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INTERNATIONAL VIRTUAL CONFERENCE ON EMERGING TRENDS ON ARTIFICIAL INTELLIGENCE IN INDUSTRY 4.0

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CERTIFICATE OF APPRECIATION

This is to certify that **MANIKANDAN S** of **MEENAKSHI SUNDARARAJAN ENGINEERING COLLEGE** *has presented a paper on* **IOT BASED FUEL THEFT DETECTION SYSTEM**

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IOT BASED FUEL THEFT DETECTION SYSTEM

A PROJECT REPORT

Submitted by

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in partial fulfillment for the award of the degree

of

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ABSTRACT:

In parked vehicles fuel theft is increasing day by day lately. Moreover, frustration part is increasing fuel prices due to reason of fuel theft. This project objective is focusing on the fuel theft problem and puts forward an efficient solution for this problem. It senses the number of fuel in tank and visually displays it to the used. It successfully detects fuel thefts employing a unique method. It detects weather the vehicle is turned off. If the fuel decreases while vehicle is turned off it triggers an occasion and this event is linked to message sending functionality. Fuel level sensing gauge are going to be connected to µC through ADC. Quantity of the fuel are going to be displayed on LCD. If the reserve within the tank decreases while vehicle is in OFFstate, then an alert is going to be sent to user's mobile in text form. The primary design goal is to style a system capable of monitoring the fuel information in real time whenever we visit petrol bunks to fill our vehicles. Whenever we visit bunks to fill tanks of our vehicles, they're doing fiddle while filling it from dispensers since they coded it internally with some digital error coding technique, which dispenses less amount of petrol and show right amount on the display of the dispenser. These frauds are being happening now-a-days in many bunks across the large cities and even small towns. Another problem is fuel thefts once we park our vehicles at some place. Today's world needs digital techniques for measurement of any quantity conventional like real time fuel monitoring and theft detection system using iot. Our proposed workwe show the quantity of fuel Present in fuel tank digitally with flow sensor. The fuel while its getting dispensed from dispenser in fuel stations and monitor lively to caught them if they struggle to form fraud. In our project we implemented if fuel gets theftthen alert are becoming to be send to owner of vehicles also buzzer makes noise so asthat owner of vehicles, someone like watchmen or in charge of parking area get aware and take action. In traditional vehicle system such kind of system is not implemented like display fuel availability digitally, fuel dispensed from dispenser in bunks cannot be measured & fuel Theft from vehicles cannot be avoided.

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CHAPTER - 1

1. INTRODUCTION

Automations mandatory to handle all type of systems. It is made possible by embedded design which may be a combination of both computer and system, often with real-time computing constraints. In today's world, it's commonto regulate most of the devices, by automation since it optimizes by reducing the dimensions and price of the merchandise and increase the reliability and performance. Embedded systems are based on Microcontroller and their applications range from port able devices to large installations and it also extends to large complex systems. Specialized internal communications network which needs for vehicle control like assurance of message delivery of non- conflicting messages. It is quite common to transportation that has been suffering from many causes like fuel theft, premature dry out, fuel leakage, and improper fuel consumption in engine and disputes during the fueling of vehicle. These issues cause a drastic loss in reserve, which successively makes the authorities to urge into an excellent trouble. It leads to an excessive impact to the authorities because fuel theft is a major problem faced by the owners and drivers. It is an area error that happens within the vehicle transported, because fuel theft offers the unauthorized persons during a beneficiary part. Since it results in huge loss for the investors but at an equivalent time, it paves how for the people that involve in illegal activities. The proposed system examines to detect the quantity of fuel that has been holdup. It determines the fuel theft altogether aspects and intimates the authorities through messages. This systematic approach with the upcoming techniques will tend to scale back the fuel theft inan efficient way which is that the boon to our society.

1.1. What is IOT?

The internet of things, or IoT, may be a system of interrelated computing devices, mechanical and digital machines, objects, animals or folks that are given unique identifiers (UIDs) and therefore the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction. A thing within the internet of things are often an individual with a cardiac monitor implant, a livestock with a biochip transponder, an automobile that has built-in sensors to alert the driving force when tire pressure is low or the other natural or man-made object which will be assigned an IP address and is in a position to transfer data over a network. Increasingly, organizations during a sort of industries are using IoT to work more efficiently, better understand customers to deliver enhanced customer service, improve decision-making and increase the worth of the business. IoT has evolved from the convergence of wireless technologies, microelectromechanical systems (MEMS), microservices and therefore the internet. The convergence hashelped level the silos between operational technology (OT) and knowledgetechnology (IT), enabling unstructured machine-generated data to be analyzed for insights to drive improvements.

1.2 Why we use IoT?

Much research in recent years has focused on Internet of Things (IoT) which connects physical objects to network and manages information of the objects. Especially, home domain is the most important field of IoT. Because the research survey reported that the number of connected device will grow to nearly 8 billion devices for the year 2020 excepting mobile phone, and home devices has the biggest portion of them about 3.7 billion. It means they will generate big data such as sensory data, usage information and so on. Home service providers want to develop various and advanced service using the data, but there remains a need for an efficient method that can analyze the data. Previous works have mainly focused communication way, or the specific service of analysis. E.S.Lee, et al. Developed an auto-configuration system structure and protocol for Internet-capable home appliances, which supports the initial configuration

and remote maintenance serviceof the device with only little user effort. HJ.Lee, et al. proposed a three stage conversion process for interoperability among different middleware of home network that supports not only the conversion of the message format and schema, but also semantic conversion. Shih-Yeh Chen, et al. developed electronic appliance recognition system by building a database mechanism, electronic appliance recognition classification, and waveform recognition. It have been carried out smart meter data analysis but they are accepted only meter data. However, IoT platform needs to accept various kinds of data and manage the data uniformed system. Furthermore, many researches have studied IoT platform in another area. iHome Health-IoT proposed platform seamlessly fuses IoT devices (e.g., wearable sensors and intelligent medicine packages) with in-home healthcare services (e.g., telemedicine) for improved user experience and service efficiency. It mainly concerned a variety of health IoT device from body to cloud, and their hardware architecture. Andrea Zanella, et al. provided a comprehensive survey of the enabling technologies, protocols, and architecture for an urban IoT, and presented the technical solutions and bestpractice guidelines adopted in the Padova Smart City project. They collected the temperature, humidity, light, and benzene readings, and just shown the plots. They didn't have analysis part for urban IoT yet. Hongming Cai, et al proposed a platform which based on an abstract information model, information encapsulating, composing, discomposing, transferring, tracing, and interacting in Product Lifecycle Management could be carried out.

1.3 Sensors used in IoT:

Ultrasonic Sensor

An ultrasonic sensor is an instrument that measures the distance to an object using ultrasonic sound waves. An ultrasonic sensor uses a transducer to send and receive ultrasonic pulses that relay back information about an objects proximity.

Highfrequency sound waves reect from boundaries to produce distinct echo patterns. Ultrasound is reliable in any lighting environment and can be used inside or outside. Ultrasonic sensors can handle collision avoidance for a robot, and being moved often, as long as it isnt too fast. Ultrasonics are so widely used, they can be reliably implemented in grain bin sensing applications, water level sensing, drone applications and sensing cars at your local drive-thru restaurant or bank. Ultrasonic rangefinders are commonly used as devices to detect a collision. Ultrasonic sensors are superior to infrared sensors because they aren't affected by smoke or black materials, however, soft materials which dont reect the sonar (ultrasonic) waves very well may cause issues. Its not a perfect system, but its good and reliable.

Flow Sensors or Liquid Level Sensors:

Water flow sensor consists of a plastic valve body, a water rotor, and a hall-effect sensor. When water flows through the rotor, rotor rolls. Its speed changes with different rate of flow. The hall-effect sensor outputs the corresponding pulse signal. This one is suitable to detect flow in water dispenser or coffee machine. We have a comprehensive line of water flow sensors in different diameters. Effective water management involves supplying water according to the real requirement, and thus measuring water is very essential step in water management systems. There are many water flow measurement techniques as well as different types of water flow meters used to measure the volume of water flow in pipelines but these all are too costly. This article describes ideas for design and development of low cost automatic water flow meters, with the help of readily available and low-cost water flow sensors. YF-S201 Hall-Effect Water Flow Sensor accurate flow measurement is an essential step both in the terms of qualitative and economic points of view. Flow meters have proven excellent devices for measuring water flow, and now it is very easy to build a water management system using the renowned water flow sensor YF-S201. This sensor sits in line with the water line and contains a pinwheel sensor to measure how much water has moved through it. There is an integrated magnetic Hall-Effect sensor that outputs an electrical pulse with every revolution.

The YFS201 Hall Effect Water Flow Sensor comes with three wires: Red/VCC (5- 24V DC Input), Black/GND (0V) and Yellow/OUT (Pulse Output). By counting the pulses from the output of the sensor, we can easily calculate the water flow rate (in litre/hour L/hr) using a suitable conversion formula.

