RFID and GSM Based Intelligent Parking System

S. Anitha Shree, J. Dhiviya Rose, M. Sumitha

Abstract - The parking of vehicles in big parking spaces like shopping complexes, office complexes and other types of building that requires large parking space needs proper planning. There is a need to address the visitors to notify occupied and non occupied parking spaces. Most of the visitors lose their valid time up-to 30 to 45 minutes just to find an empty parking space. Some of the existing parking space systems offered using image processing technology process the brown rounded image drawn at parking lot and produce the information about the empty parking spaces. However, this type of technique is expensive in order to install and to be maintained. In this project, we have developed a unique solution by providing cost effective solution using internet of things. Our system improvises upon the existing parking system by enhancing its security features and automating the parking process thus eliminating the need for manual intervention. Here for authentication and owners identification the parking system has RFID card reader which is the part of recent IOT technology. Instead of using maintain cable ,we developed a system that uses wireless technology like GSM and messages that could help the visitor to notify empty and non empty parking spaces. The space management and identification is performed with the help of an ARM microcontroller which controls the sensors and send ASM message to visitor to park the vehicle at an appropriate parking location.

Keywords: IOT, RFID, ASM, ARM microcontroller

I. INTRODUCTION

In modern day, cost and time is the most common factors and affecting any human being whether it is for individual of for a management. As most people migrate from small town to big town, from village to the cities, most people wants to increase their quality of life by getting more wealth and health at the same time. Back in 40 to 50 years ago, office complex is not exists yet generally in all places all around the world. To get an overview of the proposed system and to understand the advantages of using Wireless sensors and GSM in IOT.IOT means connecting embedded systems with the internet. As a means of access, let us discuss the two things part by part so that we get a clear insight into the working of the system. Wireless networks [1] have recently attracted a great amount of attention and found wide application areas. our research and project is to help the office, shopping and theatre complex owner to install a low cost parking lot system that be able to reduce the cost of installing wired connection for sensors by replacing it with WLAN application, and any wireless application like GSM. Our system also has come out with a message display status that could show the current empty parking space in real-time by sending message to the visitor

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S. Anitha Shree, Student, Bachelor in Computer Science and Engineering, CARE Group of Institutions, Trichy, Tamil Nadu India.

J. Dhiviya Rose, Assistant Professor, Department of Computer Science and Engineering CARE Group of Institutions, Trichy, Tamil Nadu, India.

M. Sumitha, Student, Bachelor in Computer Science and Engineering, CARE Group of Institutions, Trichy, Tamil Nadu, India.

II. LITERATURE SURVEY

An Identification of Parking System is a mechanism designed to minimize the area required for parking vehicles in office complexes. It resembles a multi- story garage which provides parking facility for vehicles on multiple levels stacked one and the other to optimize the number of parking spaces while reducing usage [2].Separate spaces are assigned for two wheelers and four wheelers. This system makes use of a mechanical system that transports vehicles to .and from parking lots rather than the vehicle owner; so as to eliminate the wastage of space. It is analogous to an automated storage and retrieval system for vehicles. It is generally used in the entry level of the office and shopping complexes to avoid the traffic collision. Intelligent system for parking space detection based on image processing technique that capture and process the brown rounded image drawn at parking lot and produces the information of the empty car parking spaces. It will be display at the display unit that consists of seven segments in real time. The seven segments display shows the number of current available parking lots in the parking area. By identify the rounded brown image drawn at each parking lot as a reference on image detection, it makes the process of detecting image as a reference more efficient compared to the use of a moving object[3]. The conceptualization of this project is to discover the parking system by using image processing Intelligent parking system is developed using an integrated image processing approach to find the visitors non empty spaces. The disadvantage of this is Common display, and Not User Friendly.

Smart connectivity with existing networks and context-aware computation using network resources is an indispensable part of IoT. With the growing presence of WiFi and 4G-LTE wireless Internet access, the evolution towards ubiquitous information and communication networks is already evident. However, for the Internet of Things vision to successfully emerge, the computing paradigm will need to go beyond traditional mobile computing scenarios that use smart phones and portables, and evolve into connecting everyday existing objects and embedding intelligence into our environment. For technology to disappear from the consciousness of the user, the Internet of Things demands: (1) a shared understanding of the situation of its users and their appliances, (2) software architectures and pervasive communication networks to process and convey the contextual information to where it is relevant, and (3) the analytics tools in the Internet of Things that aim for autonomous and smart behavior. With these three fundamental grounds in place, smart connectivity and context-aware computation can be accomplished.

