RFID BASED CAR THEFT PREVENTER

A PROJECT REPORT

Submitted by

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BONAFIDE CERTIFICATE

Certified that this project report **"RFID BASED CAR THEFT PREVENTER"** is the bonafide work of **"S.ANEES AHAMED, S.GOPALA KRISHNAN, N.HARI HARAN and K.DEEPAK"** who carried out the project work under my supervision.

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April 15, 2008

CERTIFICATE

This is to certify that the following, **B.E-ECE Final Year** students of **KUMARAGURU COLLEGE OF TECHNOLOGY, COIMBATORE,** have sucessfully completed their Project work entitled **"RF ID BASED CAR THEFT PREVENTER "**, as a part of their course, in our Company from **JANUARY 2008 to APRIL 2008.**

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They have evinced keen interest in absorbing the nature, concept and functions of our Organisation and their conduct and character were **good** during the period.

For SALZER ELECTRONICS LIMITED,

AM-HR.

ACKNOWLEDGEMENT

We are greatly indebted to our beloved Principal **Dr.Joseph.V.Thanikal, Ph.D.,** Who has been the backbone of all our deeds.

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LIST OF ABBREVIATIONS:

RFID - RADIO FREQUENCY IDENTIFICATION

FSK - FREQUENCY SHIFT KEYING

PSK - PHASE SHIFT KEYING

PSW - PROGRAM STATUS WORD

TTL - TRANSISTOR-TRANSISTOR LOGIC

ALE - ADDRESS LATCH ENABLE

VPP - PROGRAM ENABLE VOLTAGE

PSEN - PROGRAM STORE ENABLE

EA - EXTERNAL ACCESS ENABLE

NO - NORMALLY OPEN

ABSTRACT

The main objective of this project is to improve the security performance in the Auto mobiles by using RFID. In this project RFID card is used as security access card to start the car. This project is designed to use the RFID based security system application in the car.

Now a day's some people make duplicate keys. In this project as RFID card is used for accessing the car. It improves the security performance because no one can make the duplicate RFID card.

At the same it has one more added feature, if anyone try to break the car then it will automatically activate the alarm. The car door breaking is sensed through vibration sensor. The microcontroller will not allow the car to start in any of avoidable condition by keeping the relay in off condition.

CHAPTER 1

HARDWARE OVER VIEW

1.1.1. INTRODUCTION

RFID is the special type of wireless card which has inbuilt the embedded chip along with loop antenna. The inbuilt embedded chip represents the 12 digit card number. RFID reader is the circuit which generates 125KHZ magnetic signal. This magnetic signal is transmitted by the loop antenna connected along with this circuit which is used to read the RFID card number. Each owner has the individual RFID card which represents the card number. RFID reader and keypad is interfaced with microcontroller. Here the microcontroller is the flash type reprogrammable microcontroller which is already programmed with card number.

When the customer shows the RFID card in the reader, the reader will read the number and send to microcontroller. Then the customer has to press the personal identification number (pass word) through key pad.

The microcontroller receives the card number from the reader compares the stored number if the card is valid the microcontroller allows to enter password. Through keypad we can enter the password, if its correct it allows to start the car otherwise it will start to alarm. If anyone try to break the car then it automatically gives alarm. The car door breaking is sensed through vibration sensor. The microcontroller will not allow the car to start in any of the avoidable conditions by keeping the relay in off condition.

1.1.2. MODULES:

1. RFID 125 reader module
2. RFID tag
3. AT89C52 microcontroller
4. Vibration sensor circuit
5. Alarm circuit
6. Relay circuit
7. Key pad
8. Power supply

1.1.3. BLOCK DIAGRAM

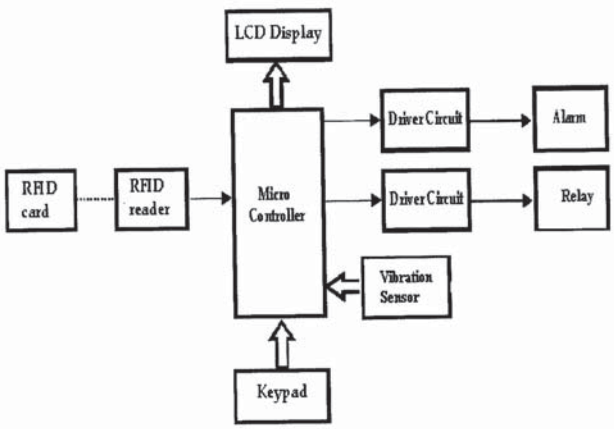


FIG 1

1.2. RFID SYSTEM

1.2.1. INTRODUCTION

Radio Frequency Identification has become a hot topic around the world. RFID system delivers what bar codes cannot: real time information on the precise location and status of goods in a process flow. It does it through wireless transfer of data between the RFID reader and the RFID tags. The purpose of RFID system is to enable data to be transmitted by a portable device called a tag, which is read by an RFID reader and processed according to the needs of a particular application.

The read/write capability of an active RFID system is also a significant advantage in interactive applications such as work-in-process or maintenance tracking. Though it is a costly technology (compared with barcode), RFID has become indispensable for a wide range of automated data collection and identification applications that would not be possible otherwise.

Their frequency ranges also distinguish RFID systems. Low-frequency (30 KHz to 500 KHz) systems have short reading ranges and lower system costs. They are most commonly used in security access, asset tracking, and animal identification applications. High-frequency (850 MHz to 950 MHz and 2.4 GHz to 2.5 GHz) systems, offering long read ranges (greater than 90 feet) and high reading speeds, are used for such applications as railroad car tracking and automated toll collection. The significant advantage of all types of RFID systems is the non-contact, non-line-of-sight nature of the technology.

The tag is energized by a time-varying electromagnetic radio frequency (RF) wave that is transmitted by the reader. This RF signal is called a carrier signal. When the RF field passes through an antenna coil, there is an AC voltage generated across the coil. This voltage is rectified to supply power to the tag. The information stored in the tag is transmitted back to the reader. This is often called backscattering. By detecting the backscattering signal, the information stored in the tag can be fully identified.

1.2.2. 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 an integrated electronic chip and an antenna coil that includes basic modulation circuitry and non-volatile memory.

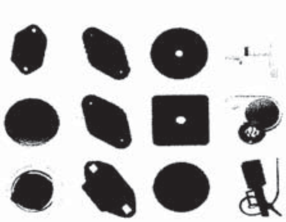


Fig 2. Different types of tags

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.

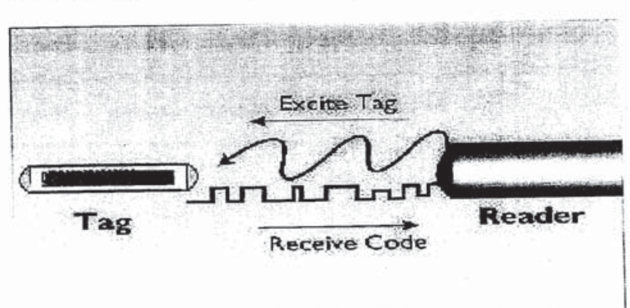


Fig 3. Interaction between tag and reader

The reader powers the tag (transponder), by emitting a radio frequency wave. The tag then responds by modulating the energizing field. 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.

1.3. RFID TAG AND READER

1.3.1. DEFINITIONS

Reader

Usually a microcontroller-based unit with a wound output coil, peak detecting hardware, comparators, and firmware designed to transmit energy to a tag and to read information back from it by detecting the backscatter modulation.

Tag

A RFID device incorporating a silicon memory chip (usually with on-board rectification bridge and other RF front-end devices), a wound or printed input/output coil, and (at lower frequencies) a tuning capacitor.

Carrier

A Radio Frequency (RF) sine wave generated by the reader to transmit energy to the tag and retrieve data from the tag. In these examples the ISO frequencies of 125 kHz and 13.56 MHz are assumed; higher frequencies are used for RFID tagging but the communication methods are somewhat different. 2.45 GHz, for example, uses a true RF link. 125 kHz and 13.56 MHz, utilize transformer-type electromagnetic coupling

Modulation

Periodic fluctuations in the amplitude of the carrier, used to transmit data back from the tag to the reader. Systems incorporating passive RFID tags operate in many ways that may seem unusual to anyone who already understands RF or microwave systems. There is only one transmitter. The passive tag is not a transmitter or transponder in the purest definition of the term, yet bidirectional communication is taking place. The RF field generated by a tag reader (the energy transmitter) has three purposes:

1. **Induce enough power into the tag coil to energize the tag.**
Passive tags have no battery or other power source; they must derive all power for operation from the reader field. 125 kHz and 13.56 MHz tag designs must operate over a vast dynamic range of carrier input, from the very near field (in the range of 200 VPP) to the maximum read distance (in the range of 5 VPP).
2. **Provide a synchronized clock source to the tag.**
Most RFID tags divide the carrier frequency down to generate an on-board clock for state machines, counters, etc., and to derive the data transmission bit rate for data returned to the reader. Some tags, however, employ on-board oscillators for clock generation.
3. **Act as a carrier for return data from the tag.**
Backscatter modulation requires the reader to peak-detect the tag's modulation of the reader's own carrier. See Section for additional information on backscatter modulation

1.3.2. SYSTEM HANDSHAKE

Typical handshake of a tag and reader is as follows:

1. The reader continuously generates an RF carrier sine wave, watching always for modulation to occur. Detected modulation of the field would indicate the presence of a tag.
2. A tag enters the RF field generated by the reader. Once the tag has received sufficient energy to operate correctly, it divides down the carrier and begins clocking its data to an output transistor, which is normally connected across the coil inputs.
3. The tag's output transistor shunts the coil, sequentially corresponding to the data which is being clocked out of the memory array.
4. Shunting the coil causes a momentary fluctuation (dampening) of the carrier wave, which is seen as a slight change in amplitude of the carrier.
5. The reader peak-detects the amplitude-modulated data and processes the resulting bitstream according to the encoding and data modulation methods used.