1.4.IOT ARCHITECTURE:

The IOT (Internet of Things) Drawing representing the web of things (IoT). The Internet of things (IoT) is that the network of physical devices, vehicles, home appliances and other items embedded with electronics, software, sensors, actuators, and network connectivity which enables these objects to connect and exchange data. Each thing is uniquely identifiable through its embedded computing system but can inter-operate within the prevailing Internet infrastructure.

IOT are usually widespread recognition of the evolving nature of the design and management of the online of things, sustainable and secure deployment of IoT solutions must design for "anarchic scalability." Application of the concept of anarchic scalability are often extended to physical systems (i.e. Controlled real-world objects), by those systems being designed to account for uncertain management futures. This "hard anarchic scalability" thus provides a pathway forward to completely realize the potential of Internet-of-things solutions by selectively constraining physical systems to permit for all management regimes without risking physical failure. Brown University scientist Michael Littman has argued that successful execution of the web of things requires consideration of the interface's usability also because the technology itself.

CHAPTER - 2

2.LITERATURE SURVEY

2.1. Design and Implementation of a New Nonradioactive-Based Machine for Detecting Oil-water Interfaces in Oil Tanks

Ahmed M. Al-Naamany et al (2007) describes that a replacement ultrasound- based technique was developed to work out oil, emulsion and water level withinthe oil tank. It consists of a compact, programmable ultrasound-based multilayer level measuring device for a feed forward neural network is implemented. The advantages of this method over current methods include contactless distance measurement, higher precision, lower costs, easier configuration and nonionizing radiation is employed. The other advantage of this technology to light -based method is its insensitivity to a dusty and smoky environment and therefore the independence of the thing material and surface. Preliminary trials were carried out on the device. A new ultrasound -based hardware device for multilayer level measurement (MLLM) is presented. This solution uses the very fact that the ultrasonic characteristics of an emulsion or suspension vary significantly with varying disperse phase volume fraction. Actual results are very encouraging and show that the device can be easily measured with high accuracy. Moreover, since all its circuits are arranged outside the tank, the device can operate in hazardous to wash or sterile environments and deal with surface scum or soil mud. The reform, the approach can also be extended to measure different typesof media allow. The system was designed in order that they will add remote areas autonomously over long periods during which the environmental conditions(ie, temperature) vary within wide ranges.

2.2. Contactless Liquid -level Measurement Frequency-Modulated Millimeter Wave Through Opaque Container

Tatsuo Nakagawa et al (2013) describe a non-contact method for measuring liquid level by an opaque container is proposed. A millimeter -wave Doppler sensor is to detect by a target container developed, and measures the liquid level on the idea of the absorption of millimeter waves within the liquid. One of the challenges is to accurately measure liquid level (sub-millimeter error) in spite of the inherently large beam diameter of the millimeter wave by diffraction. A piezoelectric vibrator permits accurate measurement by a limited portion of the spread beam to reflect and it's modulated within the frequency of the opposite a part of the beam to differ. The feasibility of our proposed method for clearly an air-liquid interface detecting hiddenin an opaque container is confirmed experimentally. The non -linearity error of the measured liquid level within 0.5 mm. Level measurement necessary for various applications, like factory automation, industrial processes and medical instruments. There is a good sort of methods for measuring the extent of which within the field of mechanical float and capacitive and optical sensors ultrasonic method. General capacitive level sensors measure the electrical capacitance between two electrodes immersed during a liquid and calculate the liquid level of the capacity. A capacitive sensor semi cylindrical mounted to a liquid container can measure liquid level, without coming into contact with the liquid, has, but its accuracy isn't high, becausethe capacity of the space between the container and therefore the sensor is very dependent. Optical sensors like CCD cameras can measure fluid without the liquid with the image processing. However, to capture a picture of the surface of the liquid, the container should be transparent, or the optical sensors should be introduced into the container. By the utilization of ultrasonic sensors, level are often calculated from the world between the sensor and therefore the liquid surface. However, these sensors can't be used for sealed containers. The principle of measurement is predicated on the absorption properties of a millimeter wave to a target liquid.

2.3. Fuel Gauge Sensing Technologies for Automotive Applications

The paper describes the existing fuel display techniques used in cars i.e. the traditional fuel display system and therefore the smart fuel display system. It describes its function and a comparison is made between the two existing techniques based on performance, complexity and cost of development. Some problems in relation to the existing techniques are identified and a better alternative sensing technology. A tank display (or gas) is an instrument used to indicate that the level of the fuel in the tank. The system consists of two important circuits, is employedto record and display reserve. The sensor unit normally sends a float sort of reservesensor to live, while the indicator measures the quantity of electrical current throughthe sensor unit and indicates that voltage from the fuel tank sensor. There are different techniques to implement remote sensing and systems. The existing traditional and the micro controller-based type float measuring techniques are far from exact. On the conservative, but the microcontroller -based procedure is more accurate in comparison to the traditional procedures but still lacks accuracy by means of the fuel in the tank, if sloshing float sensor is calibrated with regard to the dimensions and therefore the curves of the tanks. Efficient and reliable sensing technology is that the capacitive level sensing system, the utilization of tilt sensor also as a microprocessor, remedial measures code installed, located on the fuel sensor signal on the idea of the inclinometer measurements provide highly precise measurement of the level of fuel in the tank.

2.4. Modified Type Intelligent Digital Fuel Indicator System.

There are many sensor is predicated on the market available techniques for measurement of level and there's a narrow idea of the number of fluid, but it are often an accurate approximation of the number as in cars by fuel m where a thought of whether the tank is full, half full or empty, etc. can be determined. The fill level of the detector and therefore the Optimizer play a crucial role in tanks for the specification

of the liquid of a selected density. This device Digital displays the level of the liquid in the tank, fuel composition & current function of the vehicle using the load sensors. A reserve detector (tank display) may be a device during a car or another vehicle, measures the quantity of fuel remaining within the vehicle. This sort of system are often wont to measure the quantity of gasoline or the other type of liquid. There is usually or sensor measures the quantity of fuel actually and leaves a dial indicator or indicator, passes this information outside of the container. A tank display can be designed in a number of different ways and many measuring devices are several deficiencies, the measured values can be less accurate. The two parts of the fuel indicator are the remote sensing or sensor and therefore the display or display. A sensor unit is that part of a tank display within or to the particular storage containers on one vehicle. For example, the sensor unit consists of a float within the tank, connected with a metal rod that results in a little circuit . The float raises or lowers. Depending on the quantity of fuel in the tank, wheel speed, braking torque, load (vehicle passenger's luggage) & acceleration ratio etc.

2.5. A Novel Fluid Level Sensor: Dual Purpose, Auto ranging, Self-Calibrating

A fluid level sensor distinguishes between isotropic liquids due to their electrical conductivity and dielectric constants. The sensor determines the electrical propertiesof the fluid that selects the appropriate method for measuring conductivity or capacity, then calculates the depth of the probe in the liquid studied. Readings include the depth of insertion, dielectric constant and electrical conductivity. The probe is automatic range selection and self -calibrating. Many vehicles with combustion engine of today run on a mix of gasoline and ethanol and other fuel additives. It is desirable to create a robust, low-cost measuring device to the level of the fuel in the vehicle tank. Capacitive or conductive probes are often utilized in this application, but they suffer from serious defects. Before ultramodern capacitive sensor depth probes are not intended for use with these compounds due to the complex nature of the variation of the dielectric constant as a function of the concentration of various kinds. The same applies to pre art conductivity

sensor depth probes. The effect of temperature on these measurements is additionally a priority.A depth measurement probe, not suffer these shortcomings. The probe is mechanically simple and uses automatic range selection electronic circuits to measure both fluid properties and the depth of the probe in a liquid.

CHAPTER-3

SYSTEM ANALYSIS

3.1. EXISTING SYSTEM

The system actually determines the fuel level using the PIC Microcontroller. It uses mechanically float level sensor to calculate the fuel Level in the fuel tank. A password is provided to access the fuel tank level and this is authenticated only by the driver and the owner. Once the fuel tank is opened an alert is sent to owners through sms including the timing details.

3.2 METHODLOGY:

The figure above shows how the interfacing of the GSM with microcontroller. The GSM module is for communication between the microcontrollers with mobile phones through UART. To communicate over UART or USART, we just need three basic signals which are namely, RXD (receive), TXD (transmit), GND (common ground).GSM modem interfaces with microcontroller for SMS. Text message may be sent through the modem by interfacing only three signals of the serial interface of modem with microcontroller i.e., TXD, RXD and GND.The transmit signal of serial port of microcontroller is connected withtransmit signal (TXD) of the serial interface of GSM Modem while receive signal of microcontroller serial port is connected with receive signal (RXD) of serial interface of GSM Modem.

After switching on the system, the GSM based fuel theft security is installed.

