RFID Based Smart Car Parking And Security System Using Arduino.

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ABSTRACT

Radio Frequency Identification [RFID] system is evolving as a major technology in Automation System in Malls/Buildings/Industries or in the medical field in order to increase efficiency and security. Typically RFID comprises of two parts. First is the RFID reader/Interrogator and the second is the RFID transponder. Transponder may be smart cards or tags or key chains or any other electronic devices. RFID technology is the advanced method of barcode method. RFID system uses electromagnetic fields (radio waves) in order to transfer data for performing automatic detection and tracking of different tags or different objects from some distance. RFID system is an Automatic Identification and Data Capture (AIDC) technology used to identify, capture, track and store the data present in the tag. The main objective is to provide a system with security. In this paper we have proposed contactless smart cards in order to limit the unauthorized vehicles to enter into the parking area. Each card has unique information stored in it and if it comes nearer to the reader then RFID reader scans the information present in the card and sends this information to the database (stores the data present in the tag) and displays the relevant information on LCD. If the reader has details about that tag in the database then gate is opened automatically for authorized vehicle to enter into the parking lot, If not gate will be closed and alerts through a buzzer for unauthorized vehicle.
Keywords: RFID, Smart car parking system Wireless sensor networks, Security surveillance

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INTRODUCTION

Security and privacy related issues need to be carefully addressed; numerous technologies have been implemented to extend the security [1-2] of the system. Few among them are widely in practice and some are not used because of the cost factor and complex design. To overcome security related issues Automatic Identification and Capturing of Data is used. Installation of entire system at the main entrance will allow only authorized vehicles to enter into the parking area. AIDC refers to automatically tracking [3-4], identifying and collecting data from different objects and transferring that data directly into the database (without any human action). Some of the latest technologies involved in AIDC are Barcode method, Thumb impression, and smart card [5-6] technology and face recognition [7-8]. Barcode system mainly consists of mobile computers, handheld scanners, printers. A regular PC can't read barcodes; particular or special scanners are used to scan the data present. Most of the scanners used are easily compatible with PC's and Operating Systems. Special software installation is necessary which is simple and easy to use to scan the code. Barcodes can be read only one at a time, can't be read if the data is damaged. Data can't be read from longer distance (i.e. Line of Sight communication) is necessary and the main demerit is data storage of transponder is also very low. To overcome all these demerits we use Radio Frequency Identification (RFID) technology [9-10].

RFID technology mainly consists of RFID tags and Readers. Small microchip attached to antenna is called as a Transponder or Tag and this antenna is used to enable microchip and transfer amount of data present on tag to a reader. Further conversion of radio waves from tag to digital data and it can be transferred on to computers can be done with the help of reader. RFID tags are further divided into Active and Passive tags. Active tag relies on battery operated devices i.e. have internal power within the tag to power up the tag whereas Passive tags rely on energy from reader to power up the tag. Smart cards offer many advantages over barcode method. Data can be read from the tag if it is passed nearer to the field of reader even if it is covered by other object or not visible. By using RFID technology more number of tags can be read when comes nearer to the field of RFID reader. Increased technologies like video surveillance can be implemented. Information can be updated or overwritten whenever needed. Data from the tags can be read very quickly in any type of environmental conditions. RFID has many different applications that extend beyond retail sector some of them are libraries, attendance management in schools, animal identification, transportation payments, hospitals and health care. ARDUINO-UNO [11-12] (ATmega328) microcontroller board is main controlling unit. UNO has 14 digital pins acts as input or output pins, 6 analog pins used as input pins with a dc voltage of 5V for operating, flash memory of 32KB, SRAM of 2KB, and EEPROM of 1KB and with a clock speed of 16 MHZ and controller unit is interfaced with LCD display unit and Buzzer.