1.3.3. BACKSCATTER MODULATION

This terminology refers to the communication method used by a passive RFID tag to send data back to the reader. By repeatedly shunting the tag coil through a transistor, the tag can cause slight fluctuations in the reader's RF carrier amplitude. The RF link behaves essentially as a transformer; as the secondary winding (tag coil) is momentarily shunted, the primary winding (reader coil) experiences a momentary voltage drop. The reader must peak-detect this data at about 60 dB down (about 100 mV riding on a 100V sine wave) as transmitted field provides a communication path back to the reader. The data bits can then be encoded or further modulated in a number of ways

1.3.4. DATA ENCODING

Data encoding refers to processing or altering the data bitstream in-between the time it is retrieved from the RFID chip's data array and its transmission back to the reader. The various encoding algorithms affect error recovery, cost of implementation, bandwidth, synchronization capability, and other aspects of the system design. Entire textbooks are written on the subject, but there are several popular methods used in RFID tagging today:

1. **NRZ (Non-Return to Zero) Direct.**
In this method no data encoding is done at all; the 1's and 0's are clocked from the data array directly to the output transistor. A low in the peak-detected modulation is a '0' and a high is a '1'.
2. **Differential Biphase.**
Several different forms of differential biphase are used, but in general the bitstream being clocked out of the data array is modified so that a transition always occurs on every clock edge, and 1's and 0's are distinguished by the transitions within the middle of the clock period. This method is used to embed clocking information to help synchronize the reader to the bitstream; and because it always has a transition at a clock edge, it inherently provides some error correction capability. Any clock edge that does not contain a transition in the data stream is in error and can be used to reconstruct the data.

3. **Biphase L (Manchester).**
This is a variation of biphase encoding, in which there is not always a transition at the clock edge.

1.3.5. DATA MODULATION

Although all the data is transferred to the host by amplitude-modulating the carrier (backscatter modulation), the actual modulation of 1's and 0's is accomplished with three additional modulation methods:

1. **Direct.**
In direct modulation, the Amplitude Modulation of the backscatter approach is the only modulation used. A high in the envelope is a '1' and a low is a '0'. Direct modulation can provide a high data rate but low noise immunity.

2. **FSK (Frequency Shift Keying).**
This form of modulation uses two different frequencies for data transfer; the most common FSK mode is Fc/8/10. In other words, a '0' is transmitted as an amplitude-modulated clock cycle with period corresponding to the carrier frequency divided by 8, and a '1' is transmitted as an amplitude-modulated clock cycle period corresponding to the carrier frequency divided by 10. The amplitude modulation of the carrier thus switches from Fc/8 to Fc/10 corresponding to 0's and 1's in the bitstream, and the reader has only to count cycles between the peak-detected clock edges to decode the data. FSK allows for a simple reader design, provides very strong noise immunity, but suffers from a lower data rate than some other forms of data modulation. In Figure 3, FSK data modulation is used with NRZ encoding:

3. **PSK (Phase Shift Keying).**
This method of data modulation is similar to FSK, except only one frequency is used, and the shift between 1's and 0's is accomplished by shifting the phase of the backscatter clock by 180 degrees.
Two common types of PSK are:

- Change phase at any '0', or
- Change phase at any data change

(0 to 1 or 1 to 0).
PSK provides fairly good noise immunity, a moderately simple reader design, and a faster data rate than FSK. Typical applications utilize a backscatter clock of Fc/2, as shown in Figure 4.

1.3.6. ANTICOLLISION

In many existing applications, a single-read RFID tag is sufficient and even necessary: animal tagging and access control are examples. However, increasing of new applications, the simultaneous reading of several tags in the same RF field is absolutely critical: library books, airline baggage, garment and the retail applications are a few. In order to read multiple tags simultaneously, the tag and reader must be designed to detect the condition that more than one tag is active. Otherwise, the tags will all backscatter the carrier at the same time, and the amplitude-modulated waveforms shown in Figures 3 and 4 would be garbled. This is referred to as a collision. No data would be transferred to the reader. The tag/reader interface is similar to a serial bus, even though the "bus" travels through the air. In a wired serial bus application, arbitration is necessary to prevent bus contention. The data over the "bus" at one time. A number of different methods are in use and in development today for preventing collisions; most are patented or patent pending, but all are related to making sure that only one tag "talks" (backscatters) at any one time.

1.4. CONFIGURATION OF ANTENNA COILS

1.4.1. Tag Antenna Coil

An antenna coil for an RFID tag can be configured in many different ways, depending on the purpose of the application and the dimensional constraints. A typical inductance *L* for the tag coil is a few (mH) for 125 kHz devices. Figure shows various configurations of tag antenna coils. The coil is typically made of a thin wire. The inductance and the number of turns of the coil can be calculated by the formulas given in the previous section. An Inductance Meter is often used to measure the inductance of the coil. A typical number of turns of the coil is in the range of 100 turns for 125 kHz and 3~5 turns for 13.56 MHz devices. For a longer read range, the antenna coil must be tuned properly to the frequency of interest (i.e., 125 kHz). Voltage drop across the coil is maximized by forming a parallel resonant circuit. The tuning is accomplished with a resonant capacitor that is connected in parallel to the coil as shown in figure. The formula for the resonant capacitor value is given as

$$C=1/(2pf)^2L \;;$$

$$L=0.31(aN)^2 / 6a+9h+10b \;;$$

where,
a = average radius of the coil in cm
N = number of turns
b = winding thickness in cm
h = winding height in cm

VARIOUS CONFIGURATIONS OF TAG ANTENNA COIL

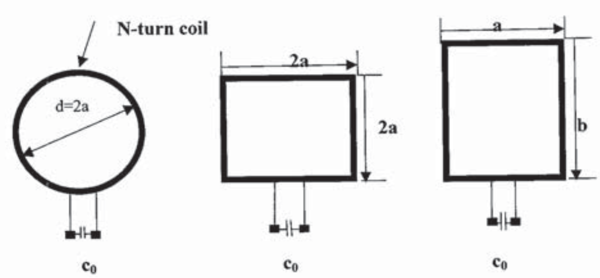


FIG 4

1.4.2. Reader Antenna Coil

The inductance for the reader antenna coil is typically in the range of a few hundred to a few thousand micro-Henries (mH) for low frequency applications. The reader antenna can be made of either a single coil that is typically forming a series resonant circuit or a double loop (transformer) antenna coil that forms a parallel resonant circuit. The series resonant circuit results in minimum impedance at the resonance frequency. Therefore, it draws a maximum current at the resonance frequency. On the other hand, the parallel resonant circuit results in current becomes minimized at the resonance frequency. Since the voltage can be stepped up by forming a double loop (parallel) coil, the parallel resonant circuit is often used for a system where a higher voltage signal is required. Figure 5.2 shows an example of the transformer loop antenna. The main loop (secondary) is formed with several turns of wire on a large frame, with a tuning capacitor to resonate it to the resonance frequency (125 kHz). The other loop is called a coupling loop (primary), and it is formed with less than two or three turns of coil. This loop is placed in a very close proximity to the main loop, usually (but not necessarily) on the inside edge and not more than a couple of centimetres away from the main loop. The purpose of this loop is to couple signals induced from the main loop to the reader (or vice versa) at a more reasonable matching impedance. The coupling (primary) loop provides an impedance match to the input/output impedance of the reader. The coil is connected to the input/output signal driver in the reader electronics. The main loop (secondary) must be tuned to resonate at the resonance frequency and is not physically connected to the reader electronics. The coupling loop is usually untuned, but in some designs, a tuning capacitor C2 is placed in series with the coupling loop. Because there are far fewer turns on the coupling loop than the main loop, its inductance is considerably smaller. As a result, the capacitance to resonate is usually much larger.