The complexity of coding substantially increases, but once programmed the module works at its robust best since it is a dedicated embedded system and not a general purpose computer. The design procedure involves identifying and assembling all the required hardware and ensuring safe interfacing between all the components. Then we have the coding process which has to take care of the delays between two successive transmissions. The limiting constraint is the RAM of the microcontroller rather than the coding- complexities.

3.3 Disadvantages of Existing System

1. Poor efficiency
2. Unnecessary message to the concerned authorities.
3. Lack of accurate results

CHAPTER-4

PROPOSED SYSTEM

4.1 PROPOSED SYSTEM

The proposed system is to determine the amount of fuel that has been stolen and also to determine whether the vehicle is accessed by any unauthorized person using the technologies like IOT, Fuel sensor, wireless device with Bluetooth hc 05. The fuel sensor is used to calculate the height of the tank up to which the fuel is available based on the height it is possible to calculate the amount of fuel. Once the fuel tank is opened an alert message is sent to owners through making call.

The proposed method given in this paper is designing a system to monitor fuel dispensing from the fuel dispenser in filling stations and it detects gambling by measuring the amount of fuel flown through the flow sensor. If the amount of fuel dispensed from dispenser doesn't match with the amount shown to us in the android application or cloud account, then the fraud can be detected. Another thing about this system is, fuel thefts can be caughtby using ultrasonic sensor which is fixed at the fuel pipe which is basically present at the left side of bikes. This system offers an theft detection System in addition to manual monitoring of fuel. This system measures fuel volume and sends measured volume to the owner's mobile as well as cloud through network. It also provides a technique for detecting theft or fraud incidents in case of fuel theft or fuel leakage are practically verified. This system allows for an automated analysis and monitoring of fuel level, havinga reduced cost due to affordable and easy-to-acquire electronic components.

4.2. METHODLOGY:

The proposed method given in this paper is designing a system to monitor fuel dispensing from the fuel dispenser in filling stations and it detects gambling by measuring the amount of fuel flown through the flow sensor. If the amount of fuel dispensed from dispenser doesn't match with the amount shown to us in the android application or cloud account, then the fraud can be detected. Another thing about this system is, fuel thefts can be caught by using ultrasonic sensor which is fixed at the fuel pipe which is basically present at the left side

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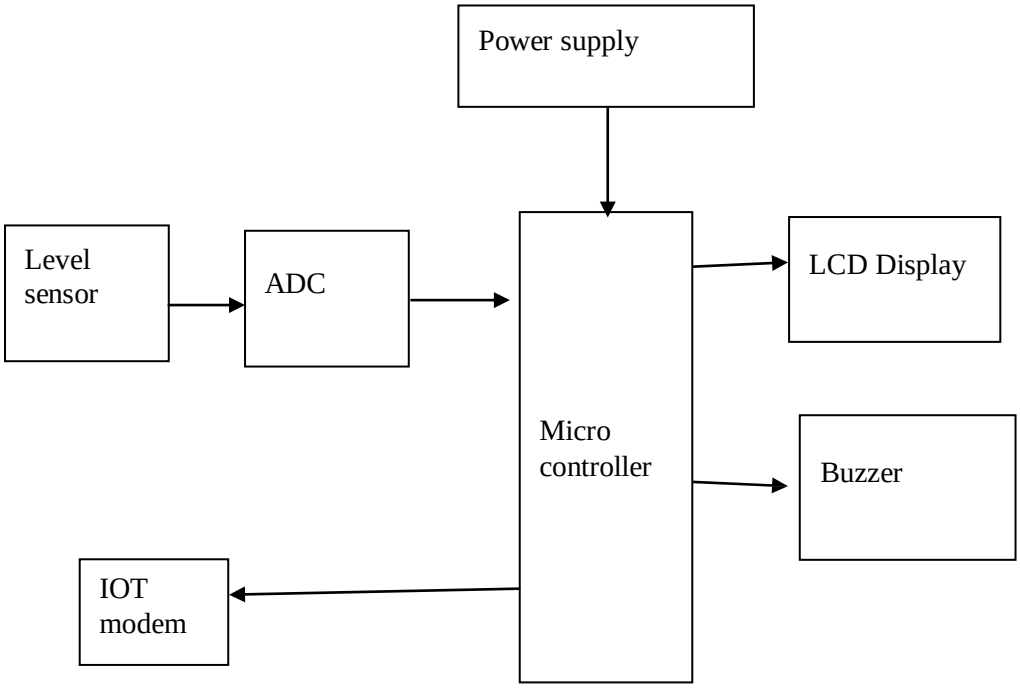
The embedded system module acquires information from the fuel vehicles, maintains record and sends messages to the monitoring agents through communication module. The GPS tracking module is used for the real time tracking of fuel tank.

4.3. BLOCK DIAGRAM



4.4 Advantages of proposed system

1. This project is easy to use.
2. This system is fully automated and it does not require any human attention.

CHAPTER-5

HARDWARE AND SOFTWARE SPECIFICATIONS

5.1 HARDWARE REQUIREMENT:

Micro Controller type	:8051 Microcontroller
Modem type	: GSM modem
Power supply	:220v
Display	: LCD
Converter	: ADC
Sensor type	: Liquid Level sensor

5.2 SOFTWARE REQUIREMENT

1.Embedded C

2.Keil C Compiler

5.3. HARDWARE DESCRIPTION:

5.3.1. MICROCONTROLLER 8051

The complete description regarding the interrupt structure of 8051 is given in chapter-5, 'INTERRUPTS' of this manual.

5.3.2. MEMORY ORGANISATION OF 8051

8051 has got separate address spaces for program and data memory.

5.3.3. PROGRAM MEMORY

A program memory is a block of memory which can be used to store a sequence of program codes. It can only be read from and not written into, under normal operating conditions.

There can be upto 62k bytes of program memory in 8051. in ROM and EPROM versions of these devices, if the special control signal EA* (External Access enable) to the appendix at the back of this manual for pin details is strapped to Vcc, then program fetches to addresses 000 to 0FFF are directed to the internal ROM. The program fetch will be from external memory, when EA* is grounded.

After reset, the CPU begins execution from address location 0000 of the program memory.

5.3.4. DATA MEMORY

Data memory is the Read/Write memory. Hence, it can be both read from and written into 8051 has got 128 bytes of internal data memory and 62k of external data memory.

5.3.5. INTERNAL DATA MEMORY

Internal data memory addresses are one byte wide which includes 128 bytes of on- chip RAM plus a number of special function registers. The 128 bytes of RAM can be accessed either by direct addressing or by indirect addressing.

The lowest 32 bytes (00-1F) of on-chip RAM are grouped into 2 banks of 8 register each. Program instructions call out these registers as RO through R7. bits 3 and 2 in register bank is in use. This allows more efficient use of code space, since register instructions are shorter than instructions that use direct addressing.

Reset initializes the stack pointer register to 7 and it is incremented once to start from location 08, which is register R0 of second register bank. Hence, in order to use more than one register bank, the stack pointer should be initialized to a different location of RAM where it is not used for data storage.

5.3.6. EXTERNAL DATA MEMORY

There can be upto 62k bytes of data memory external to the chip. External data memory addresses can be either 1 or 2 bytes wide depending on the addressing mode. The 'MOVX' instruction can be used to access the external data memory.External program and data memory may be combained, if desired, by enabling the external memory devices for both RD* and PSEN* cycles.

5.3.7. I/O STRUCTURE OF 8051

a) PARALLEL PORT

8051 has four 8-bit parallel ports. All four parallel ports are bi-directional. Each line consists of a latch, an output driver and an input buffer.

The four ports are named as port 0 (p0), port 1(p1), port 2(p2) and port 3 (p3a). they are bit addressable and has to be represented in the form PX, Y i.e. bit Y of port X while using bit addressing mode. PX.0 is the LSB (Least Significant Bit) of port X and PX.7 is the MSB (Most significant bit) of that port.

Out of the four ports, port 0 and port 2 are used in accesses to external memory. All the port 3 pins are multifunctional. They are not only port pins, but also serve the functions of various special features as listed in Table-1.

The alternate functions can only be activated if the corresponding bit latch in the port SFR (Special Function Register) contains a1. Otherwise, the port pin is stuck at 0. hence, only port 1 is available exclusively for the user. Port 3 pins can be used if their alternate functions are not used.

The output drivers of port 0 and port 2 and the input buffers of port 0 are used in accesses to external memory, port 0 outputs the low byte of the external memory address, time-multiplexed with the byte being written or read. Port 2 outputs the high byte of the external memory address when the address is 16-bits wide. Otherwise, port 2 pins continue to emit the p2 SFR content

.