The term Internet of Things was first coined by Kevin Ashton in 1999 in the context of supply chain management [4]. However, in the past decade,

the definition has been more inclusive covering wide range of applications like healthcare, utilities, transport, etc. [5]. Although the definition of 'Things' has changed as technology evolved, the main goal of making a computer sense information without the aid of human intervention remains the same. A radical evolution of the current Internet into a Network of interconnected objects that not only harvests information from the environment (sensing) and interacts with the physical world (actuation/ command/control), but also uses existing Internet standards to provide services for information transfer, analytics, applications, and communications[6]. Fueled by the prevalence of devices enabled by open wireless technology such as Bluetooth, radio frequency identification (RFID), Wi-Fi, and telephonic data services as well as embedded sensor and actuator nodes.

III. SYSTEM DESIGN

Our aim is to provide the parking spaces using the IOT communication devices like GSM and the wireless IR(infrared rays) sensor networks .

A. System Architecture

Initially, at the entry level RFID reader detects the card and the user information like phone number. Then the visitor receives the ASM (Available Space Message) through the GSM modem as shown in Fig 3.1.

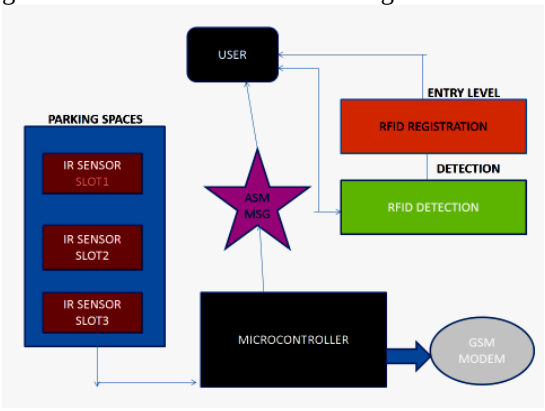


Fig. 3.1 Block Diagram of Parking System using IOT

The server gets the information from the ARM microcontroller. The wireless sensors that sense the non empty spaces using ARM microcontroller and sends the information to the server which is inspired by Internet of Things [7].

B. RFID Setup

(1)Transponder - The Transponder or tag is fixed on to the baggage to be tracked in the airport. When this tag comes within the range of the reader or integrator, the tag is energized. Now, this tag transmits the data to the reader.This data is automatically sent to the micro-controller for further processing. The time at which the tag is sensed is sent to the micro-controller from the RTC (Real Time Clock). These details are displayed on LCD (Liquid Crystal Display) and also sent to the PC. The same is sent to the EEPROM (Electrically Erasable and Programmable Read Only Memory), which is used as a backup.The information is sent to the PC via FM transmitter receiver. This data is stored in a database, which in turn can be stored, processed and retrieved.

(2)Passive Tag and Reader - Passive tags are those energized by the reader itself, they contain no power source, typically have very long lifetimes (near indefinite) a drawback over active tags is the read range, typically 2cm (1in) to 1.5m (4.5 ft), a strong positive is individual tag cost. RFID Passive tag is composed of a integrated electronic chip and a antenna coil that includes basic modulation circuitry and non-volatile memory. The different types of Tags are shown in Fig 3.2.

Fig. 3.2 Different types of tags

For most general applications passive tags are usually the most cost effective. These are made in a wide variety of sizes and materials: there are durable plastic tags for discouraging retail theft, wafer thin tags for use within "smart" paper labels, tiny tracking tags which are inserted beneath an animal's skin and credit card sized tags for access control. In most cases the amount of data storage on a passive tag is fairly limited - capacity often being measured in bits as opposed to bytes.

However for most applications only a relatively small amount of data usually needs to be codified and stored on the tag, so the limited capacity does not normally pose a major limitation. Most tags also carry an unalterable unique electronic serial number, which makes RFID tags potentially very useful in applications where item tracking is needed or where security aspects are important.