A TRANSFORMER LOOP ANTENNA FOR READER

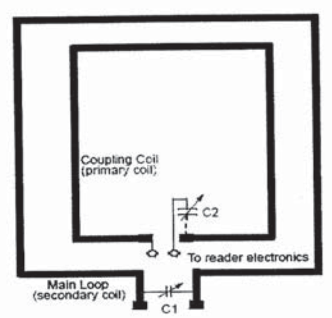


FIG 5

1.4.3. READ RANGE OF RFID DEVICES

Read range is defined as a maximum communication distance between the reader and tag. The read range of typical passive RFID products varies from about 1 inch to 1 meter, depending on system configuration. The read range of an RFID device is, in general, affected by the following parameters:

a) Operating frequency and performance of antenna coils
b) Q of antenna and tuning circuit
c) Antenna orientation
d) Excitation current and voltage
e) Sensitivity of receiver
f) Coding (or modulation) and decoding (or demodulation) algorithm
g) Number of data bits and detection (interpretation) algorithm
h) Condition of operating environment (metallic, electrical noise), etc.

With a given operating frequency, the above conditions (a – c) are related to the antenna configuration and tuning circuit. The conditions (d – e) are determined by a circuit topology of the reader. The condition (f) is called the communication protocol of the device, and (g) is related to a firmware program for data interpretation. Assuming the device is operating under a given condition, the read range of the device is largely affected by the performance of the antenna coil. It is always true that a longer read range is expected with the larger size of the antenna. Figures shows typical examples of the read range of various passive RFID devices.

READ RANGE VS. TAG SIZE FOR PROXIMITY APPLICATIONS

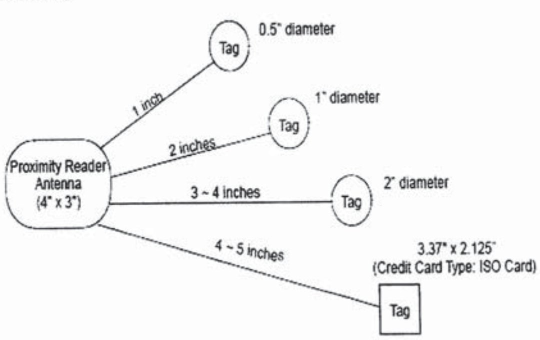


FIG 6

READ RANGE VS. TAG SIZE FOR LONG RANGE APPLICATIONS

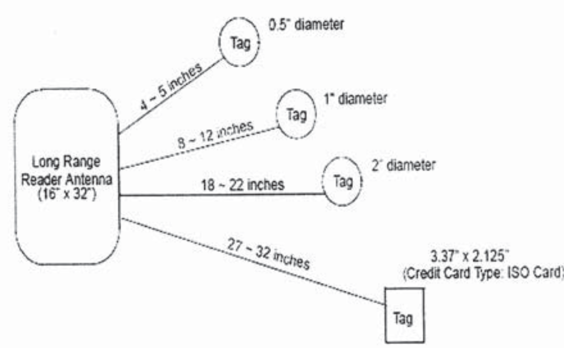


FIG 7

1.4.4. The advantages of a passive tag are:

The tag functions without a battery; these tags have a useful life of twenty years or more.

- The tag is typically much less expensive to manufacture
- The tag is much smaller (some tags are the size of a grain of rice). These tags have almost unlimited applications in consumer goods and other areas.
- Tags can be read through a variety of substances such as snow, fog, ice, paint, crusted grime, and other visually and environmentally challenging conditions, where barcodes or other optically read technologies would be useless.

RFID tags can also be read in challenging circumstances at remarkable

1.5. MICROCONTROLLER

1.5.1 8-Bit Micro controller – AT89S52

Features:

- Compatible with MCS-51 ® Products
- 8K Bytes of In-System Programmable (ISP) Flash Memory
- Endurance: 1000 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
- Dual Data Pointer
- Power off flag

DESCRIPTION:

The AT89S52 is a low-power, high-performance CMOS 8-bit micro controller with 8K Bytes of in-system programmable Flash memory. 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 programmer. By combining a versatile 8-bit CPU with in-system programmable flash on a monolithic chip, the Atmel AT89S52 is a powerful micro controller, which provides a highly flexible and cost-effective solution to many embedded control applications. The AT89S51 provides 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 AT89S52 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. The Power-down mode saves the RAM contents but freezes the oscillator, disabling all other chip functions until the next interrupt or hardware reset.

MICROCONTROLLER 89S52

1.5.2. PIN DIAGRAM

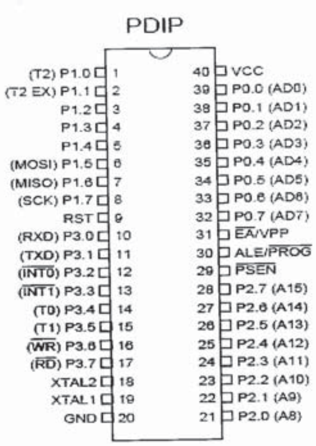


FIG 8

Pin Description:

VCC

Supply voltage.

GND

Ground.

Port 0

Port 0 is an 8-bit open drain bi-directional I/O port. As an output port, each pin can sink eight TTL inputs. When 1s are written to port 0 pins, the pins can be used as high impedance inputs. Port 0 can also be configured to be the multiplexed low order address/data bus during accesses to external program and data memory. In this mode, P0 has internal pull-ups. Port 0 also receives the code bytes during Flash programming and outputs the code bytes during program verification. External pull-ups are required during program verification.

Port 1

Port 1 is an 8-bit bi-directional I/O port with internal pull-ups. The Port 1 output buffers can sink source four TTL inputs. When 1s are written to Port 1 pins, they are pulled high by the internal pull-ups and can be used as inputs. As inputs, Port 1 pins that are externally being pulled low will source current (IIL) because of the internal pull-ups. In addition, P1.0 and P1.1 can be configured to be the timer/counter 2 external count input (P1.0/T2) and the timer/counter 2 trigger input (P1.1/T2EX), respectively, as shown in the following table. Port 1 also receives the low-order address bytes during Flash programming and verification.

Port 2

Port 2 is an 8-bit bi-directional I/O port with internal pull-ups. The Port 2 output buffers can sink/source four TTL inputs. When 1s are written to Port 2 pins, they are pulled high by the internal pull-ups and can be used as inputs. As inputs, Port 2 pins that are externally being

Port 2 emits the high-order address byte during fetches from external program memory and during accesses to external data memory that use 16-bit addresses (MOVX @ DPTR). In this application, Port 2 uses strong internal pull-ups when emitting 1s. During accesses to external data memory that use 8-bit addresses (MOVX @ RI), Port 2 emits the contents of the P2 Special Function Register.

Port 2 also receives the high-order address bits and some control signals during Flash programming and verification.

Table No:1 PORT 1 PIN DETAILS

Port Pin	*Alternate Functions*
P 1.0	T2 (external count input to Timer/Counter 2), clock-out
P 1.1	T2EX (Timer/Counter 2 capture/reload trigger and direction control)
P 1.5	MOSI (used for In-System Programming)
P 1.6	MISO (used for In-System Programming)
P 1.7	SCK (used for In-System Programming)

Port 3

Port 3 is an 8-bit bi-directional I/O port with internal pull-ups. The Port 3 output buffers can sink/source four TTL inputs. When 1s are written to Port 3 pins, they are pulled high by the internal pull-ups and can be used as inputs. As inputs, Port 3 pins that are externally being pulled low will source current (IIL) because of the pull-ups. Port 3 also serves the functions of various special features of the AT89S52, as shown in the following table. Port 3 also receives some control signals for Flash programming and verification.

TABLE NO:2 PORT 3 DETAILS

Port Pin	Alternate Functions
P 3.0	RXD (serial input port)
P 3.1	TXD (serial output port)
P 3.2	INT0 (external interrupt 0)
P 3.3	INT1 (external interrupt 1)
P 3.4	T0 (timer 0 external input)
P 3.5	T1 (timer 1 external input)
P 3.6	WR (external data memory write strobe)
P3.7	RD(external data memory read strobe)

RST

Reset input. A high on this pin for two machine cycles while the oscillator is running resets the device. This pin drives High for 96 oscillator periods after the Watchdog times out. The DISRTO bit in SFR AUXR (address 8EH) can be used to disable this feature. In the default state of bit DISRTO, the RESET HIGH out feature is enabled.

ALE/PROG

Address Latch Enable (ALE) is an output pulse for latching the low byte of the address during accesses to external memory. This pin is also the program pulse input (PROG) during Flash programming. In normal operation, ALE is emitted at a constant rate of 1/6 the oscillator frequency and may be used for external timing or clocking purposes. Note, however, that one ALE pulse is skipped during each access to external data memory. If desired, ALE operation can be disabled by setting bit 0 of SFR location 8EH. With the bit set, ALE is active only during a MOVX or MOVC instruction. Otherwise, the pin is weakly pulled high. Setting the ALE-disable bit has no effect if the micro-controller is in external execution mode.