Port pin	Alternate Function
P3.0	RxD (serial input port)
P3.1	TxD (Serial output port)
P3.2	$\overline{INT}$0 (External interrupt 0)
P3.3	INT1 (External interrupt 1)
P3.2	T0 (Timer/counter 0 external input)
P3.5	
P3.6	$\overline{T1}$ (Timer/counter 1 external input)
P3.7	WR (External data memory write strobe)
	$\overline{RD}$ (External data memory read strobe)

NOTE:

For the complete details of various registers mentioned in the following sections, please refer to the section "Registers of 8051" of this chapter.

b) TIMER/COUNTERS

8051 has two 126-bit timer/counters namely Timer / counter 0 and timer / counter 1. they can be configured in any of the four operating modes, which are selected by bit modes 0,1 and 2 are the same for both the timer/counters. Mode 3 is different.

MODE 0:

Either Timer in mode 0 is an 8-bit counter with a divide-by-32 prescaler. In this mode, the timer register is configured as a 13-bit register. As the count rolls over from all is to all 0s, it sets the timer interrupt flag TF1.

The 12-bit register consists of all 8 bits of TH1 and the lower 5 bits of TL1 and the lower 5 bits of TL1. the upper 3 bits of TL1 are indeterminate and should be ignored. Setting the run flag TR1 does not clear the registers.

MODE 1:

Mode 1 is the same as mode 0, except that the timer register is being run with all 16 bits.

MODE 2:

Mode 2 configures the Timer register as an 8-bit counter (TL1) with automatic reload. Overflow from TL1 not only sets TF1, but also reloads TL1 with the contents of TH1, which is preset by software. The reloads leave TH1 unchanged. Mode 2 operation is the same for timer 0 and 1.

MODE 3:

Timer 1 in mode 3 simply holds its count. The effect is the same as setting TR1 =0. Timer 0 in mode 3 establishes TL0 and TH0 as two separate counters.

c) SERIAL PORT:

The 8051 has a full Duplex Serial Port, meaning it can transmit and receive simultaneously received byte has been read from the receive register. The serial port receive and transmit registers are both accessed at special function register SBUF (Serial data Buffer). Writing to SUBF loads the transmit register. The serial port of 8051 can be employed in four modes, the details of which are presented below.

MODE 0:

Mode 0 has a fixed baud rate which is 1/12 of the crystal oscillator frequency. To run the serial port in this mode, one of the timer/counters need to be set up only the SCON register needs to be defined.

Serial data enters and exists through RxD (Receive data). Tx D (Transmit Data) outputs the shift clock. 8 bits are transmitted/received with LSB taking the leading position.

MODE 1:

10 bits are transmitted or received: a start bit(0), 8 data bits and a stop bit(1). On receive, the stop bit goes into RB8 in special function register SCON. The Baud rate is variable. The baud rate can be generated by timer 0 and timer 1.

MODE 2:

11 bits are transmitted (through TxD) or received (through RxD); a start bit (0), 8 data bits (LSB), a programmable 9th data bit and a stop bit (1). on transmit, the 9th data bit can be assigned the value of 0 or 1. or, for example, the parity bit goes into RB8 in the special function registers SCON, while the stop bit is ignored. The baud rate is programmable to either 1/32 or 1/62 of the crystal oscillator frequency.

MODE 3:

11 bits are transmitted (through TXD) or received (through RXD): a start bit (0) , 8data bits (LSB first) , a programmable 9th data bit and a stop bit (1). Infact , Mode 3 is the same as Mode 2 in all respect in all respects expect the baud rate . The baud rate in Mode 3 is variable.

NOTE:

Please refer to Chapter 2, for generating baud rates using the on chip timer of 8051 , to access the onchip serial port in various modes, under the heading 'Onchip features of 8051.

5.3.7.1. REGSISTERS OF 8051

The various special function registers available in the internal data memory 8051 are listed in Table –2. The table also indicated whether each one is only byte addressable or byte and bit addressable (marked with an asterisk *) and the addresses of those registers (i.e., On-chip RAM address.)

TABLE -1.

SYMBOL OF SFR	NAME OF THE SFR	ADDRESS
*ACC	ACCUMULATOR	E0
*B	B REGISTER	F0
*PSW	PROGRAM STATUS WORD	D0
SP	STACK POINTER	81
DPTR	DATA POINTER 2 YTES	

DPL	LOW BYTE	82
DPH	HIGH BYTE	83
*P0	PORT 0	80
*P1	PORT 1	90
*P2	PORT 2	A0
*P3	PORT 3	B0
*IP	INTERRUPT PRIORITY	B8
*IE	CONTROL	A8
TMOD	INTERRUPT ENABLE	89
*TCON	CONTROL	88
	TIMER/COUNTER MODE	
	CONTROL	
	TIMER/COUNTER CONTROL	

TABLE-2: Bit Addressable

SYMBOL	NAME	ADDRESS
TH0	TIMER/COUNTER 0 HIGH BYTE	8C
TL0	TIMER/COUNTER 0 LOW BYTE	8A
TH1	TIMER/COUNTER 1 HIGH BYTE	8D
TL1	TIMER/COUNTER 1 LOW BYTE	8B
*SCON	SERIAL CONTROL	98
SBUF	SERIAL DATA BUFFER	99
PCON	POWER CONTROL	87

5.3.7.2. ACCUMULATOR

ACC is the Accumulator register, The mnemonics for Accumulator-Specific instructions, however refer to the Accumulator as simply A. Accumulator is an important Register on which various special operations such as reading from or writing to an external memory , rotation , addition, subtraction, multiplication, division and various other operations can be done.

5.3.8. B REGISTER

Register B is used during multiply and drive operations. For other instructions, it can be treated as another scratch pad register.

PROGRAM STATUS WORD:

The PSW register contains several status bits that reflect the current state of the CPU. It contains the carry bit, the Auxillary carry bit, two register bank select bits, the over flow flag, the parity bit and two user-definable status flags. This register is bit addressable.

D7	D6	D5	D2	D3	D2	D1	D0
CY	AC	F0	RS1	RS0	OV	-	P

CY	PSW.7	Carry Flag
AC	PSW.6	Auxillary Carry Flag
F0	PSW.5	Flag 0 available to the user
RS1	PSW.2	Register bank selector BIT 1
RS0	PSW.3	Register bank selector BIT 0
OV	PSW.2	Over flow Flag
-	PSW.1	User definable Flag
P	PSW.0	Parity flag. Set/cleared by hardware after the execution of each instruction to indicate odd/evennumber of ‘1’ bits in the accumulator.

NOTE:

The value of RS0 and RS1 select the on chip register banks.

RS1	RS0	REGISTER BANK	ADDRESS
0	0	0	00 – 07
0	1	1	08 – 0F
1	0	2	10 – 17
1	1	3	18 – 1F

5.3.9. STACK POINTER

The stack pointer register is 8 bits wide. It is incremented before data is stored during the execution of PUSH and CALL instructions. While the stackmay reside anywhere in the on-chip RAM, the stack pointer is initialized to 07 after a RESET. This causes the stack to begin at location 08.

5.3.10. DATA POINTER

The data pointer (DPTR) consists of a high byte (DPH) and a low byte (DPL). Its intended function is to hold a 16-bit address for external memory access. It may be manipulated as a 16-bity register or as two independent 8-bit registers.

PORTS 0 TO 3:

Port 0, port 1, port 2 and port 3 are the SFR latches of ports 0, 1, 2 and 3 respectively.

5.3.11. SERIAL DATA BUFFER

The serial data buffer is actually two separate registers, a transmit buffer and a receive buffer register when data is written to SUBF, it goes to the transmit buffer where itis held for serial transmission. When data is read from SBUF, it comes from the receive buffer.

5.3.12. TIMER REGISTERS

Register pairs (TH0, TL0), (TH1, TL1) are the 16-bit counting registers for Timer/counters 0 and 1 respectively.

5.3.13. CONTROL REGISTERS

Special function registers IP, IE, TMOD, TCON, SCON and PCON contain control and status bits for the interrupt system, the Timer/counters and the serial port.

5.3.14. PCON: POWER CONTROL REGISTER

Bit 7 of PCON register is used to control the baud clock generated from the timer. In the case of 80C51BH, PCON register can be used to select the power down mode and Idle mode of operation. Please refer to the Intel data sheets of 80C51BH for the complete details of the above said modes. This register is not bit addressable.

D7	D6	D5	D2	D3	D2	D1	D0
Smod	-	-	-	GF1	GF0	PD	IDL

SMO - Double baud rate bit. If timer 1 is used to generate baud rate and SMOD = 1, the baud rate is doubled when the serial port is used in modes 1, 2 or Bits 2,5,6 - Not implemented, reserved for future use. User software should not write is to reserved bits. GF1, GF0 - User definable, general purpose flag bits.

PD - Power down bit. Setting this bit activates power down operation in the 80C51BH. In rest of the microcontrollers, PD and IDL bits does not serve any purpose.

IDL - Idle mode bit. Setting this bit activates Idle mode operation of 80C51BH.If is are written to PD and IDL at the same time, PD takes precedence.

5.3.15. IE: INTERRUPT ENABLE REGISTER

IE register, with its bit addressing capability, is used to enable/disable all or any of the interrupts of 8051. if the bit is 0, the corresponding interrupt is disabled. If the bit is 1, the corresponding interrupt is enabled.