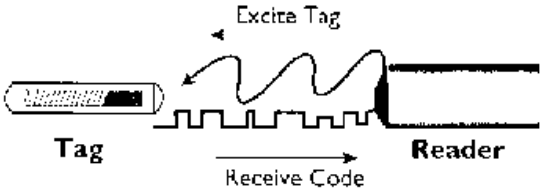


Fig. 3.3Interaction between tag and reader

The reader powers the tag (transponder), by emitting a radio frequency wave. The tag then responds by modulating the energizing field shown in Fig 3.3. This modulation can be decoded to yield the tags unique code, inherent in the tag. The resultant data can be the passed to a computer from processing. Tags have various salient features apart from their physical size: Other available features are: Read Only, Read Write, Anti-Collision.

C. IR Transmitter And Receiver

A passive Infra Red sensor (PIR sensor) is an electronic device which measures infrared light radiating from objects in its field of view. PIRs are often used in the construction of PIR-based motion detectors .Apparent motion is detected when an infrared source with one temperature, such as a human, passes in front of an infrared source with another temperature, such as a wall.

All objects emit what is known as black body radiation. This energy is invisible to the human eye but can be detected by electronic devices designed for such a purpose. The term 'passive' in this instance means the PIR does not emit energy of any type but merely accepts incoming infrared radiation.

(1) Design

Infrared radiation enters through the front of the sensor, known as the sensor face. At the core of a PIR is a solid state sensor or set of sensors, made from approximately 1/4 inches square of natural or artificial pyroelectric materials, usually in the form of a thin film, out of gallium nitride (GaN), cesium nitrate (CsNO3), polyvinyl fluorides, derivatives of phenylpyrazine, and cobalt phthalocyanine. (See pyroelectric crystals.) Lithium tantalate (LiTaO3) is a crystal exhibiting both piezoelectric and pyroelectric properties.

The sensor is often manufactured as part of an integrated circuit and may consist of one (1), two (2) or four (4) 'pixels' of equal areas of the pyroelectric material. Pairs of the sensor pixels may be wired as opposite inputs to a differential amplifier. In such a configuration, the PIR measurements cancel each other so that the average temperature of the field of view is removed from the electrical signal; an increase of IR energy across the entire sensor is self-cancelling and will not trigger the device. This allows the device to resist false indications of change in the event of being exposed to flashes of light or field-wide illumination. (Continuous bright light could still saturate the sensor materials and render the sensor unable to register further information.) At the same time, this differential arrangement minimizes common-mode interference; this allows the device to resist triggering due to nearby electric fields. However, a differential pair of sensors cannot measure temperature in that configuration and therefore this configuration is specialized for motion detectors, see below.

D. Microcontroller

The AT89c51 is a low-power, high-performance CMOS 8-bit microcontroller with 8K bytes of in-system programmable Flash memory [8]. The device is manufactured using Atmel's high-density nonvolatile memory technology and 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 nonvolatile memory pro-grammer. By combining a versatile 8-bit CPU with in-system programmable Flash on a monolithic chip, the Atmel AT89c51is a powerful microcontroller which provides a highly-flexible and cost-effective solution to many embedded control applications. The AT89c51provides the following standard features: 8K bytes of Flash, 256 bytes of RAM, 32 I/O lines, Watchdog timer, two data pointers, three 16-bit timer/counters, a six-vector two-level interrupt architecture, a full duplex serial port, on-chip oscillator, and clock circuitry. In addition, the AT89c51 is designed with static logic for operation down to zero frequency and supports two software selectable power saving modes. The Idle Mode stops the CPU while allowing the RAM, timer/counters, serial port, and interrupt system to continue functioning.