PSEN

Program Store Enable (PSEN) is the read strobe to external program memory. When the AT89S52 is executing code from external program memory, PSEN is activated twice each machine cycle, except that two PSEN activations are skipped during each access to external data memory.

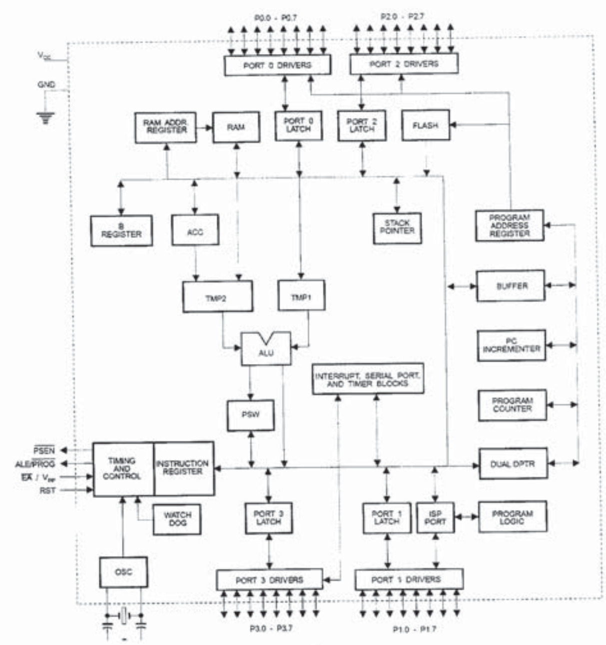


FIG 9

Block Diagram

EA/VPP

External Access Enable. EA must be strapped to GND in order to enable the device to fetch code from external program memory locations starting at 0000H up to FFFFH. Note, however, that if lock bit 1 is programmed, EA will be internally latched on reset. EA should be strapped to VCC for internal program executions. This pin also receives the 12-volt programming enable voltage (VPP) during Flash programming.

XTAL1

Input to the inverting oscillator amplifier and input to the internal clock operating circuit.

Oscillator characteristics:

XTAL1 and XTAL2 are the input and output, respectively, of an inverting amplifier that can be configured for use as an on-chip oscillator. Either a quartz crystal or ceramic resonator may be used. To drive the device from an external clock source, XTAL2 should be left unconnected while XTAL1 is driven. There are no requirements on the duty cycle of the external clock signal, since the input to the internal clocking circuitry is through a divide-by-two flip-flop, but minimum and maxi-mum voltage high and low time specifications must be observed.

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. Note that 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 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 instruction that 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. Exit from Power-down mode can be initiated either by a hardware reset or by an enabled external interrupt. 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.

Table No:3 Status of external pins during Idle and Power Down Modes:

Mode	Program Memory	ALE	PSEN	PORT0	PORT1	PORT2	PORT3
Idle	Internal	1	1	Data	Data	Data	Data
Idle	External	1	1	Float	Data	Address	Data
Power-Down	Internal	0	0	Data	Data	Data	Data
Power-Down	External	0	0	Float	Data	Data	Data

Program Memory Lock Bits:

The AT89S52 has three lock bits that can be left unprogrammed(U) or can be programmed (P) to obtain the additional features .When lock bit 1 is programmed, the logic level at the EA pins sampled and latched during reset. If the device is powered up without a reset, the latch initializes to a random value and holds that value until reset is activated. The latched value of EA must agree with the current logic level at that pin in order for the device to function properly.

1.6. POWER SUPPLY

1.6.1. INTRODUCTION:

The present chapter introduces the operation of power supply circuits built using filters, rectifiers, and then voltage regulators. Starting with an ac voltage, a steady dc voltage is obtained by rectifying the ac voltage, then filtering to a dc level, and finally, regulating to obtain a desired fixed dc voltage. The regulation is usually obtained from an IC voltage regulator unit, which takes a dc voltage and provides a somewhat lower dc voltage, which remains the same even if the input dc voltage varies, or the output load connected to the dc voltage changes.

A block diagram containing the parts of a typical power supply and the voltage at various points in the unit is shown in fig. The ac voltage, typically 120 Vrms, is connected to a transformer, which steps that ac voltage down to the level for 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 can use this dc input to provide a dc voltage that not only has much less ripple voltage but also remains the same dc value even if the input dc voltage varies somewhat, or the load connected to the output dc voltage changes. This voltage regulation is usually obtained using one of a number of popular voltage regulator IC units.

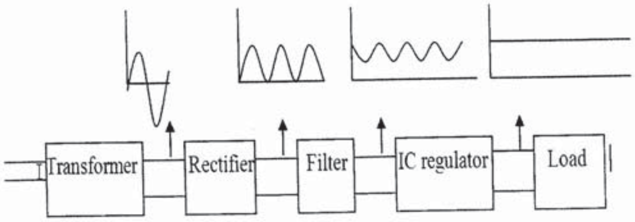
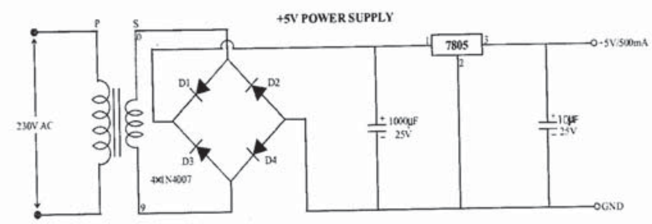
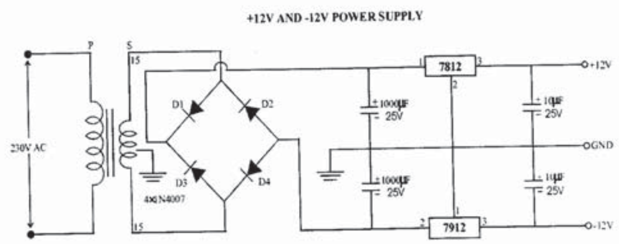


FIG 10 Block diagram

1.6.2.CIRCUIT DIAGRAM:





WORKING PRINCIPLE:

Transformer:

The potential transformer will step down the power supply voltage (0-230V) to (0-6V) level. Then the secondary of the potential transformer will be connected to the precision rectifier, which is constructed with the help of op–amp. The advantages of using precision rectifier are it will give peak voltage output as DC, rest of the circuits will give only RMS output.

Bridge rectifier:

When four diodes are connected as shown in figure, the circuit is called as bridge rectifier. The input to the circuit is applied to the diagonally opposite corners of the network, and the output is taken from the remaining two corners.

Let us assume that the transformer is working properly and there is a positive potential, at point A and a negative potential at point B. the positive potential at point A will forward bias D3 and reverse bias D4.

The negative potential at point B will forward bias D1 and reverse D2. At this time D3 and D1 are forward biased and will allow current flow to pass through them; D4 and D2 are reverse biased and will block current flow.

The path for current flow is from point B through D1, up through RL, through D3, through the secondary of the transformer back to point B. this path is indicated by the solid arrows. Waveforms (1) and (2) can be observed across D1 and D3.

One-half cycle later the polarity across the secondary of the transformer reverse, forward biasing D2 and D4 and reverse biasing D1 and D3. Current flow will now be from point A through D4, up

point A. The current flow through RL is always in the same direction. In flowing through RL this current develops a voltage correspondingly. Since current flows through the load (RL) during both half cycles of the applied voltage, this bridge rectifier is a full-wave rectifier.

One advantage of a bridge rectifier over a conventional full-wave rectifier is that with a given transformer the bridge rectifier produces a voltage output that is nearly twice that of the conventional full-wave circuit. This may be shown by assigning values to some of the components shown in views A and B. assume that the same transformer is used in both circuits. The peak voltage developed between points X and y is 1000 volts in both circuits. In the conventional full-wave circuit shown in view A, the peak voltage from the center tap to either X or Y is 500 volts. Since only one diode can conduct at any instant, the maximum voltage that can be rectified at any instant is 500 volts. The maximum voltage that appears across the load resistor is nearly- but never exceeds-500 v0lts, as result of the small voltage drop across the diode. In the bridge rectifier shown in view B, the maximum voltage that can be rectified is the full secondary voltage, which is 1000 volts. Therefore, the peak output voltage across the load resistor is nearly 1000 volts. With both circuits using the same transformer, the bridge rectifier circuit produces a higher output voltage than the conventional full-wave rectifier circuit.

1.7. RELAY

Relay:

A relay is an electrically operated switch. Current flowing through the coil of the relay creates a magnetic field which attracts a lever and changes the switch contacts. The coil current can be on or off so relays have two switch positions and they are double throw (changeover) switches. Relays allow one circuit to switch a second circuit which can be completely separate from the first. For example a low voltage battery circuit can use a relay to switch a 230V AC mains circuit. There is no electrical connection inside the relay between the two circuits; the link is magnetic and mechanical.