D7	D6	D5	D2	D3	D2	D1	D0
EA	-	ET2	ES	ET1	EX1	ET0	EX0

EA IE.7 - Diables all interrupts. If EA = 0, no interrupt will be acknowledged. If EA = 1, each interrupt source is individually enabled or disabled by setting or clearing its enable bit.

IE.6 - Not implemented, reserved for future use.

ET2 IE.5 - Enable or disable the timer 2 overflow interrupt.

ES IE.2 - Enable or disable the serial port interrupt

ET1 IE.3 - Enable or disable the timer 1 overflow interrupt.

EX1 IE.2 - Enable or disable the external interrupt 1.

ET0 IE.1 - Enable or disable the timer 0 overflow interrupt.

EX0 IE.0 - Enable or disable the external interrupt 0.

5.3.16. IP: INTERRUPT PRIORITY REGISTER

IP register is used to assign the priority for the interrupts of 8051. if the bit is 0, the corresponding interrupt has a lower priority and if the bit is 1, the corresponding interrupt has a higher priority. Bit addressing is allowed with this register also.

D7	D6	D5	D2	D3	D2	D1	D0
-	-	PT2	PS	PT1	PX1	PT0	PX0

IP.7, IP.6 - Not implemented, reserved for future use.

PT2 IP.5 - Defines the timer 2 interrupt priority

PS IP.2 - Defines the Serial port interrupt priority

PT1 IP.3 - Defines the Timer 1 interrupt 1 priority

PX1 IP.2 - Defines External interrupt 1 priority

PT0 IP.1 - Defines the Timer 0 interrupt priority

PX0 IP.0 - Defines External Interrupt 0 priority.

5.3.17 TCON: TIMER/COUNTER CONTROL REGISTER

TCON register is used to control the entire operation of the timer/counters of 8051. This register can also be bit addressed.

D7	D6	D5	D2	D3	D2	D1	D0
TF1	TR1	TF0	TR0	IE1	IT1	IE0	IT0

TF1 TCON.7 - Timer 1 overflow flag. Set by hardware when the Timer/Counter 1 over flows. Cleared by hardware as the processor vectors to the interrupt service routine.

TR1 TCON.6 - Timer 1 run control bit. Set/cleared by software to turn Timer/Counter 1 ON/OFF.

TF0 TCON.5 - Timer 0 overflow flag. Set by hardware when the Timer/counter 0 overflows. Cleared by hardware as the processor vectors to the service routine.

TR0 TCON.2 - Timer 0 run control bit. Set/cleared by software to turn Timer/counter 0 ON/OFF.

IE1 TCON.3 - External interrupt 1 edge flag. Set by hardware when external interrupt edge is detected. Cleared by hardware when interrupt is processed.

IT1 TCON.2 - Interrupt 1 type control bit. Set/cleared by software to specify falling edge/low level triggered external interrupt.

IE0 TCON.1 - External Interrupt 0 edge flag. Set by hardware when external interrupt edge detected. Cleared by hardware when interrupt is processed.

IT0 TCON.0 - Interrupt 0 type control bit. Set/cleared by software to specify falling edge/low level triggered external interrupt.

TMOD: TIMER/COUNTER MODE CONTROL REGISTER. NOT BIT ADDRESSABLE:

TMOD register is used to specify the mode of operation of Timers / counters of 8051.

D7	D6	D5	D2	D3	D2	D1	D0
GATE	C/T*	M1	M0	GATE	C/T*	M1	M0
TIMER 1				TIMER 0			

GATE - When TRx is set and GATE =1, TIMER/COUNTERx will runonlywhile INTx pin is high. When GATE =0, TIMER/COUNTERx will run only while TRx = 1

C/T* - Timer or counter selector, cleared for timer operation. Set for counter operation.

M1,M0 - Mode selector bit.

5.3.18. SCON: SERIAL PORT CONTROL REGISTER. BIT ADDRESSABLE

SCON register is used to specify the mode in which the serial port is to work. TI (Transmit interrupt) / RI (Receiver Interrupt) flag(s) of SCON register can be used to check whether the transmission/reception is over.

D7	D6	D5	D2	D3	D2	D1	D0
SM0	SM1	SM2	REN	TB8	RB8	TI	RI

SM0, SM1 SCON.7, SCON.6 - Serial port mode specifier.

SM2 SCON.5- Enables the multiprocessor communication feature in modes 2 &3. in mode 2 or 3, if SM2 is set to 1, then RI will not be activated if the received 9th data bit (RB8) is0. in mode 1, if SM2 = 1, then RI will not be activated if a valid stop bit was not received. In mode 0, SM2 should be 0.

REN SCON.2 - Set/cleared by software to enable/disable reception of serial data.

TB8 SCON.3 - The 9th bit that will be transmitted in modes 2 &3. set/cleared by software.

RB8 SCON.2 - In moed 2 & 3, is the 9th data bit that was received. In mode 1, if SM2 =0, RB8 is the stop bit that was received. In mode 0, or at the beginning of the stop bit in the other modes. Must be cleared by software.

TI SCON.1 - Transmit interrupt flag. Set by hardware at the end of the 8th bit time in mode 0, or at the beginning of the stop bit in the other modes. Must be cleared by software.

RI SCON.0 - Receive interrupt flag. Set by hardware at the end of the 8th bit time in mode 0, or halfway through the stop bit time in the other modes. Must be cleared by software.

5.3.19. ADDRESSABLE MODES

The 8051 instruction operate on data stored in internal CPU registers, external memory or on the I/O ports. There are a number of methods in which these registers, memory and I/O ports can be addressed, called addressing modes. This section giuves a brief summary of the various types of addressing modes available in 8051. these modes are:

- Immediate
- Direct
- Indirect
- Register
- Register specific
- Indexed

5.3.20. MEDIATE ADDRESSIN

In this mode, the data to be operated upon is in the location immediately followingthe opcode. For example, the instruction,

MOV A,#21

Loads the A ccumulator with the hex value 21.“#” Signifies IMMEDIATE ADDRESSING.

5.3.21. DIRECT ADDRESSING

In direct addressing, the operand is specified by an 8-bit address field in the instruction. Only internal data RAM and SFRs can be directly addressed. For example, the instruction, INC20 Increments the contents of the on-chip data RAM address 20 by one.

5.3.22. INDIRECT ADDRESSING

In indirect addressing, the instruction specifes a register which contains the address of the operand. Both internal and external RAM can be indirectly addressed.

The address register for 8-bit addresses can be R0 or R1 of the selected register bank or the stack pointer. The address register for 16-bit addresses can only be the 16-bit “data pointer” register, DPTR. For example, the instruction,

MOVX @DPTR,A

Writes the contents of the accumulator to the addres held by the DPTR register.

5.3.23. REGISTER ADDRESSING

The register banks, containing registers R0 through R7, can be accessed by certain instruction which carry a 3-bit register specification within the opcode of the instruction. Instructions that access the registers this way are code efficient, since this mode eliminates an addres byte.

When the instruction is executed, one of the eight registers in the selected bank is accessed. One of the four banks is selected at the execution time by the two bank select bits in the PSW. For example, the instruction,MOV A,R0Copies the contents of the register R0 to the accumulator.

5.3.24. REGISTER-SPECIFIC INSTRUCTIONS

Some instructions are specific to a certain register. Stating in other words, the opcode itself contains the implied operand or the operand destination. For example, some instruction always operate on the accumulator or data pointer, etc., so no address byte is needed to point to it. The opcode itself does that needed to point to it. The opcode itself does that instructions that refer to the accumulator as a assemble as accumulator-specific opcodes. Such instructions are one byte long. The instruction RR AIs such an instruction which operates only on the accumulator. This instruction when executed, rotates the contents of accumulator one bit towards right.

5.3.25. INDEDDRESSING

Only program memory can be accessed with indexed addressing and it can only be read. This addressing mode is intended for reading look-up tables in program memory. A

16-bit base register points to the base of the table and the accumulator is set up with the table entry number. The address of the table entry in program meory is formed by adding

the accumulator data to the base pointer. The instruction, MOV A,@A+DPTR Reads the contents of program memory, whose address is obtained by adding the contents of DPTR and accumulator and copies it to the accumulator.

Another type of indexed addressing is used in the "case jump" instruction. In this case, the destination address of a jump instruction is computed as the sum of the contents of base pointer and accumulator.

5.3.26. I/O ADDRESSES OF PERIPHERALS IN MICRO-51 AND MP-I (8051)

This manual is formulated as a user manual common for both Micro-51 and Micro power-I based 8031/8051 piggyback boards. Since almost all the features are common for both the kits, the worked out examples given in chapters 2, 3 and 2 will work in both the kits. But, the peripherals addresses will differ.

Having this in mind, the addresses of all the peripherals provided in both the kits are tabulated in table-3 and are given a general name. In the worked out examples, only these general names are mentioned. The user has to substitute the correct address depending on the kit in which the user is working.