System Overview

The important feature of RFID system is that it gets verification or validation from RTO- Road Transport Office. Owner or user of vehicle or object requires verification of the identity to proceed with the thumb impression module by which the efficiency of thumb is developed by using PMA-Pattern Match Algorithm. Face recognition method is a technique which will be used after thumb registration module. Figure 1 represents the overview of RFID technology.
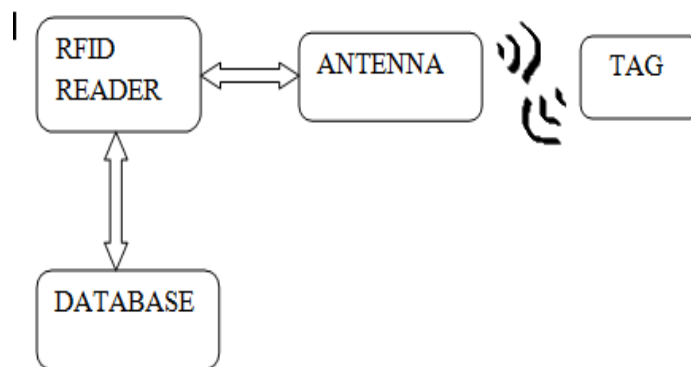

Fig 1: System overview of car parking based on RFID technology

Finally, the technology will allow the user to drive the vehicle and in case of emergency, a key insertion slot algorithm is used through which user can insert the key into the respective parking lot. In case of emergency mode, camera is installed to capture the image of driver and send that image to the respective owner mobile in the form of MMS and in turn owner of the vehicle provides authentication password. In case of tracking the entire operation GSM module is kept inbuilt. Contactless smart cards or tags are used to limit the entries of unauthorized vehicles to enter into the parking lot. Entire information such as employee ID, name, and additional data is stored in the contactless smart card. When this card comes within or near the field of interrogator, it scans the information stored in the transponder. Reader reads the entire information present in the card and matches related information on card with its database. If the details of the card are matched, display the comments on LCD and gate is opened automatically for authorized vehicle. If reader does not match the information of the card in its database then gate will be closed and unauthorized vehicle will not be allowed to enter into the parking lot.

METHODOLOGY

Operating principle:

Figure 2 represents operating principle of RFID system. RFID systems operate in different frequency ranges i.e. from low frequency range to extra high frequency range. Different frequencies such as lower frequency of 125KHZ, higher frequency of around 12 to13.56MHZ and extra high frequency of 900MHZ. RFID system with low frequency uses electro-magnetic wave propagation for communicating with corresponding data and commands. Both transponder and readers have to be tuned with exact frequency to communicate. Low frequency tags are less expensive when compared with ultra high frequency tags. Operating principle of RFID system uses near field region coupling between the transponder and reader. Near field region of coupling is based on Faraday's law of electromagnetic induction. Radio waves transmitted by reader are propagated outwards as spherical wave front in near field coupling. Transponder with in the near field absorbs some energy transmitted by the reader and the energy at any particular point is related to distance from the reader and is expressed as 1/d.
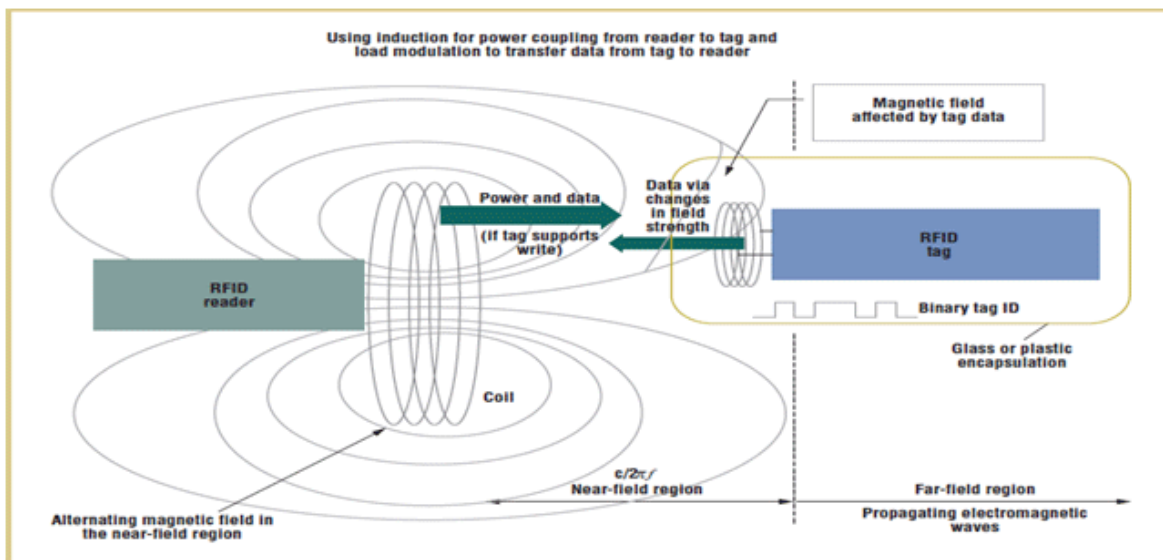