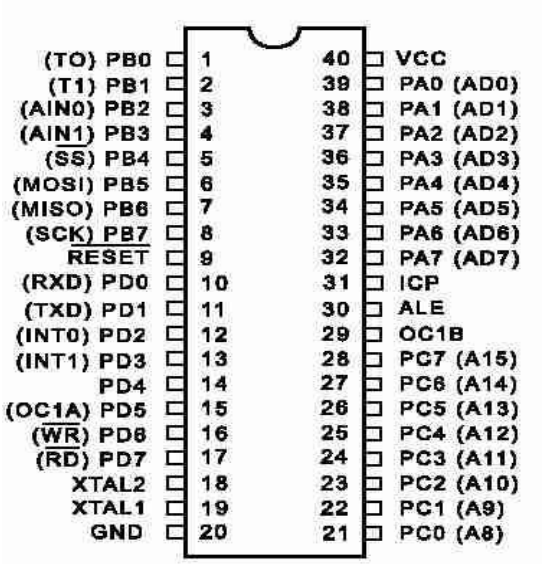


Fig. 3.4 Pin Diagram of AT89c51

(1) Features

- Compatible with MCS-51 Products
- 8K Bytes of In-System Programmable (ISP) Flash Memory
- Endurance: 10,000 Write/Erase Cycles
- 4.0V to 5.5V Operating Range
- Fully Static Operation: 0 Hz to 33 MHz
- Three-level Program Memory Lock
- 256 x 8-bit Internal RAM
- 32 Programmable I/O Lines
- Three 16-bit Timer/Counters
- Eight Interrupt Sources
- Full Duplex UART Serial Channel
- Low-power Idle and Power-down Modes
- Interrupt Recovery from Power-down Mode
- Watchdog Timer

(2) Modes of Operation

Idle Mode**:** In idle mode, the CPU puts itself to sleep while all the on chip peripherals remain active. The mode is invoked by software. The content of the on-chip RAM and all the special functions registers remain unchanged during this mode. The idle mode can be terminated by any enabled interrupt or by a hardware reset. When idle mode is terminated by a hardware reset, the device normally resumes program execution from where it left off, up to two machine cycles before the internal reset algorithm takes control. On-chip hardware inhibits access to internal RAM in this event, but access to the port pins is not inhibited. To eliminate the possibility of an unexpected write to a port pin when idle mode is terminated by a reset, the instruction following the one that invokes idle mode should not write to a port pin or to external memory.

Power-Down Mode: In the power-down mode, the oscillator is stopped, and the instructionthat invokes power-down is the last instruction executed. The on-chip RAM and Special Function Registers retain their values until the power-down mode is terminated. The only exit from power-down is a hardware reset. Reset redefines the SFRs but does not change the on-chip RAM. The reset should not be activated before VCC is restored to its normal operating level and must be held active long enough to allow the oscillator to restart and stabilize.

E. Power Supply

There are many types of power supply. Most are designed to convert high voltage AC mains electricity to a suitable low voltage supply for electronic circuits and other devices. A power supply can by broken down into a series of blocks, each of which performs a particular function. For example a 5V regulated supply can be shown as below

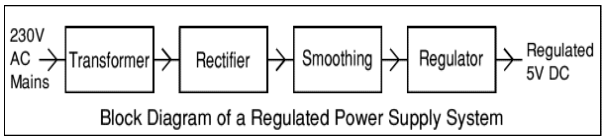


Fig. 3.5 Regulated Power Supply System

Similarly, 12v regulated supply can also be produced by suitable selection of the individual elements. Each of the blocks is described in detail below and the power supplies made from these blocks are described below with a circuit diagram and a graph of their output:

Transformer : A transformer steps down high voltage AC mains to low voltage AC. Here we are using a center-tap transformer whose output will be sinusoidal with 36volts peak to peak value.

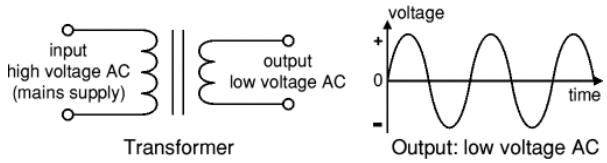


Fig 3.3:Output Waveform of transformer

The low voltage AC output is suitable for lamps, heaters and special AC motors. It is not suitable for electronic circuits unless they include a rectifier and a smoothing capacitor. The transformer output is given to the rectifier circuit.

Rectifier : A rectifier converts AC to DC, but the DC output is varying. There are several types of rectifiers; here we use a bridge rectifier.The Bridge rectifier is a circuit, which converts an ac voltage to dc voltage using both half cycles of the input ac voltage. The Bridge rectifier circuit is shown in the figure. The circuit has four diodes connected to form a bridge. The ac input voltage is applied to the diagonally opposite ends of the bridge. The load resistance is connected between the other two ends of the bridge.

For the positive half cycle of the input ac voltage, diodes D1 and D3 conduct, whereas diodes D2 and D4 remain in the OFF state. The conducting diodes will be in series with the load resistance R_L and hence the load current flows through R_L.

For the negative half cycle of the input ac voltage, diodes D2 and D4 conduct whereas, D1 and D3 remain OFF. The conducting diodes D2 and D4 will be in series with the load resistance R_L and hence the current flows through R_L in the same direction as in the previous half cycle. Thus a bi-directional wave is converted into unidirectional.