TABLE –3: SOFTWARE EXAMPLES

NAME OF THE PERIPHERAL	ADDRESS IN Micropower-i	ADDRESS IN Micro-51	GENERAL NAME
8279 DATA PORT	A000	E000	DSP_DAT
8279 CONTROL PORT	A001	E001	DSP_CNT
8253 CHANNEL 0	A002	E008	TMR_CH0
8253 CHANNEL 1	A005	E009	TMR_CH1
8253 CHANNEL 2	A006	E00A	TMR_CH2
8253 CONTROL	A007	E00B	TMR_CNT
8251 DATA PORT	A008	E002	SER_DAT
8251 CONTROL PORT	A009	E005	SER_CNT
8255-1 PORT A	A00C	E00C	APORT_1
8255-1 PORT B	A00D	E00D	BPORT_1
8255-1 PORT C	A00E	E00E	CPORT_1
8255-1 CONTROL	A00F	E00F	CNT_1

8255-2 PORT A	A010	E010	APORT_2
8255-2 PORT B	A011	E011	BPORT_2
8255-2 PORT C	A012	E012	CPORT_2
8255-2 CONTROL	A013	E013	CNT_2
8255-3 PORT A	-	E012	APORT_3
8255-2 PORT B	-	E015	BPORT_3
8255-2 PORT C	-	E016	CPORT_3
8255-2 CONTROL	-	E017	CNT_3
TAPE WIRTE	A012	E01C	TPE_WR
8259 ICW1	A018	-	ICW1
8259 ICW2	A018	-	ICW2
8259 ICW3	A019	-	ICW3
8259 ICW2	A019	-	ICW2
			OCW1
8259 OCW1	A019	-	OCW2
8259 OCW2	A018	-	OCW3
8259 OCW3	A018	-	COM2_DAT
8251_2 DATA	A01C	-	COM2_CNT
8251_2 CONTROL	A01D	-	
DAC DATA	A020	-	DAC -DAT
ADC DATA	A022	-	ADC - DAT
ADC SOC	A028	-	ADC_SOC
PRINTER STATUS &ADC EOC	A02C	E022	PRN_STA ADC_EOC
PRINTER CONTROL	A032	E020	PRN_CNT
PRINTER DATA	A032	E028	PRN_DAT
ADC CHANNEL SELECT	A038	-	ADC_CHS
TAPE READ	A03C	E022	TPE_RD
EPROM PROG	-	E018	**EPISEL**

5.4. 16x 2 LCD MODULES

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 is 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 polarizer is 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, theliquid 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.

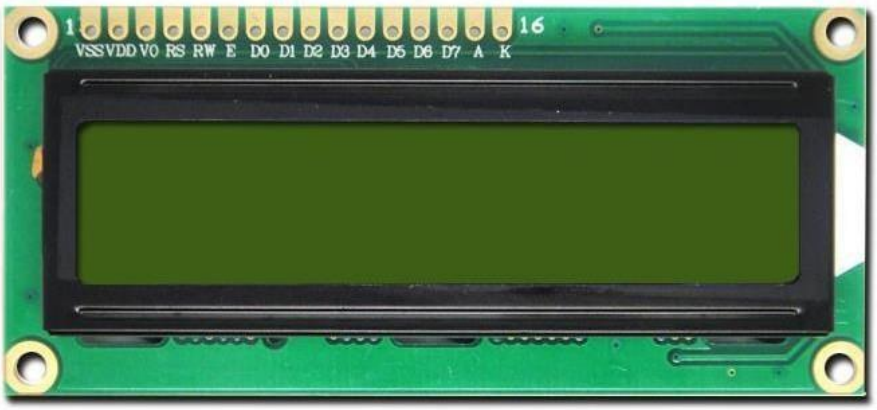


Figure: 3.2. 16x 2 LCD MODULES

The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The data register stores the data to be displayed on the LCD. The data is the ASCII value of the character to be displayed on the LCD. Click to learn more about internal structure of a LCD.

DESCRIPTION:

This is the first interfacing example for the Parallel Port. We will start with something simple. This example doesn't use the Bi-directional feature found on newer ports, thus it should work with most, if not all Parallel Ports. It however doesn't show the use of the Status Port as an input. So, what are we interfacing? A 16 Character x 2 Line LCD Module to the Parallel Port. These LCD Modules are very common these days, and are quite simple to work with, as all the logic required to run them is on board.

LCD’s also are used as numerical indicators, especially in digital watches where their much smaller current needs than LED displays (microamperes compared with mill amperes) prolong battery life. Liquid crystals are organic (carbon) compounds, which exhibit both

solid and liquid properties. A ‘cell’ with transparent metallic conductors, called electrodes, on opposite daces, containing a liquid crystal, and on which light falls, goes ‘dark’ when a voltage is applied across the electrodes. The effect is due to molecular rearrangement within the liquid crystal.

The LCD display used in this project consists of 2 rows. Each row consists of maximum 16 characters. So, using this display only maximum of 32 characters can be displayed.

FEATURES

1)Wide viewing angle and high contrast.

2)57 dot character matrix with cursor.

3) Interfaces with 4-bit or 8-bit MPUs.

4) Displays up to 226 characters and special symbols.

5) Custom character patterns are displayed with the character RAM.

6) Abundant instruction set including clear display, cursor on/off, and character blinking.

7)Compact and light weight for easy assembly to the host instrument.

8)Operable on single 5 V power supply.

9)Low power consumption.

5.5.POWER SUPPLY

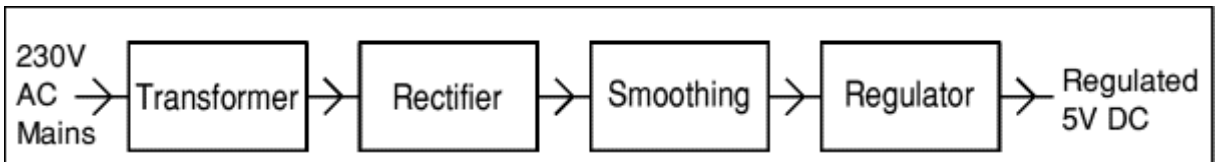
We are using linear regulated power supply having 5V output which will be useful for driving the other components in the circuit like microcontroller.

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

Types of 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 electronics 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:



Block Diagram of a Regulated Power Supply System

Each of the blocks is described in more detail below:

- **Transformer** - steps down high voltage AC mains to low voltage AC.
- **Rectifier** - converts AC to DC, but the DC output is varying.
- **Smoothing** - smooths the DC from varying greatly to a small ripple.
- **Regulator** - eliminates ripple by setting DC output to a fixed voltage.

5.6.SOFTWARE DESCRIPTION

5.6.1. EMBEDDED SYSTEM

5.6.1.1 DEFINITION

An embedded system is a system that has embedded software and computer-hardware which makes it a system dedicated for an application(s) or specific part of application or product or a part of a larger system.

5.6.1.2 COMPONENTS

An embedded system is a system that has three main components embedded into it

- It embeds hardware similar to a computer.
- It embeds main application software.
- It embeds a real-time operating system (RTOS).

Embedded systems are controllers with on chip control. They consist of microcontrollers, input and output devices, memories etc., on chip and they can be used for a specific application.

A small computer designed in a single chip is called a single chip microcomputer. A single chip microcomputer typically includes a microprocessor RAM, ROM, timer, interrupt and peripheral controller in a single chip. This single chip microcomputer is also called as microcontroller; These Microcontrollers are used for variety of applications where it replaces the computer. The usage of this microcomputer for a specific application, in which the microcontrollers as a part of application, is called embedded systems.

Embedded systems are used for real time applications with high reliability, accuracy and precision, embedded systems are operated with Real Time Operating systems like WinCE, RT Linux, VxWorks, PSOS, etc.

Nowadays, embedded systems are very popular. Most of the Electrical, Electronics, Mechanical, Chemical, Industrial, Medical, Space and many more areas have the embedded systems in their applications.

5.6.1.3 CLASSIFICATIONS

We can classify embedded systems into three types

- **Small scale embedded systems:** These systems are designed with a single 8-bit or 16-bit microcontroller; they have little hardware and software complexities and involve board-level design. They may even be battery operated.
- **Medium scale embedded systems:** These systems are usually designed with a single or a few 16-bit or 32-bit microcontrollers, DSPs or RISCs. Medium scale embedded systems has both hardware and software complexities.

- **Sophisticated embedded systems:** These systems have enormous hardware and software complexities and may need several IPs, ASIPs, scalable processors or configurable processors and programmable logic arrays.

5.6.1.4 CHARACTERISTICS

An embedded system is characterized by the following

- Real-time and multirate operations define the ways in which the, system works, reacts to events, and interrupts and schedules the system's functioning in real time.
- Complex algorithm.
- Complex graphic user interfaces (GUIs) and other user interfaces.