Fig 2: Operating Principle of RFID technology

Implementation and working:

Figure 3 represents the implementation of RFID based car parking system, when RFID card placed on RFID reader module then it reads the information present on the tag and through reader its code is sent to the controller and then controller matches this received code with stored code in database if code is matched then it displays on LCD and gate is opened for authorized entry. If code is unmatched with its stored memory in the database then closes the door and alerts the persons through a buzzer.
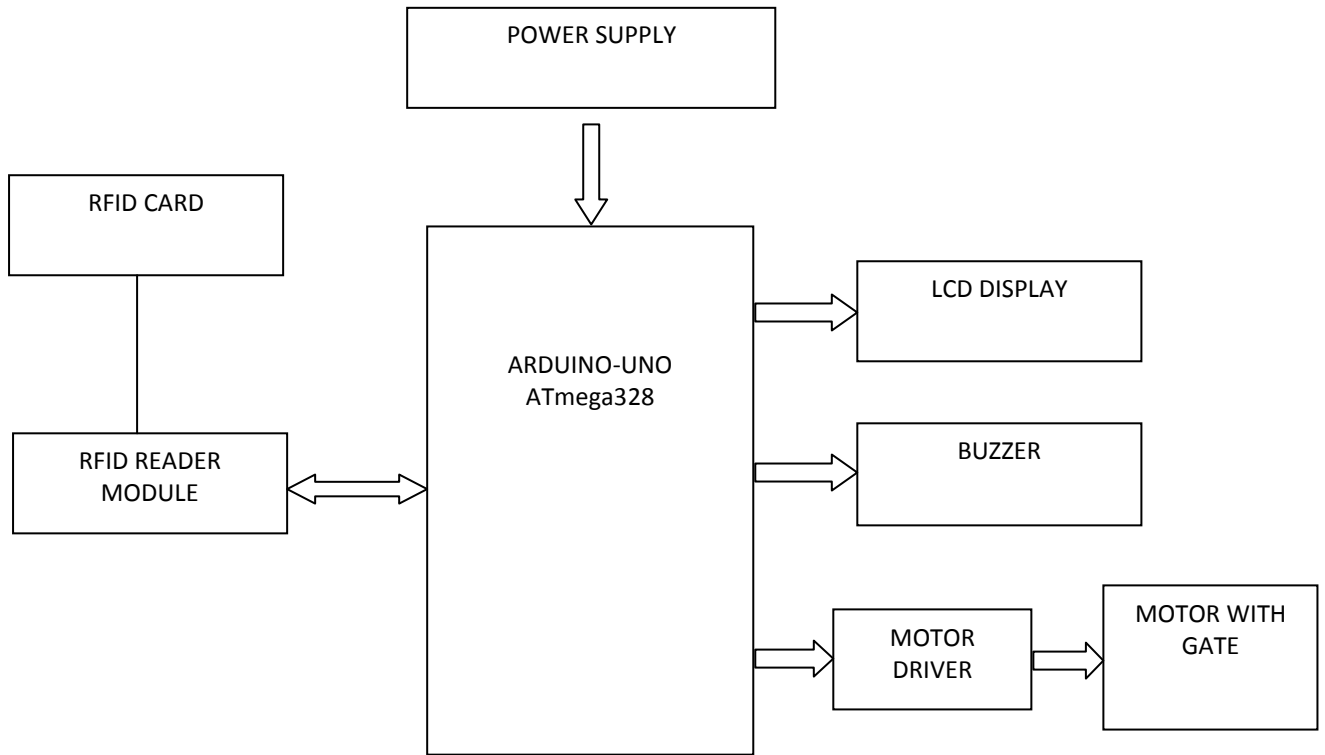
Fig 3: Implementation of car parking system based on RFID