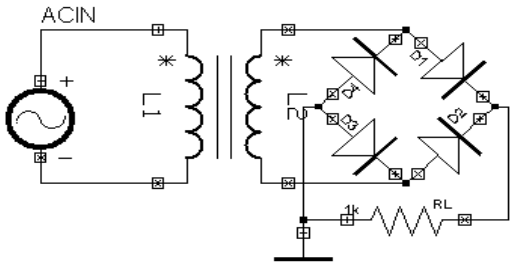


Fig. 3.6 The output waveform of the rectifier

The varying DC output is suitable for lamps, heaters and standard motors. It is not suitable for electronic circuits unless they include a smoothing capacitor.

IV. IMPLEMENTATION

Printed circuit boards, or PCBs, form the core of electronic equipment domestic and industrial. Some of the areas where PCBs are intensively used are computers, process control, telecommunications and instrumentation.

A. Manufacturing

The manufacturing process consists of two methods; print and etch, and print, plate and etch. The single sided PCBs are usually made using the print and etch method. The double sided plate through – hole (PTH) boards are made by the print plate and etch method. The production of multi layer boards uses both the methods. The inner layers are printed and etch while the outer layers are produced by print, plate and etch after pressing the inner layers. The technical specification of the RFID tag is shown in the Table4.1.The Hardware requirements are

- RFID module
- GSM module
- Sensor module
- Micro controller 8051
- Power supply unit

Table 4.1 Technical specification

Frequency:	125 KHz / 13.56 MHz / 915 MHz / 2.45 GHz Read/Write
Distance:	Up to 6m (with mounted antenna)
Dimensions	Varies, as small as 0.8mm diameter
Weight:	6-54g
Memory:	Up to 16 Kbits
Data durability:	10 Years

B. Software Requirements

Embedded system is a combination of hardware and software, it is also named as "Firm ware".An embedded system is a specialized system that is a part of a larger system or machine. As a part of a larger system it largely determines its functionality. Embedded systems are electronic devices that incorporate microprocessors with in their implementations. The main purpose of the microprocessors are simplify the system design and improve flexibility. In the embedded systems, the software is often stored in a read only memory (RAM) chip.

Embedded systems provide several major functions including monitoring of the analog environment by reading data from sensors and controlling actuators.

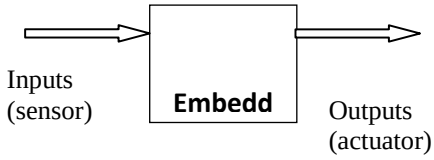


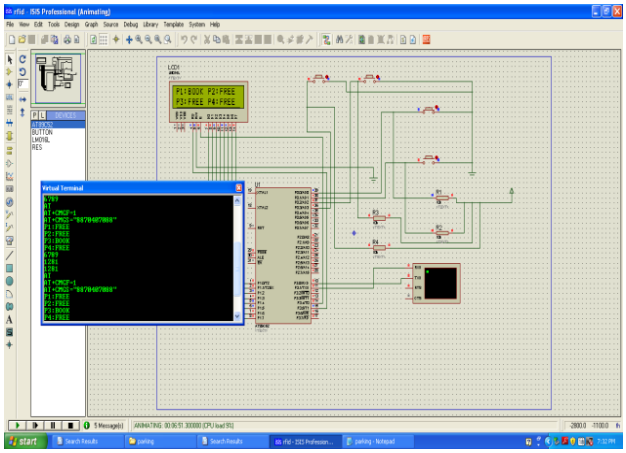
Fig. 4.1 Operation of Embedded System

KEIL C COMPILER

The Keil µVision Debugger accurately simulates on-chip peripherals (I²C, CAN, UART, SPI, Interrupts, I/O Ports, A/D Converter, D/A Converter, and PWM Modules) of your 8051 device..Simulation helps you understand hardware configurations and avoids time wasted on setup problems. Additionally, with simulation, you can write and test applications before target hardware is available [9] . The specifications are

- Keil C complier
- Embedded C
- Proteus professional

C. Screenshots



V. CONCLUSION

Our parking system thus reduced the manpower and waiting time. The Low cost to design the circuit is good .By using this microcontroller IC we can create many more control to the appliances which provides Reliability, Compatibility, Easy convenience to handle and Good security. The project is mainly used in the automobile industry where they use bar code access. Due to use of RFID more security is there and its saves time a lot.

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