5.6.1.5 CONSTRAINTS

An embedded system is designed keeping in view three constraints

- Available system memory.
- Available processor speed.
- The need to limit power dissipation when running the system continuously in cycles of 'wait for events', 'run', 'stop', 'wake up' and 'sleep'.

5.6.1.6. ROLE OF EMBEDDED SYSTEMS

Embedded systems are compact, smart, efficient, and economical and user friendly. They respond to the real world situation very fast and also they are closed systems. Closed system means, everything required or specific application is embedded on the chip and hence, they do not call for external requirement for their functioning.

5.6.1.7 APPLICATIONS OF EMBEDDED SYSTEMS

- Robotics
- Aviation
- Telecommunication and Broadcasting
- Mobile Phones and mobiles networking
- Satellite Communication
- Blue Tooth
- Electronic sensors
- Home Appliances etc.

5.6.2 KEIL C

INTRODUCTION OF KEIL C

The C programming language is a general-purpose, programming language that provides code efficiency, elements of structured programming, and a rich set of operators. C is not a big language and is not designed for any one particular area of application. Its generality combined with its absence of restrictions, makes C a convenient and effective programming solution for a wide variety of software tasks. Many applications can be solved more easily and efficiently with C than with other more specialized languages. The Cx51 Optimizing C Compiler is a complete implementation of the American National Standards Institute (ANSI) standard for the C language. Cx51 is not a universal C compiler adapted for the 8051 target. It is a ground-up implementation dedicated to generating extremely fast and compact code for the 8051 microprocessor. Cx51 provides you the flexibility of programming in C and the code efficiency and speed of assembly language. The C languageon its own is not capable of performing operations (such as input and output) that would normally require intervention from the operating system. Instead, these capabilities are provided as part of the standard library. Because these functions are separate from the language itself, C is especially suited for producing code that is portable across a wide number of platforms. Since Cx51 is a cross compiler, some aspects of programming language and standard libraries are altered or enhanced to address the peculiarities of an embedded target processor.

5.6.3. INTERFACING C PROGRAMS TO ASSEMBLER

We can easily interface Cx51 to routines written in 8051 Assembler. The A51 Assembler is an 8051 macro assembler that emits object modules in OMF-51 format. By observing a few programming rules, we can call assembly routines from C and vice versa. Public variables declared in the assembly module are available to your C programs. There are several reasons why we might want to call an assembly routine from your C program. We may have assembly code already written that you wish to use, we may need to improve the speed of a particular function, or we may want to manipulate SFRs or memory-mapped I/O devices directly from assembly.

This section describes how to write assembly routines that can be directly interfaced to C programs. For an assembly routine to be called from C, it must be aware of the parameter passing and return value conventions used in C functions. For all practical purposes, it must appear to be a C function.

5.6.3.1 FUNCTIONS OF Cx51 COMPILER

- Direct Cx51 to generate a listing file
- Control the information included in the object file Specify code optimization and memory models

5.6.3.2 DIFFERENCES FROM ANSI C

1. WIDE CHARACTERS

Wide 16-bit characters are not supported by Cx51. ANSI provides wide characters for future support of an international character set.

2. RECURSIVE FUNCTION CALLS

Recursive function calls are not supported by default. Functions that are recursive must be declared using the reentrant function attribute. Reentrant functions can be called recursively because the local data and parameters are stored in a reentrant stack. In comparison, functions which are not declared using the reentrant attribute use static memory segments for the local data of the function. A recursive call to these functions overwrites the

local data of the prior function call instance.

5.6.3.3 USE OF KEIL C

KEIL C software is used for microcontroller programming. C is efficient when compared to assembly language because

- Minimizes the lines of code - In assembly language, program which takes 100 lines will take 10 lines in Keil C

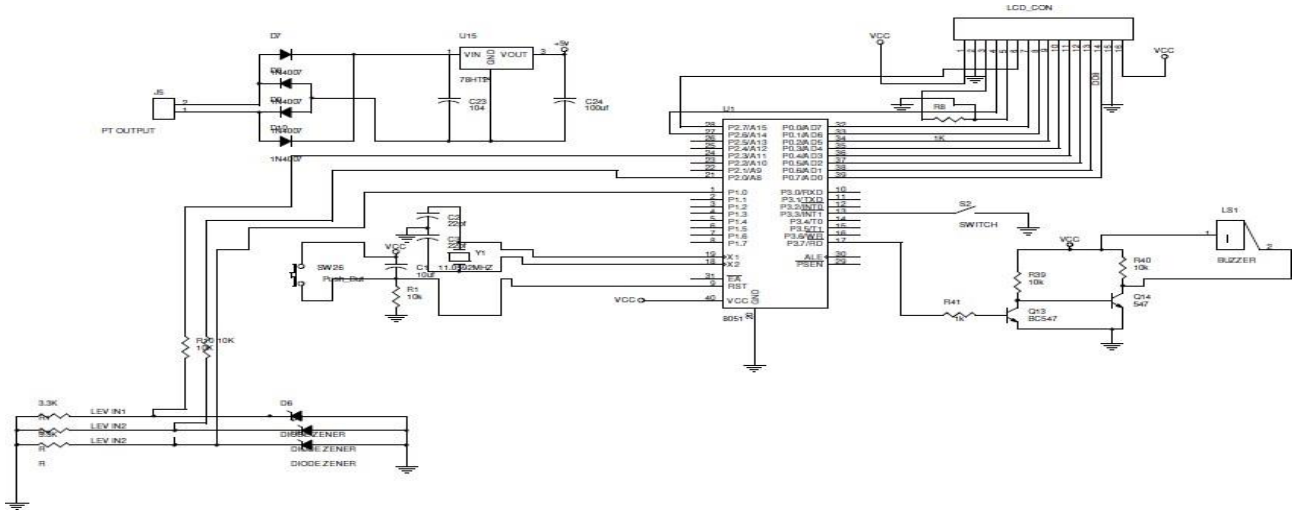
Easy to code and debug - C is easy to learn so it easy to code and since no of lines is less it will reduce complexity in debugging Compatible with any microcontrollers - Just changing the header files we can make the program to work for different microcontrollers e.g. PIC.

For programming the Microcontroller we use KEIL C programming. The Microcontroller is programmed for serial communication by enabling Timer 1 and also the coding is written so as to collect the digital data from the Analog to digital convertor. A keil cross compiler is a software, which compiles a source code of one environment as an object file to be executed in different environment. It is broadly classified into development and simulation. The simulation is handled by D Scope.

5.6.3.4 APPLICATION

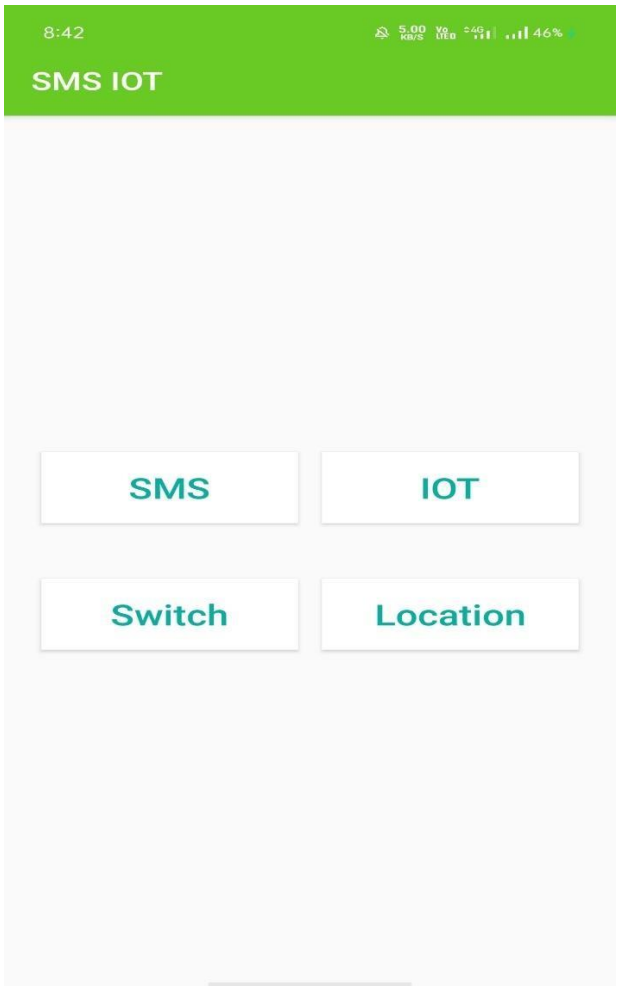
- Car
- Bike
- Bus

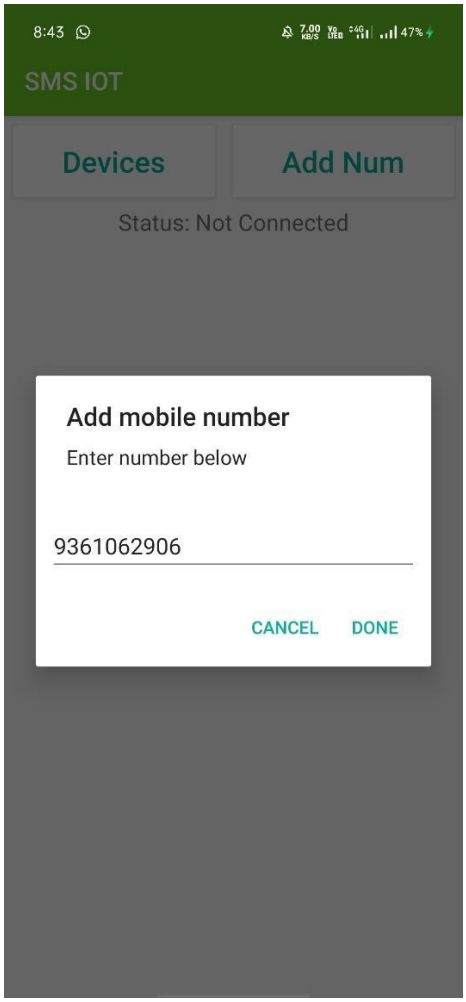
5.6.3.5 CIRCUIT DIAGRAM :