The coil of a relay passes a relatively large current, typically 30mA for a 12V relay, but it can be as much as 100mA for relays designed to operate from lower voltages. Most ICs (chips) cannot provide this current and a transistor is usually used to amplify the small IC current to the larger value required for the relay coil. The maximum output current for the popular 555 timer IC is 200mA so these devices can supply relay coils directly without amplification.

FIG 12 Relay

Relays are usually SPDT or DPDT but they can have many more sets of switch contacts, for example relays with 4 sets of changeover contacts are readily available. Most relays are designed for PCB mounting but you can solder wires directly to the pins providing you take care to avoid melting the plastic case of the relay. The animated picture shows a working relay with its coil and switch contacts. You can see a lever on the left being attracted by magnetism when the coil is switched on. This lever moves the switch contacts. There is one set of contacts (SPDT) in the foreground and another behind them, making the relay DPDT.

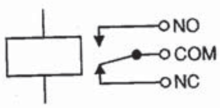


FIG 13

The relay's switch connections are usually labeled COM, NC and NO:

- **COM** = Common, always connect to this, it is the moving part of the switch.
- **NC** = Normally Closed, COM is connected to this when the relay coil is **off**.
- **NO** = Normally Open, COM is connected to this when the relay coil is **on**.

1.8. ALARM

Buzzer:

A buzzer or beeper is a signaling device, usually electronic, typically used in automobiles, household appliances such as a microwave oven, or game shows. It most commonly consists of a number of switches or sensors connected to a control unit that determines if and which button was pushed or a preset time has lapsed, and usually illuminates a light on the appropriate button or control panel, and sounds a warning in the form of a continuous or intermittent buzzing or beeping sound. Initially this device was based on an electromechanical system which was identical to an electric bell without the metal gong (which makes the ringing noise).

Often these units were anchored to a wall or ceiling and used the ceiling or wall as a sounding board. Another implementation with some AC-connected devices was to implement a circuit to make the AC current into a noise loud enough to drive a loudspeaker and hook this circuit up to a cheap 8-ohm speaker. Nowadays, it is more popular to use a ceramic-based piezoelectric sounder like a Sonalert which makes a high-pitched tone. Usually these were hooked up to "driver" circuits which varied the pitch of the sound or pulsed the sound on and off.

1.9. VIBRATION SENSOR

1.9.1. INTRODUCTION

Piezo Electric Sensor: A piezoelectric sensor is a device that uses the piezoelectric effect to measure pressure, acceleration, strain or force by converting them to an electrical signal.

Piezo Electric Effect:

Piezoelectricity is the ability of crystals and certain ceramic materials to generate a voltage in response to applied mechanical stress. Piezoelectricity was discovered by Pierre Curie and the word is derived from the Greek *piezein*, which means to squeeze or press.

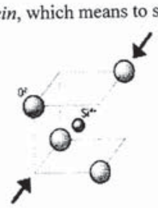


FIG 14

The piezoelectric effect is reversible in that piezoelectric crystals, when subjected to an externally applied voltage, can change shape by a small amount. (For instance, the deformation is about 0.1% of the original dimension in PZT.) The effect finds useful applications such as the production and detection of sound, generation of high voltages, electronic frequency generation, microbalance, and ultra fine focusing of optical assemblies.

Application:

Piezoelectric sensors have proven to be versatile tools for the measurement of various processes. They are used for quality assurance, process control and process development in many different industries. Piezo electric sensors are also seen in nature. Bones act as force sensors. Once loaded, bones produce charges proportional to the resulting internal torsion or displacement. Those charges stimulate and drive the build-up of new bone material. This leads to the strengthening of structures where the internal displacements are the greatest. With time, this causes weaker structures to increase their strength and stability as material is laid down proportional to the forces affecting the bone.

1.10. LCD DISPLAY

1.10.1. INTRODUCTION:

Liquid crystal displays (LCDs) have materials which combine the properties of both liquids and crystals. Rather than having a melting point, they have a temperature range within which the molecules are almost as mobile as they would be in a liquid, but are grouped together in an ordered form similar to a crystal.

An LCD consists of two glass panels, with the liquid crystal material sand witched in between them. The inner surface of the glass plates are coated with transparent electrodes which define the character, symbols or patterns to be displayed polymeric layers are present in between the electrodes and the liquid crystal, which makes the liquid crystal molecules to maintain a defined orientation angle.

One each polarizers are pasted outside the two glass panels. These polarizers would rotate the light rays passing through them to a definite angle, in a particular direction

When the LCD is in the off state, light rays are rotated by the two polarizers and the liquid crystal, such that the light rays come out of the LCD without any orientation, and hence the LCD appears transparent.

When sufficient voltage is applied to the electrodes, the liquid crystal molecules would be aligned in a specific direction. The light rays passing through the LCD would be rotated by the polarizers, which would result in activating / highlighting the desired characters.

The LCD's are lightweight with only a few millimeters thickness. Since the LCD's consume less power, they are compatible with low power electronic circuits, and can be powered for long

durations. The LCD's don't generate light and so light is needed to read the display. By using backlighting, reading is possible in the dark. The LCD's have long life and a wide operating temperature range. Changing the display size or the layout size is relatively simple which makes the LCD's more customer friendly. The LCDs used exclusively in watches, calculators and measuring instruments are the simple seven-segment displays, having a limited amount of numeric data. The recent advances in technology have resulted in better legibility, more information displaying capability and a wider temperature range. These have resulted in the LCDs being extensively used in telecommunications and entertainment electronics. The LCDs have even started replacing the cathode ray tubes (CRTs) used for the display of text and graphics, and also in small TV applications.

ENVIRONMENTAL PRECAUTIONS:

Operate the LCD module under the relative condition of 40°C and 50% relative humidity. Lower temperature can cause retardation of the blinking speed of the display, while higher temperature makes the overall display discolor.

When the temperature gets to be within the normal limits, the display will be normal. Polarization degradation, bubble generation or polarizer peel-off may occur with high temperature and humidity.

Contact with water or oil over a long period of time may cause deformation or colour fading of the display. Condensation on the terminals can cause electro-chemical reaction disrupting the terminal circuit.

1.10.2. TROUBLE SHOOTING:

INTRODUCTION:

When the power supply is given to the module, with the pin 3 (VL) connected to ground, all the pixels of a character gets activated in the following manner:

All the characters of a single line display, as in CDM 16108.

The first eight characters of a single line display, operated in the two-line display mode, as in CDM 16116.

The first line of characters of a two-line display as in CDM 16216 and 40216. The first and third line of characters of a four-line display operated in the two-line display mode, as in CDM 20416.

If the above mentioned does not occur, the module should be initialized by software.

Make sure that the control signals 'E', R/W and RS are according to the interface timing requirements.

IMPROPER CHARACTER DISPLAY

When the characters to be displayed are missing between, the data read/write is too fast. A slower interfacing frequency would rectify the problem.

When uncertainty is there in the start of the first characters other than the specified ones are rewritten, check the initialization and the software routine.

In a multi-line display, if the display of characters in the subsequent lines does not take place properly, check the DD RAM addresses set for the corresponding display lines.

When it is unable to display data, even though it is present in the DD RAM, either the display on/off flag is in the off state or the done simultaneous with the data write operation, the data may not be visible on the display.

If a character not found in the font table is displayed, or a character is missing, the CG ROM is faulty and the controller IC have to be changed

If particular pixels of the characters are missing, or not getting activated properly, there could be an assembling problem in the module.

In case any other problems are encountered you could send the module to our factory for testing and evaluation.

1.11. KEYPAD

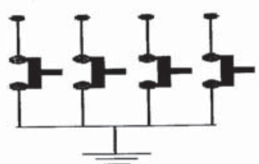
1.11.1. INTRODUCTION

A numeric keypad, or numpad for short, is the small, palm-sized, seventeen key section of a computer keyboard, usually on the very far right. The numeric keypad features digits 0 to 9, addition (+), subtraction (-), multiplication (*) and division (/) symbols, a decimal point (.) and Num Lock and Enter keys. Laptop keyboards often do not have a numpad, but may provide numpad input by holding a modifier key (typically lapelled "Fn") and operating keys on the standard keyboard.

Particularly large laptops (typically those with a 17 inch screen or larger) may have space for a real numpad, and many companies sell separate numpads which connect to the host laptop by a USB connection.

On Apple Computer Macintosh computers, which lack a Num Lock key, the numeric keypad always produces only numbers. The num lock key is replaced by the clear key.

1.11.2. CIRCUIT DIAGRAM



1.11.3. OPERATING MODES

Numeric keypads usually operate in two modes:

1. When Num Lock is off, keys 8, 6, 2, 4 act like an arrow keys and 7, 9, 3, 1 act like Home, PgUp, PgDn and End.

2. When Num Lock is on, digits keys produce corresponding digits.

These, however, differ from the numeric keys at the top of the keyboard in that, when combined with the Alt key on a PC, they are used to enter characters which may not be otherwise available: for example, Alt-0169 produces the copyright symbol. These are referred to as Alt codes.

