RFID Based Automatic Car Parking System

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***Abstract* — *RFID based vehicles parking technique uses micro controller with sensing circuits which sense entry and outgoing of the vehicles. In this technique the RFID card is swiped with the permission of vehicle's parking owner. The RFID card which is given by the parking owners will be recharged by using the two push switches i.e. SW1 and SW2. When the vehicles enter in the parking system the money will automatically be reduced from the RFID card and it displays on the screen. By using the H bridge concept we operate the entry and exit. In this concept DC motors are used for the operation of entry and exit boom. The DC motors operate clock wise and antilock wise as per the program. When the vehicles enter in the parking system the space available in the parking system reduces and vice versa. A standard power supply of 5 volt is given for the operation. An LCD displays all the activities of the parking system.*

Keywords — RFID, Microcontroller, Sensor, Antenna, LED, DC Motor, Photo Diode.

I. INTRODUCTION

Nowadays Radio frequency identification (RFID) is an automatic identification method in which the data are stored in the RFID tags .This RFID tag is placed inside the vehicles for identification and tracking by using the RF frequency. Now a days this technology are using in the vehicles parking in the shopping centers buildings, toll plazas for minimizing the chance of traffics well as security purpose of view[2]. This technology is very fruitful in big companies in metropolitan cities for the reduction of chances of traffic jamming etc. This technique uses PIC AT89S52 microcontroller for the purpose of operation. Basically, an RFID system is electronically programmed with unique code and information[1] .The category of RFID system depends on the frequency ranges like low –frequency(30-500KHZ),middle –frequency(900KHZ 1500MHZ) and high frequency(2.4GHZ-2.5GHZ)[2].

1.1 RFID Fundamentals

Basically, an RFID system consists of an antenna or coil, a transceiver I (with decoder) and I transponder (RF tag) electronically programmed I with unique information. There are many different types of RFID systems in the market. These are categorized on the basis of their frequency ranges. Some of the most commonly used .RFID kits are low-frequency (30- 500kHz), mid-frequency (900kHz-1500MHz) and high-frequency (2.4-2.5GHz) [2].

1.2 RFID Transponder

It comprises a microchip containing identifying information about the item and an antenna that transmits this data wirelessly to the reader. At its most basic, the chip contains a serialized identifier or license plate number that uniquely identifies that item (similar to bar codes). A key difference, however, is that RFID tags have a higher data capacity than their bar code counterparts. This increases the options for the type of information that can be encoded on the tag; it may include the manufacturer's name, batch or lot number, weight, ownership, destination and history (such as the temperature range to which an item has been exposed) [3]. In fact, an unlimited list of other types of information can be stored on RFID tags, depending on the application's requirements. RFID tag can be placed on individual items, cases or pallets for identification purposes, as well as fixed assets such as trailers, containers and totes [4].

1.3 RFID Antenna

The antenna emits radio signals to activate the tag and read/ write data from/ to it. It is the conduit between the tag and the transceiver, which controls the system's data acquisition and communication. Antennae are available in a variety of shapes and sizes. These can be built into a door frame to receive tag data from persons or things passing through the door, or mounted on an inter-state tollbooth to monitor the traffic passing by on a freeway. The electromagnetic field produced by the antenna can be constantly present when multiple tags are expected continually. If constant interrogation is not required, a sensor device can activate the field [4]. Often the antenna is packaged with a transceiver and decoder to act as a reader (interrogator), which can be configured either as a handheld or a fixed-mount device. The reader emits radio waves in the range of 2.5 cm to 30 meters or more, depending upon its power output and the radio frequency used. When an RFID tag passes through the electromagnetic zone, it detects the reader's activation signal. The reader decodes the data encoded in the tag's integrated circuit (silicon chip) and communicates to the host computer for processing [2].

II. LITERATURE REVIEW

Radio Frequency Identification is a growing technology that has been around since early 1900's and was used in World War II . An early research paper had explored RFID work where the author of this paper stated that "Evidently, considerable research and development work has to be done before the field of useful applications is explored". Then, the electromagnetic theory related to RFID was studied in 1960's. Apart from that, inventions like Robert Richardson's "Remotely activated radio frequency powered devices" took place in that era. By this time, the wheels of RFID development had started turning. 1960's was the start of the adoption of RFID in commercial activities. A noticeable development work in this area had taken place in 1970's where vehicle tracking, factory automation etc. were the prime intentions. By 1980's, RFID technology had taken shape in terms of the full implementation of the technology. The deployment of applications using this technology was noticed in 1990's. The pace of developments in RFID is as well apparent in the 21^{st} century where even the modest of item like cloth is bearing a small sticky patch of RFID and human implantation of RFID tag and that too of rice sized grain is the reality of the day.

III. WORKING AND CIRCUIT DIAGRAM

To get started with RFID-based automatic vehicle parking system, the vehicle owner has to first register the vehicle with the parking owner and get the RFID tag. When the car has to be parked, the RFID tag is placed near the RFID reader, which is installed near the entry gate of the parking lot. As soon as the RFID tag is read by the reader, the system automatically deducts the specified amount from the RFID tag and the entry gate boomer opens to allow the car inside the parking area. At the same time, the parking counter increments by one. Similarly, the door is opened at the exit gate and the parking counter decremented. The system also offers the facility to recharge the amount for each RFID tag. No manual processing is involved. In addition, the system provides security [2].

