram

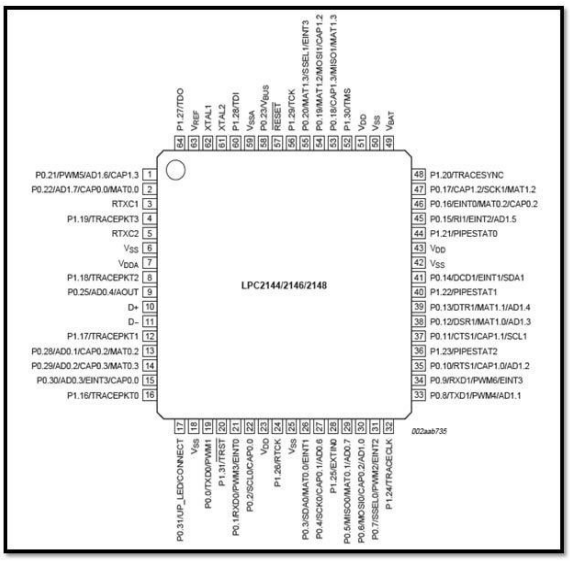


Fig: ARM7 Pin Diagram

Pin Description

PORT 0 is a 32-bit I/O port with individual direction controls for each bit. Total of 28 pins of the Port 0 can be used as a general purpose bi-directional digital I/Os while P0.31 provides digital output functions only. The operation of port 0 pins depends upon the pin function selected via the pin connect block. Pins P0.24, P0.26 and P0.27 are not available.

PORT 1 is a 32-bit bi-directional I/O port with individual direction controls for each bit. The operation of port 1 pins depends upon the pin function selected via the pin connect block. Pins 0 through 15 of port 1 are not available.

Power Supply

The power supply section is the section which provide +5V for the components to work. IC LM7805 is used for providing a constant power of +5V.

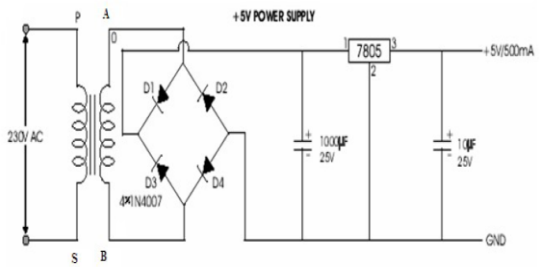


Fig: Circuit Diagram of Power Supply

The ac voltage, typically 220V, is connected to a transformer, which steps down that ac voltage down to the level of the desired dc output. A diode rectifier then provides a full-wave rectified voltage that is initially filtered by a simple capacitor filter to produce a dc voltage. This resulting dc voltage usually has some ripple or ac voltage variation. A regulator circuit removes the ripples and also retains the same dc value even if the input dc voltage varies, or the load connected to the output dc voltage changes. This voltage regulation is usually obtained using one of the popular voltage regulator IC units.

RFID.

RFID is a tracking technology used to identify and authenticate tags that are applied to any product, individual or animal. **Radio frequency Identification and Detection** is a general term used for technologies that make use of radio waves in order to identify objects and people.

Fig: RFID Module

Introduction to RFID

Purpose of Radio frequency Identification and Detection system is to facilitate data transmission through the portable device known as tag that is read with the help of **RFID** reader; and process it as per the needs of an application. Information transmitted with the help of tag offers location or identification along with other specifics of product tagged – purchase date, color, and price. Typical **RFID** tag includes microchip with radio antenna, mounted on substrate.

The RFID tags are configured to respond and receive signals from an RFID transceiver. This allows tags to be read from a distance, unlike other forms of authentication technology. The RFID system has gained wide acceptance in businesses, and is gradually replacing the barcode system

How RFID Works

Basic RFID consists of an antenna, transceiver and transponder. To understand the working of a typical RFID system, check the following animation.
Antenna emits the radio signals to activate tag and to read as well as write information to it. Reader emits the radio waves, ranging from one to 100 inches, on

the basis of used radio frequency and power output. While passing through electronic magnetic zone, RFID tag detects activation signals of readers.
Powered by its internal battery or by the reader signals, the tag sends radio waves back to the reader. Reader receives these waves and identifies the frequency to generate a unique ID. Reader then decodes data encoded in integrated circuit of tags and transmits it to the computers for use. Get in-depth about RFID tag and its working through exclusive images at the Insight about RFID tags.