CHAPTER 2

INTERFACING OF PERIPHERAL UNITS

2.1. RFID 125 Reader Module Pin Diagram

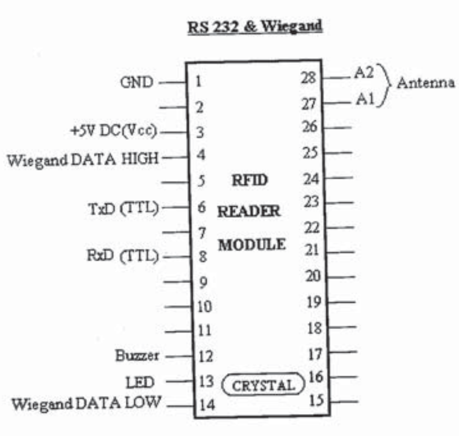


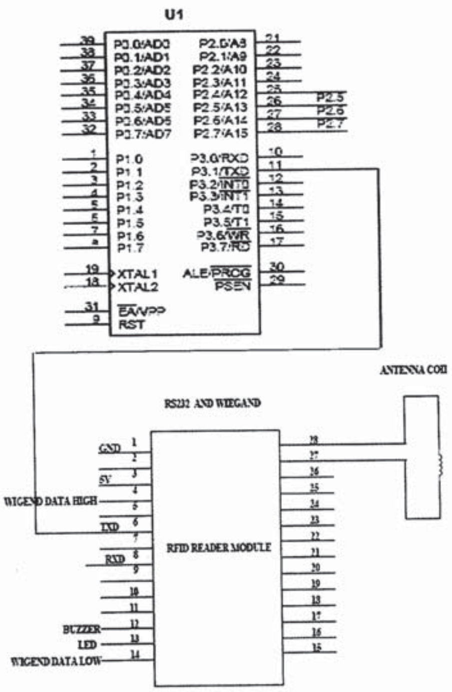
FIG 16

1. Reader module has to be mounted on non-metallic surface , else it may affect the operation of reader.
2. Buzzer & LED are Active low signals.
3. For Buzzer & LED current limiting Resister has to be mounted. MAX current is 20mA. (470 or 510 ohms for LED and 240 or 270 Ohms for Buzzer)
4. LED's Anode and Buzzer's Positive marked pin to be connected to Vcc.
5. The antenna Inductance should be about 1 mH. The same needs tuning at Factory.

Table No:4 Pin description of RFID 125 Reader Module Pin Diagram

PIN NO.	SIGNAL	DESCRIPTION
Pin No : 6	TxD	Transmit data (TTL level) output from module to serial interface
Pin No : 4	Wiegand DATA HIGH (available in Wiegand)	It will give DATA HIGH signal.
Pin No : 8	RxD	Receive data (TTL level) input to the module from serial interface
Pin No : 12	Buzzer (active low)	Buzzer will buzz for 280 ms when tag is detected
Pin No : 13	LED (active low)	LED will glow for 280 ms when tag is detected
Pin No : 14	Wiegand DATA LOW (available in Wiegand)	It will give DATA LOW signal.
Pin No:27,28	Antenna Input	Loop Antenna should be connected.

FIG 17.INTERFACING OF RFID READER MODULE WITH MICROCONTROLLER



2.2. RELAY

CIRCUIT DIAGRAM

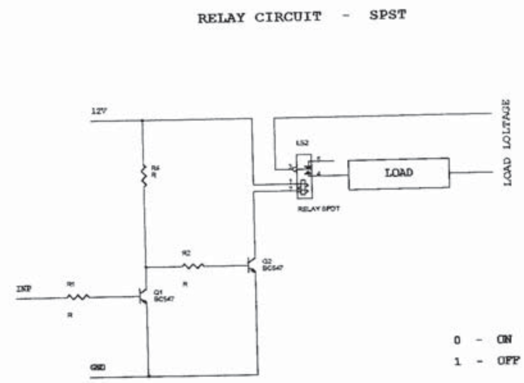


FIG 18

Circuit description:

This circuit is designed to control the load. The load may be motor or any other load. The load is turned ON and OFF through relay. The relay ON and OFF is controlled by the pair of switching transistors (BC 547). The relay is connected in the Q2 transistor collector terminal. A Relay is nothing but electromagnetic switching device which consists of three pins. They are Common, Normally close (NC) and Normally open (NO).

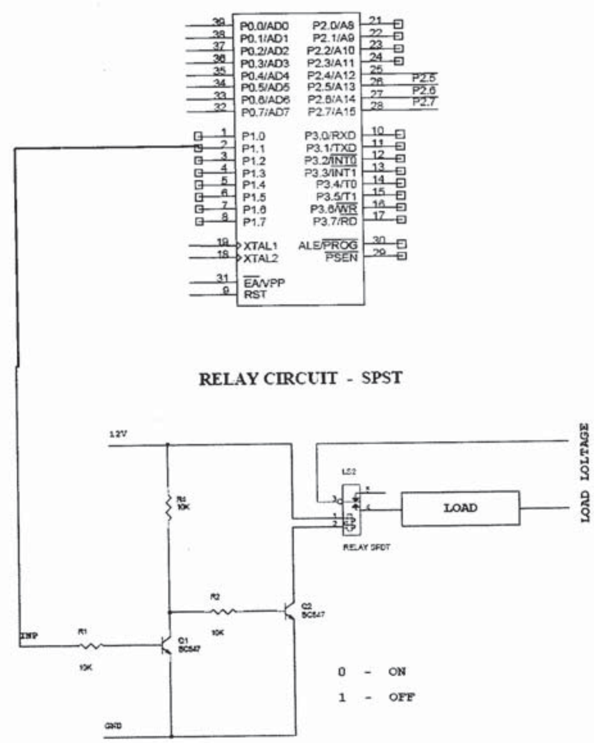
The relay common pin is connected to supply voltage. The normally open (NO) pin connected to load. When high pulse signal is given to base of the Q1 transistors, the transistor is conducting and shorts the collector and emitter terminal and zero signals is given to base of the Q2 transistor. So the relay is turned OFF state.

When low pulse is given to base of transistor Q1 transistor, the transistor is turned OFF. Now 12v is given to base of Q2 transistor so the transistor is conducting and relay is turned ON. Hence the common terminal and NO terminal of relay are shorted. Now load gets the supply voltage through relay.

Table No: 5 Conditions for Relay

Voltage signal from microcontroller or PC	Transistor Q1	Transistor Q2	Relay
1	on	off	off
0	off	on	on

FIG 19.INTERFACING RELAY CIRCUIT WITH MICROCONTROLLER



2.3.ALARM

CIRCUIT DIAGRAM:

ALARM CIRCUIT

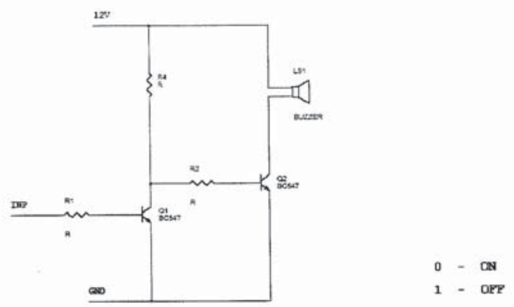


FIG 20

CIRCUIT DESCRIPTION:

The circuit is designed to control the buzzer. The buzzer ON and OFF is controlled by the pair of switching transistors (BC 547). The buzzer is connected in the Q2 transistor collector terminal.

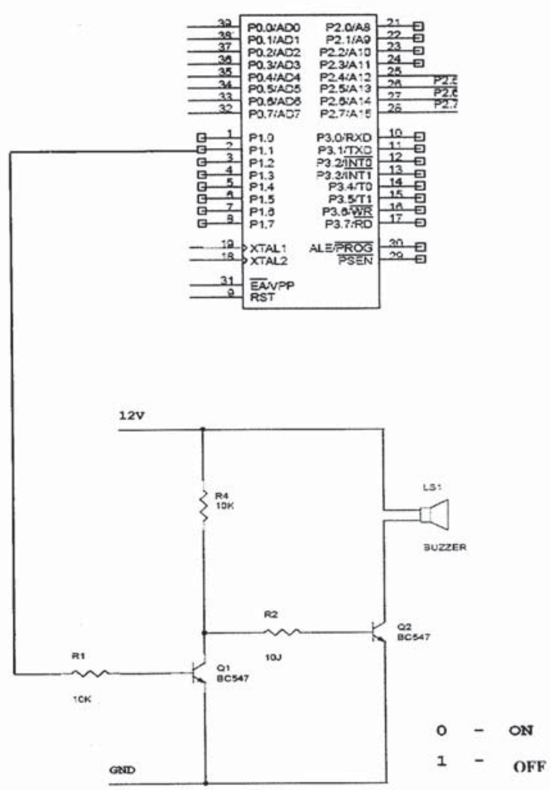
When high pulse signal is given to base of the Q1 transistors, the transistor is conducting and close the collector and emitter terminal so zero signals is given to base of the Q2 transistor. Hence Q2 transistor and buzzer is turned OFF state.