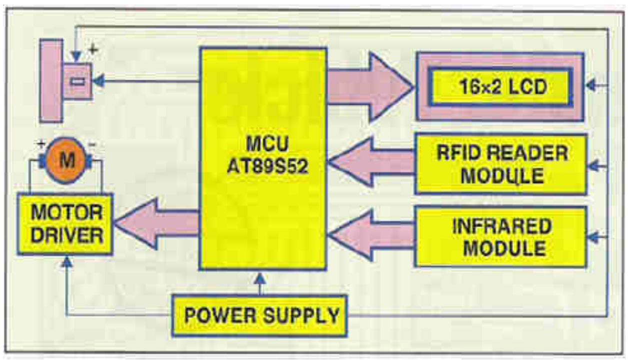

Fig 1: Block Diagram of RFID Based Parking System

To be more specific with the working the following explanation is given with respect to the circuit. When power is switched on, LED1 glows to indicate the presence of power in the circuit and LED2 glows to indicate the presence of RFID reader. Simultaneously, the 'Automatic RFID Car Parking' message is displayed on LCD1 along with a short beep from piezo buzzer PZ1. Transistor BC547 drives the buzzer. Pin details of 7805, 7812 and BC547 are shown in Fig. 6. When a car crosses the IR LED1-D1 pair installed at the entry gate, the gate boomer does not open until an RFID tag is placed near the RFID reader. After the tag is placed near the reader, the gate boomer opens for three seconds and closes automatically. If the initial recharge amount was Rs 900, the LCD display shows 'Vehicle1 Amount' in the first line and 'Deducted 100' in the second line, followed by 'Balance Amount' in the first line and '800' in the second line. It is then followed by display of 'Number of Cars' in the first line and '001' in the second line. If the parking lot is full, the message "Parking is Full, Sorry for Inconvenience" is displayed on LCD1 [4]. When a car leaves the parking area and crosses the IR beam between IR LED2 and D2 at the exit gate, the vehicle count decreases by one. The LCD shows the number of cars in the parking lot along with "Thanks for Visiting" message.

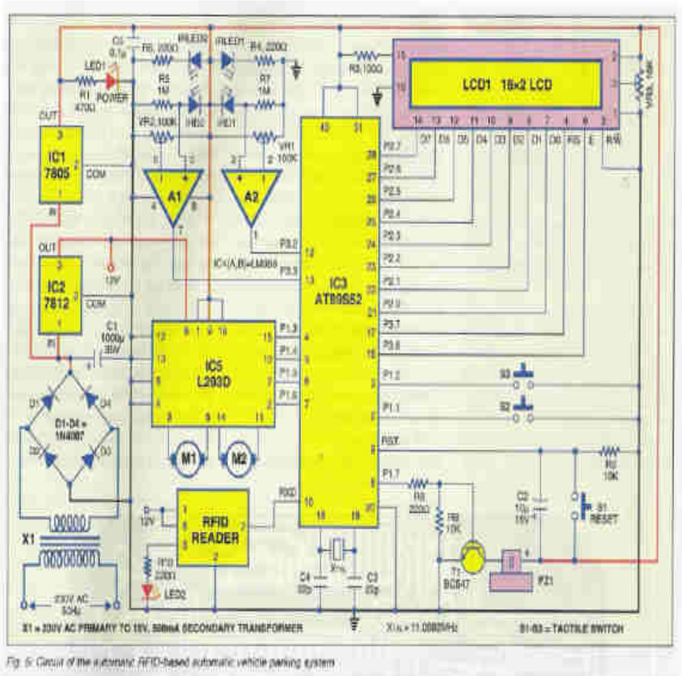

Fig 2: Circuit diagram of RFID Based Parking System

IV. HARDWARE COMPONENTS

4.1 Power supply

Connector CON1 (refer Fig. 8), diodes D1 through D4, capacitor C1, and voltage regulator ICs 7805 (IC1) and 7812 (IC2) form the power supply section of the automatic vehicle parking system. CON1 is a three-pin connector that provides 15V AC or DC power supply to the circuit. In case of 15V AC, diodes D1 through D4 form a bridge rectifier to rectify the AC supply. Capacitor C1 filters out the ripples from the rectified output [2]. ICs 7805 and 7812 provide regulated +5V and +12V, respectively, to the circuit. +5V is used to operate the microcontroller, LCD, RFID and IR sensor circuit and +12V operates the motor.

4.2 AT89S52 micro controller

AT89S52 is a low-power, high-performance CMOS 8-bit microcontroller with 8kB Flash memory. It is compatible with the industry-standard 80C51 instruction set and pin-out. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional non-volatile memory programmer. Other features include 256 bytes of RAM, 32 input/ output lines, watchdog timer, two data pointers, three 16-bit timers/ counters, a six-vector two-level interrupt architecture, a full-duplex serial port, on-chip oscillator and clock circuitry [1].