Types of RFID

Active and passive RFID are different technologies but are usually evaluated together. Even though both of them use the radio frequency for communication between tag and reader, means of providing power to tags is different. Active RFID makes use of battery within tag for providing continuous power to tag and radio frequency power circuitry. Passive RFID on the other hand, relies on energy of radio frequency transferred from reader to tag for powering it.

Passive RFID needs strong signals from reader but signal strength bounced from tag is at low levels. Active RFID receives low level signals by tag but it can create higher level signals to readers. This type of RFID is constantly powered, whether in or out of the reader's field. Active tags consist of external sensors for checking humidity, temperature, motion as well as other conditions.

RFID frequencies

Just like you can tune a radio in various frequencies for listening to different channels, RFID readers and tags need to be tuned in to a same frequency for communication. RFID system uses various frequencies but most common and popularly used frequency is low, high and ultra high frequency. Low frequency is around 125 KHz, high is around 13.56 MHz and ultra high varies between 860-960 MHz. Some applications also make use of microwave frequency of 2.45 GHz. It is imperative to choose right frequency for an application as radio waves work different at various frequencies.

Global system for mobile(GSM):

GSM is used to establish communication between a computer and a **GSM system**. **Global System for Mobile communication (GSM)** is an architecture used for mobile communication in most of the countries. **GSM** module consists of a GSM/GPRS modem assembled together with power supply circuit and communication **interfaces** (like RS-232, USB, etc) for computer. GSM/GPRS MODEM is a class of wireless MODEM devices that are designed for communication of a computer with the GSM and GPRS network. It requires a **SIM (Subscriber Identity Module)** card just like mobile phones to activate communication with the network. Also they have **IMEI** (International Mobile Equipment Identity) number similar to mobile phones for their identification. A GSM/GPRS MODEM can perform the following operations:

1. Receive, send or delete SMS messages in a SIM.
2. Read, add, search phonebook entries of the SIM.
3. Make, Receive, or reject a voice call.

The MODEM needs **attention commands**, for interacting with processor or controller, which are communicated through serial communication. These commands are sent by the controller/processor. The MODEM sends back a result after it receives a command. Different AT commands supported by the MODEM can be sent by the processor/controller/computer to interact with the **GSM and GPRS cellular network.**

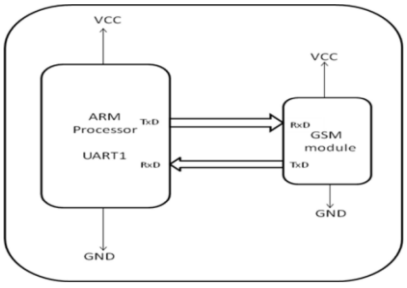


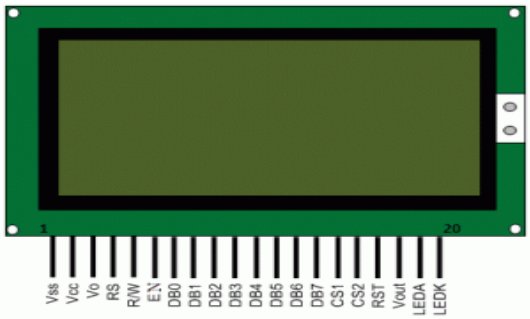
Fig: Interfacing ARM7 with GSM

Features

- ✓ Quad-Band 850/ 900/ 1800/ 1900 MHz
- ✓ Dual-Band 900/ 1900 MHz
- ✓ GPRS multi-slot class 10/8GPRS mobile station class B
- ✓ Compliant to GSM phase 2/2+Class 4 (2 W @850/ 900 MHz)
- ✓ Class 1 (1 W @ 1800/1900MHz)
- ✓ Control via AT commands (GSM 07.07 ,07.05 and SIMCOM enhanced AT Commands)
- ✓ Low power consumption: 1.5mA(sleep mode)
- ✓ Operation temperature: -40°C to +85 °C