When low pulse is given to base of transistor Q1 transistor, the transistor is turned OFF. Now 12v is given to base of Q2 transistor so the transistor is conducting and buzzer is energized and produces the sound signal.

Table No:6 conditions for Alarm

Voltage signal from microcontroller or PC	Transistor Q1	Transistor Q2	Alarm
1	on	off	off
0	Off	on	on

FIG 21. INTERFACING OF ALARM CIRCUIT WITH MICROCONTROLLER



2.4. VIBRATION SENSOR

CIRCUIT DIAGRAM

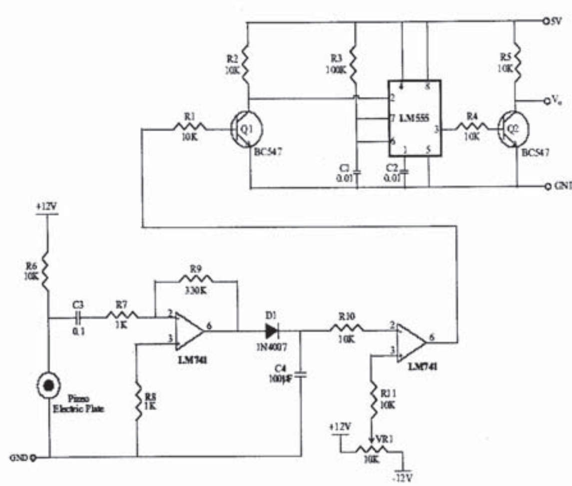


FIG 22

Circuit Description:

Vibration circuit is used to sense the mechanical vibration. This circuit is constructed with

1. Piezo electric plate.
2. Operational amplifier
3. 555 IC timer

Piezo electric plate is the special type of sensor which is used to sense the mechanical vibration. Piezo electric plate converts the mechanical vibration to electrical signal. The converted electrical

Then the electrical signal voltage is given to amplifier unit through 0.1uf capacitor in order to filter the noise signal. The amplifier circuit is constructed with operational amplifier LM 741. The amplified output is in the form of AC signal the diode is used to rectify the negative signal.

The rectified signal is given to comparator. The comparator circuit is constructed with LM 741 operational amplifier in which the signal is given to inverting input terminal. The reference voltage is given to non inverting input terminal. It converts the input signal to +12V to -12V square pulse.

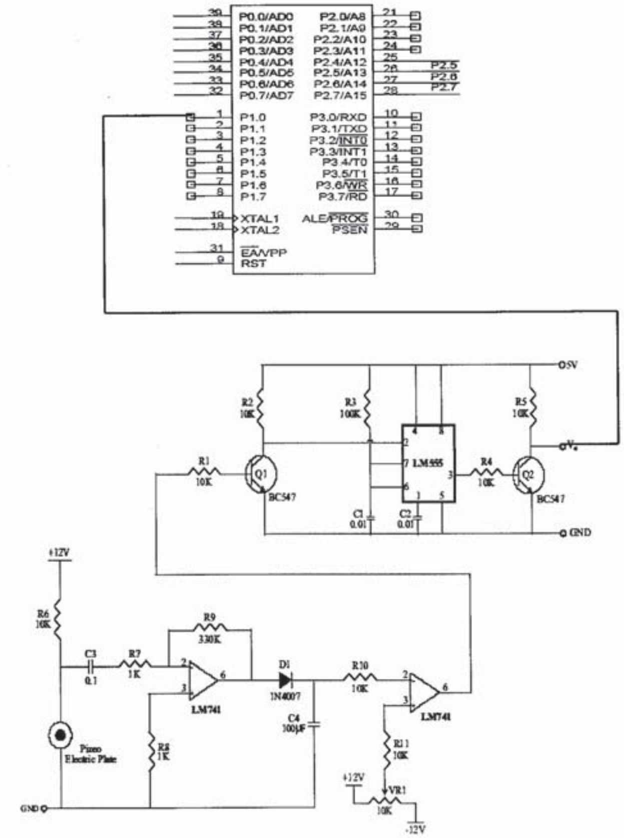
The square pulse is given to base of BC 547 transistor whenever the positive side of square pulse is come the transistor conducts emitter and collector side is short circuited because the transistor is act as switch. The collector side is connected to trigger terminal of the 555 IC. When the transistor is conducted negative signal is given to trigger terminal because the emitter is connected to ground side.

Now the 555 IC conducts and generates the square pulse. The frequency of the square pulse is depends upon the resistor and capacitor connected in between 7th (discharge) and 6th (threshold) terminal.

The square pulse is given to base of the Q2 transistor. The transistor is turn ON and turn OFF depends upon the square pulse. The Q2 transistor output is 0 to 5V pulse.

Whenever the Piezo electric plate sense the vibration the Q2 transistor outputs the 0 to 5V pulse. This pulse is given to microcontroller or other related circuit to inform that vibration has been occurred.

FIG 23.INTERFACING VIBRATION SENSOR WITH MICROCONTROLLER



2.5. LCD DISPLAY

DESCRIPTION

POWER SUPPLY:

The power supply should be of +5V, with maximum allowable transients of 10mv. To achieve a better / suitable contrast for the display, the voltage (VL) at pin 3 should be adjusted properly.

A module should not be inserted or removed from a live circuit. The ground terminal of the power supply must be isolated properly so that no voltage is induced in it. The module should be isolated from the other circuits, so that stray voltages are not induced, which could cause a flickering display.

HARDWARE:

Develop a uniquely decoded 'E' strobe pulse, active high, to accompany each module transaction. Address or control lines can be assigned to drive the RS and R/W inputs.

Utilize the Host's extended timing mode, if available, when transacting with the module. Use instructions, which prolong the Read and Write or other appropriate data strobes, so as to realize the interface timing requirements.

If a parallel port is used to drive the RS, R/W and 'E' control lines, setting the 'E' bit simultaneously with RS and R/W would violate the module's set up time. A separate instruction should be used

MOUNTING:

Cover the display surface with a transparent protective plate, to protect the polarizer.

Don't touch the display surface with bare hands or any hard materials. This will stain the display area and degrade the insulation between terminals.

Do not use organic solvents to clean the display panel as these may adversely affect tape or with absorbant cotton and petroleum benzene.

The processing or even a slight deformation of the claws of the metal frame will have effect on the connection of the output signal and cause an abnormal display.

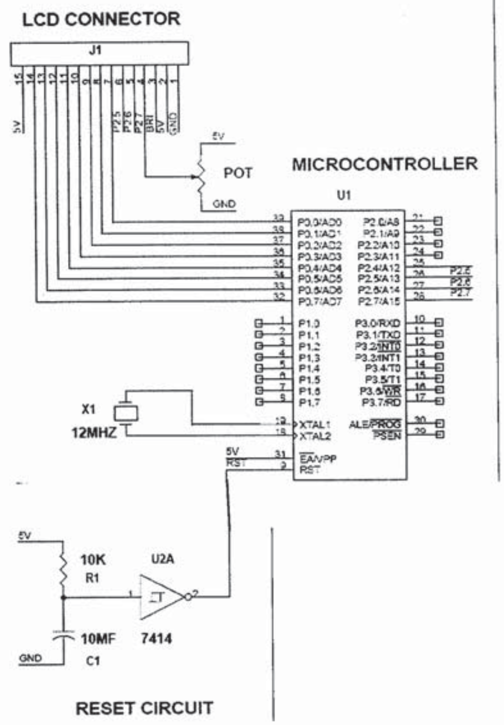
Do not damage or modify the pattern wiring, or drill attachment holes in the PCB. When assembling the module into another equipment, the space between the module and the fitting plate should have enough height, to avoid causing stress to the module surface.

Make sure that there is enough space behind the module, to dissipate the heat generated by the ICs while functioning for longer durations.

When an electrically powered screwdriver is used to install the module, ground it properly.

While cleaning by a vacuum cleaner, do not bring the sucking mouth near the module. Static electricity of the electrically powered driver or the vacuum cleaner may destroy the module.

FIG 24.INTERFACING LCD DISPLAY WITH MICROCONTROLLER



CHAPTER 3

MICROCONTROLLER CODING

Microcontroller coding is done in C language and compiled using a cross compiler KEILC. The compiled program is loaded into Microcontroller IC.