4.3 Connectors

CON2 through CON4 CON2 and CON3 are two-pin connectors that connect the 12V DC motors to the circuit for controlling the entry and exit gate boomers. CON4 is a tenpin dual-in-line female connector that connects the RFID reader module to the circuit [4].

4.4 L293D motor driver

H-bridge DC motor driver L293D (IC5) operates the DC motors to open the door or barrier for entry into and exit from the parking lot. Two high-current motor drivers can be used in place of L293D and 12V DC motors to control the entry and exit gates, respectively [4].

4.5 LM358 Op-Amp

Dual-operational amplifier LM358 (IC4) Fig.6: Pin details of is used as- a volt- 7805,7812 and BC547 age comparator to compare the output of the IR sensors with a fixed threshold voltage in order to know whether the IR beam is interrupted or not [4].

4.6 IR Transmitter and Receiver

Two IR transmitter-receiver pairs are used. The IR LEDs are connected in forward-biased condition to the +5V power supply through 220O-ohm resistors. These emit IR light, which is interrupted when an object comes into its way to the IR receiver. The IR receiving photodiodes are connected in reverse-biased condition to +5V power supply through 1-mega-ohm resistors. When the IR light falls on the photodiodes, their resistance changes and so does their output [5]. This output is compared with a fixed voltage to give a digital output to the micro controller in order to judge the entry and exit of the vehicles

4.7 LCD Display

LCD1 is a two-line, 16-character, alpha-numeric liquid crystal display. Data lines DO through D7 of the LCD are connected to port 2 of AT89S52 (IC3). Reset (RS) and enable (E) control lines are connected to port pins P3.6 and P3.7, respectively. Control lines control data flow from the micro controller to LCD1 [4].

4.8 MAX 232

The MAX232 IC is used to convert the TTL/CMOS logic levels to RS232 logic levels during serial communication of microcontrollers with PC. The controller operates at TTL logic level (0-5V) whereas the serial communication in PC works on RS232 standards (-25 V to + 25V). This makes it difficult to establish a direct link between them to communicate with each other.

It is a dual driver/receiver that includes a capacitive voltage generator to supply RS232 voltage levels from a single 5V supply. Each receiver converts RS232 inputs to 5V TTL/CMOS levels. These receivers (R1 & R2) can accept ±30V inputs.

4.9 LED

A light-emitting diode (LED) is a two-lead semiconductor light source. It is a pn-junction diode, which emits light when activated. When a suitable voltage is applied to the leads, electrons are able to recombine with electron holes within the device, releasing energy in the form of photons. This effect is called electroluminescence, and the color of the light (corresponding to the energy of the photon) is determined by the energy band gap of the semiconductor An LED is often small in area (less than 1 mm^2) and integrated optical components may be used to shape its radiation pattern.[4]

V. SOFTWARE

The program for the microcontroller is written in C and compiled using Keil software to generate the hex code. The program coding starts with '#include<reg51.h>' and '#include<string.h>' header files. The microcontroller port pins are defined using 'sbit' function for interfacing with the surrounding peripherals. The entry gate motor is controlled using 'sbit START_POINT=P1 1\3;'code

5.1 Simulation Software

KEIL Micro Vision is an integrated development environment used to create software to be run on embedded systems (like a microcontroller). It allows for such software to be written either in assembly or C programming languages and for that software to be simulated on a computer before being loaded onto the microcontroller. The software used is c programming. µVision3 is an IDE that helps write, compile, and debug embedded programs. It encapsulates the following components [2]:

1. A project manager
2. A make facility
3. Tool configuration
4. Editor

5.2 PRO51 Burner Software

PRO51Burner provides you with software burning tools for 8051 based Microcontrollers in their Flash memory. The 51 BURNER tools, you can burn AT89C/SXXXX series of ATMEL microcontrollers**.**

VI. CONCLUSION

The RFID parking management system is actual and control the vehicles. This vehicle parking system power consumption can be reduced. It enables user to operate an unattended parking barrier with control parking access. This system is ideal for apartments and condos, gated communities, business parking lots and garages, university parking area. It offers almost efficiency, convenience, safety and the reliability. It is good solution for today's car parking and reduction of traffic problem.

Advantages:

1. No need for physical contact between data career and communication device.
2. Tags can be used repeatedly.
3. Low maintenance cost.
4. Switch is used in place of RFID reader

Applications:

1. Autonomous sensors military and aerospace embedded software applications.
2. Communication application.
3. Industrial automation and process control software.
4. Mastering the complexity of applications.
5. Reduction of product design time.
6. Real time processing of ever increasing amounts of data.

VII. RESULTS

Testing process is used for more than two or three vehicles at a time. During the testing state of the parking single vehicle check in and checkout process is done. Identification of the vehicles during check in and checkout is successfully achieved at the distance depends on the frequency ranges. When the vehicles enter in the parking system the RFID tag read the coding system and allows the vehicles inside the parking area.

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