RESULTS AND DISCUSSION

RFID tag and Reader are the two main components used and each passive tag has unique information within the microchip of the tag. Serial identity for each tag is given by the manufacturer itself and serial identity is stored in programming and we can use different passive tags with different serial numbers and other additional information stored in the tag. Figure 4 represents the hardware working circuit of RFID based parking security system.
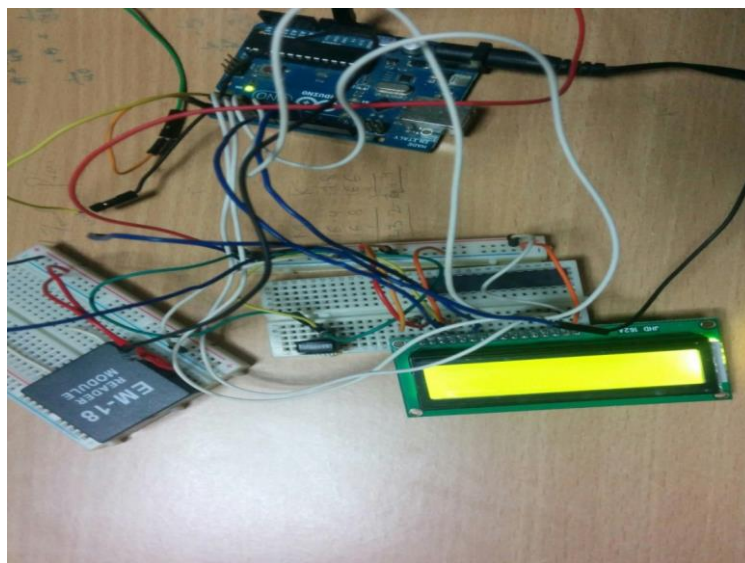

Fig 4: Working Circuit of proposed design

When RFID tag is placed nearer to the field of reader module; reader scans the entire data from the tag;

Case 1:

If the details of the tag are valid then the result in LCD is displayed as **"Matched"** and gate is opened for authorized vehicle to enter into the parking area and figure 5 represents the hardware module of LCD display when tag is Valid.

Fig 5: LCD status when RFID tag is valid

Case 2:

If the details of the tag are invalid then the result in LCD is displayed as **"Wrong Tag"** and the gate is not opened for unauthorized vehicle to enter into the parking area and Figure 6 represents the hardware module of LCD status when tag is Invalid.

Fig 6: LCD status when RFID tag is Invalid

Conclusions and future scope

When compared to other systems like barcode method, RFID system is more secure and has quick response. RFID technology works with contactless smart cards and is based on non line of sight technology. ARDUINO platform makes the response of system faster with simple and accurate coding. Applications can be changed accordingly by the user using ARDUINO microcontroller. This project is very useful in providing real time application for car parking with security benefits. RFID technology provides security at low cost. In future we can develop the security for the system by using advanced microcontrollers and advance technology such as installing camera, and if the card is lost then service to that card should be blocked and give new card to the

user immediately, and improve the work by increasing the range of the reader in which the tag can be read. As we know that work of thumb registration module and face recognition module are in progress, extend its security to safe guard human life from accidents.

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