Keil c

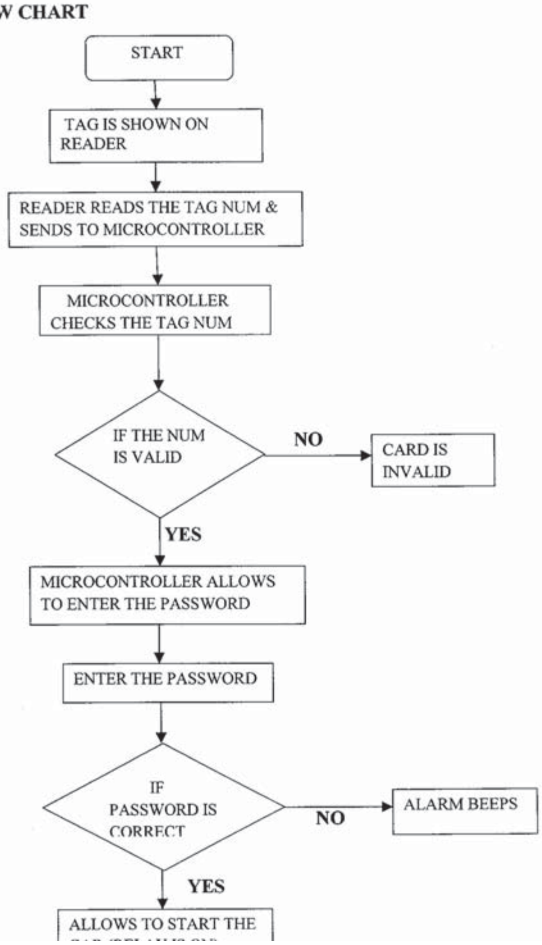
The software was written in Keil c which is a cross compiler. A cross compiler converts the high level language into its corresponding hex code format of the assembly language. Keil compiler is compatible with 8051-based microcontroller. The hex file can be directly burned to the flash memory.

The Keil environment is called as .µvision2 integrated development environment.µvision2 is an IDE that contains the following

1. A project manager
2. Tool configuration
3. An Editor
4. A powerful debugging

using the tools .µvision2 allows writing ,compiling and debugging the programs

3.1. FLOW CHART



CHAPTER 4

Advantages:

1. Low power consumption.
2. We can access vary easily.
3. Improves security performance in the security places because we cannot make the duplicate RFID card.

CHAPTER 5

FUTURE WORK

The project can be further refined and brought out in other dimensions. Applying the same principle, application is varied . We can use RFID based security system in highly secured areas such as

1. RFID based Bank security system.
2. RFID based door opening and closing.
3. RFID based production security system.

CHAPTER 6

CONCLUSION

All the modules were individually constructed and then integrated successfully. When the customer shows the RFID card in the reader, the reader will read the number and send to microcontroller The microcontroller receives the card number from the reader and compares it with the stored number .If the card is valid the microcontroller allows to enter password. If its correct microcontroller will send the signal to switch on the relay to start the car otherwise it will start to beep alarm. Each time when we switch off the car microcontroller has to reset. The car door breaking is sensed through vibration sensor. If anyone tries to break the car then it automatically gives alarm.

APPENDIX 1

LM78XX

Series Voltage Regulators

General Description

The LM78XX series of three terminal regulators is available with several fixed output voltages making them useful in a wide range of applications. One of these is local on card regulation, eliminating the distribution problems associated with single point regulation. The voltages available allow these regulators to be used in logic systems, instrumentation, Hi-Fi, and other solid state electronic equipment. Although designed primarily as fixed voltage regulators these devices can be used with external components to obtain adjustable voltages and currents. The LM78XX series is available in an aluminum TO-3 package which will allow over 1.0A load current if adequate heat sinking is provided. Current limiting is included to limit the peak output current to a safe value. Safe area protection for the output transistor is provided to limit internal power dissipation. If internal power dissipation becomes too high for the heat sinking provided, the thermal shutdown circuit takes over preventing the IC from overheating. Considerable effort was expanded to make the LM78XX series of regulators easy to use and minimize the number of external components. It is not necessary to bypass the output, although this does improve transient response. Input bypassing is needed only if the regulator is located far from the filter capacitor of the power supply. For output voltage other than 5V, 12V and 15V the LM117 series

Features

1. Output current in excess of 1A
2. Internal thermal overload protection
3. No external components required
4. Output transistor safe area protection
5. Internal short circuit current limit
6. Available in the aluminium TO-3 package

Voltage Range

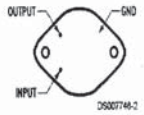
LM7805C- 5V

LM7812C- 12V

LM7815C- 15V

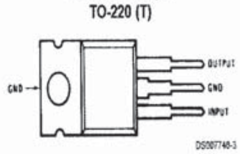
CONNECTION DIAGRAMS

Metal Can Package
TO-3 (K)
Aluminum



Bottom View
Order Number LM7805CK,
LM7812CK or LM7815CK
See NS Package Number KC02A

Plastic Package
TO-220 (T)



Top View
Order Number LM7805CT,
LM7812CT or LM7815CT
See NS Package Number T03B

APPENDIX 2

FUNCTIONAL DESCRIPTION OF THE CONTROLLER IC

REGISTERS:

The controller IC has two 8 bit registers, an instruction register (IR) and a data register (DR). The IR stores the instruction codes and address information for display data RAM (DD RAM) and character generator RAM (CG RAM). The IR can be written, but not read by the MPU.

The DR temporally stores data to be written to /read from the DD RAM or CG RAM. The data written to DR by the MPU, is automatically written to the DD RAM or CG RAM as an internal operation.

When an address code is written to IR, the data is automatically transferred from the DD RAM or CG RAM to the DR. data transfer between the MPU is then completed when the MPU reads the DR. likewise, for the next MPU read of the DR, data in DD RAM or CG RAM at the address is sent to the DR automatically. Similarly, for the MPU write of the DR, the next DD RAM or CG RAM address is selected for the write operation.

Table No:7Register selection table

RS	R/W	Operation
0	0	IR write as an internal operation
0	1	Read busy flag (DB7) and address counter (DB0 to DB6)
1	0	DR write as an internal operation (DR to DD RAM or CG RAM)
1	1	DR read as an internal operation (DD RAM or CG RAM to DR)

BUSY FLAG:

When the busy flag is1, the controller is in the internal operation mode, and the next instruction will not be accepted.

When RS = 0 and R/W = 1, the busy flag is output to DB7.

The next instruction must be written after ensuring that the busy flag is 0.

ADDRESS COUNTER:

The address counter allocates the address for the DD RAM and CG RAM read/write operation when the instruction code for DD RAM address or CG RAM address setting , is input to IR, the address code is transferred from IR to the address counter. After writing/reading the display data to/from the DD RAM or CG RAM, the address counter increments/decrements by one the address, as an internal operation. The data of the address counter is output to DB0 to DB6 while R/W = 1 and RS = 0.

DISPLAY DATA RAM (DD RAM)

The characters to be displayed are written into the display data RAM (DD RAM), in the form of 8 bit character codes present in the character font table. The extended capacity of the DD RAM is 80 x 8 bits i.e. 80 characters.

CHARATCER GENERATOR ROM (CG ROM)

The character generator ROM generates 5 x 8 dot 5 x 10 dot character patterns from 8 bit character codes. It generates 208, 5 x 8 dot character patterns and 32, 5 x 10 dot character patterns.

CHARACTER GENERATOR RAM (CG RAM)

In the character generator RAM, the user can rewrite character patterns by program. For 5 x 8 dots, eight character patterns can be written, and for 5 x 10 dots, four character patterns can be written.

INTERFACING THE MICROPROCESSOR / CONTROLLER:

The module, interfaced to the system, can be treated as RAM input/output, expanded or parallel I/O.

Since there is no conventional chip select signal, developing a strobe signal for the enable signal (E) and applying appropriate signals to the register select (RS) and read/write (R/W) signals are important.

The module is selected by gating a decoded module – address with the host – processor's read/write strobe. The resultant signal, applied to the LCDs enable (E) input, clocks in the data.

The 'E' signal must be a positive going digital strobe, which is active while data and control information are stable and true. The falling edge of the enable signal enables the data / instruction register of the controller. All module timings are referenced to specific edges of the 'E' signal. The 'E' signal is applied only when a specific module transaction is desired.

The read and write strobes of the host, which provides the 'E' signals, should not be linked to the module's R/W line. An address bit which sets up earlier in the host's machine cycle can be used as R/W.

When the host processor is so fast that the strobes are too narrow to serve as the 'E' pulse.

a. Prolong these pulses by using the hosts 'Ready' input
b. Prolong the host by adding wait states
c. Decrease the Hosts Crystal frequency.

Inspite of doing the above mentioned, if the problem continues, latch both the data and control information and then activate the 'E' signal

When the controller is performing an internal operation he busy flag (BF) will set and will not accept any instruction. The user should check the busy flag or should provide a delay of approximately 2ms after each instruction.

The module presents no difficulties while interfacing slower MPUs.

The liquid crystal display module can be interfaced, either to 4-bit or 8-bit MPUs. For 4-bit data interface, the bus lines DB4 to DB7 are used for data transfer, while DB0 to DB3 lines are disabled. The data transfer is complete when the 4-bit data has been transferred twice. The busy flag must be checked after the 4-bit data has been transferred twice. Two more 4-bit operations then transfer the busy flag and address counter data. For 8-bit data interface, all eight-bus lines (DB0 to DB7) are used.

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