LIQUID CRYSTAL DISPLAY:

The most commonly used Character based LCDs are based on Hitachi's HD44780 controller or other which are compatible with HD44580. In this tutorial, we will discuss about character based LCDs, their interfacing with various microcontrollers, various interfaces (8-bit/4-bit), programming, special stuff and tricks you can do with these simple looking LCDs which can give a new look to your application.



The most commonly used LCDs found in the market today are 1 Line, 2 Line or 4 Line LCDs which have only 1 controller and support at most of 80 characters, whereas LCDs supporting more than 80 characters make use of 2 HD44780 controllers. Most LCDs with 1 controller has 14

Pin description of LCD:

Pins and LCDs with 2 controller has 16 Pins (two pins are extra in both for back-light LED connections).

IV. SOFTWARE REQUIREMENTS

Language used:

EMBEDDED C: Embedded C is a set of language extension for the C programming language by the C standards committee to address commonality issues that exist between C extensions for different embedded system. Embedded C uses most of the syntax and semantics of standard C, eg : main()function, variable definition, data type declaration, conditional statements , loops, arrays and strings etc.

SOFTWARE USED:

1. **KEIL COMPILER:** Keil development tools for the 8051-micro controller architecture support every level of software developer from the professional applications to the learning about embedded software development. The industry standard keil C compiler, micro assembler, debuggers, real time kernels, single-board computers and emulators support all 8051 derivatives.

Pin No.	Name	Description
Pin no. 1	**D7**	Data bus line 7 (MSB)
Pin no. 2	**D6**	Data bus line 6
Pin no. 3	**D5**	Data bus line 5
Pin no. 4	**D4**	Data bus line 4
Pin no. 5	**D3**	Data bus line 3
Pin no. 6	**D2**	Data bus line 2
Pin no. 7	**D1**	Data bus line 1
Pin no. 8	**D0**	Data bus line 0 (LSB)
Pin no. 9	**EN1**	Enable signal for row 0 and 1 (1st controller)
Pin no. 10	**R/W**	0 = Write to LCD module 1 = Read from LCD module
Pin no. 11	**RS**	0 = Instruction input 1 = Data input
Pin no. 12	**VEE**	Contrast adjust
Pin no. 13	**VSS**	Power supply (GND)
Pin no. 14	**VCC**	Power supply (+5V)
Pin no. 15	**EN2**	Enable signal for row 2 and 3 (2nd controller)
Pin no. 16	**NC**	Not Connected

2. FLASH MAGIC: "flash magic is a tool which used to program hex code in EPROM of microcontroller. it is a freeware tool. it only supports the microcontroller of Philips and NXP. you can burn hex code in to those controllers which supports ISP feature".

3. PROTEUS: Proteus combines ease of use powerful features to help you design, test and layout professional PCBs like never before. With nearly 800 micro controller variants ready for simulation straight from the schematic, one of the most intuitive professional PCB layout packages on the market and a world class shape based autoroute included as standard, proteus design suite 8 delivers the complete software package.

ADVANTAGES:

1. It is simple and cost effective
2. Security

APPLICATIONS:

1. It is used in medical field.
2. It's used in homes application.
3. It can be used for various security purposes.

V. CONCLUSION

The knowledge and application of new techniques in electronics and telecommunication has made our life more secured and comfortable. RFID based security system is one of such applications. RFID security access control system with GSM technology presented in this work is based on microcontroller; hence the hardware requirement is greatly reduced. An RFID based security access control systit em with GSM technology has been implemented and function as desired. The system can be installed at the entrance of a secured environment to prevent an unauthorized individual access..

VI. RESULT

As we can observe the module will read the RFID serial number and the related information will be displayed which is been already saved in ARM7 through coding, after entering the OTP through keypad to ARM7 then after the microcontroller will display the data on LCD20*4.

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