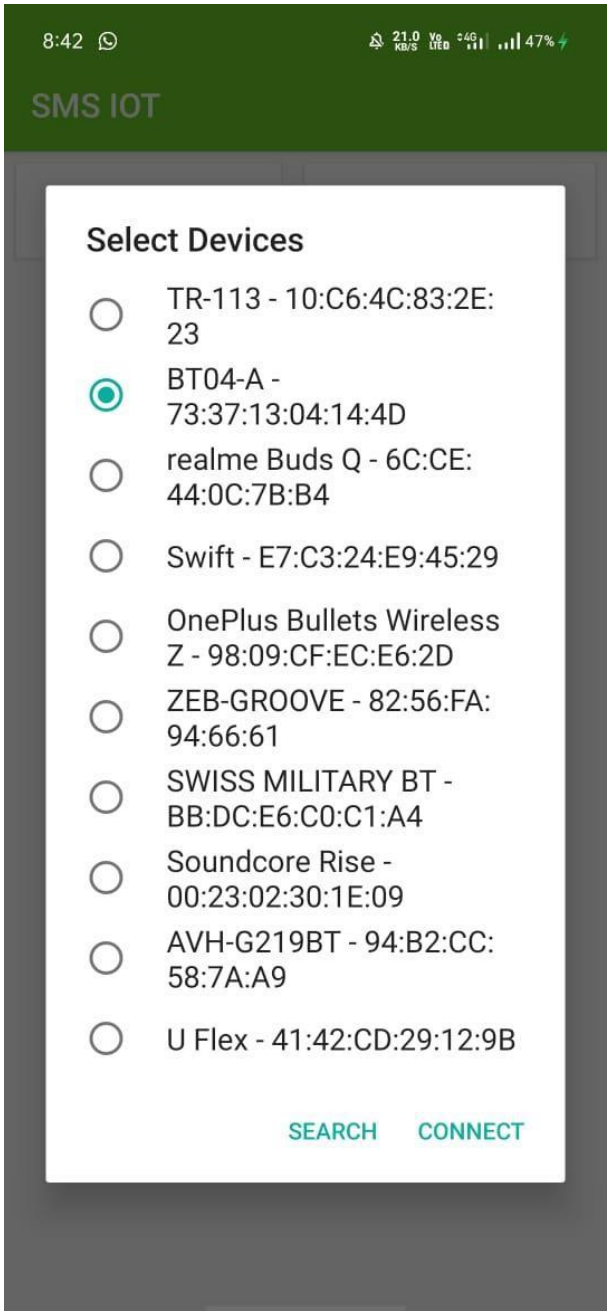


CHAPTER-6
RESULT ANALYSIS

The user can access the quantity of fuel in the tank through this GSM and GPS technology. The keypad is unlocked using the secret password. A signal is sent for fuel verification. If fuel is beyond the range of the sensor the buzzer will go “on” for two minutes and simultaneously a text message is sent to the owner. The intruder can’t stop the buzzer and if the buzzer is not stopped within two minutes then it will be treated as a theft of fuel and vehicle and a message is sent to the police station and to previously stored numbers with co-ordinates of that location.







Real time tracking and fuel monitoring using IoT android application is successfully implemented using R-Pi and gathered information are uploaded into adafruit IO cloud platform. illustrates the dashboard view Adafruit IO feeds of various sensor.information received from R-Pi in real time. In feed menu it shows the different types of feeds connection group, their keys, last values if GPS sensor use the system is normal or any accident detectionfind in this column and recorded column the system last active.

CHAPTER-7
CONCLUSION AND FUTURE ENHANCEMENT

7.1.CONCLUSION:

The proposed system will help us to fuel theft and unauthorized access of the vehicle to solve problem. Our system will periodically inform and vehicle access information on the fuel level. Hence the larceners results rather than the fuel or to the vehicle theft by chance in the situation and provide the overall protection. The messages are provided to the owner in relation to the fuel level in the vehicle in periodic manner. The proposed rule also avoids the other way to fuel theft of fuel tank fault detection system. The numeric lock system is to open authentication for the fuel in the vehicle fuel tank. Finally the system at any time. The wireless technology will enable the vehicle owner, the vehicle with the mobile phone of monitor anywhere, anytime.

7.2.FUTURE ENHANCEMENT:

As the fuel monitoring system is applicable for single vehicle if the owner is having multiple vehicles like a travels company with many vehicles mobile won't be sufficient to track .So many vehicles so this can be extended to tracking system where all the vehicles fuel data can be directed to a database were each vehicle can be tracked easily by the owner.

CHAPTER-8.
8.APPENDIX

8.1. SAMPLE CODING

```
#include <AT89X52.H>
void serial_line_trans(unsigned char *dat);
void delay(unsigned long);
void IO_init(void);
void read_id(void);
void serial_init(void);
void serial_trans(unsigned char dat);
unsigned char serial_recev(void);
unsigned char id1,id2,id3,id4,id5,id6,id7,id8,id9,id10,id11,id12,id13,i,j;
sbit spd_nrl = P1^2;
sbit LEV1 = P1^0;
sbit LEV2 = P1^1;
sbit LEV3 = P1^2;
sbit BUZZ = P1^4;
sbit SW = P1^5;
#define BEEP  BUZZ=0;delay(5000);BUZZ=1;
//#define IN1 P3_6
sbit IN1        = 0x90;
sbit RS=0xb7;
sbit EN=0xb6;
sfr lcd_dat=0xa0;
void lcd_data(unsigned char);
void lcd_command(unsigned char);
void lcd_line(unsigned char*,unsigned char);
void lcd_init(void);
```

```
void delay(unsigned long);
unsigned char change=0,cntrl=0,y=0;
void main(void)
{
        P0=P2=0x00;
                P1=0XFF;    BUZZ=0;
//              mot=0;

        lcd_init();
        lcd_line("FUEL THEFT        ",0x80);
        lcd_line("DETECTION SYM       ",0xC0);
        delay(10000);
        P1=0xFF;
        serial_init();
        while(1)
        {
  if(LEV3==0)
{
    //  MOT=0;
  //  OUT1=OUT2=OUT3=0;
        lcd_line("   LEVEL THREE      ",0x80);
 //     lcd_line("   MOTOR OFF       ",0xC0);
        if(SW==0)
        {
          lcd_line("FUEL THEFT FOUND        ",0xC0); BUZZ=1;
          serial_line_trans("LEVEL THREE FUEL THEFT FOUND");
serial_trans('#');delay(10000);
    }
        else
```

```
        {
          lcd_line("                    ",0xC0);          BUZZ=0;
          }

}
else if(LEV2==0)
{
       // OUT1=0; OUT2=0;OUT3=0;
        lcd_line("   LEVEL TWO     ",0x80);
        //lcd_line("   MOTOR ON         ",0xC0);
        if(SW==0)
        {
          lcd_line("FUEL THEFT FOUND         ",0xC0); BUZZ=1;
          serial_line_trans("LEVEL Two FUEL THEFT FOUND");
serial_trans('#');delay(10000);
    }
        else
        {
          lcd_line("                    ",0xC0);          BUZZ=0;
          }
}
else if(LEV1==0)
{
        lcd_line("   LEVEL ONE     ",0x80);
 //     lcd_line("   MOTOR ON         ",0xC0);
        if(SW==0)
        {

          lcd_line("FUEL THEFT FOUND         ",0xC0); BUZZ=1;
```

```
                    serial_line_trans("LEVEL one FUEL THEFT FOUND");
serial_trans('#');delay(10000);
    }
        else
        {
          lcd_line("                    ",0xC0);          BUZZ=0;
          }
}
else
{
// MOT=1;
      lcd_line("   LEVEL EMPTY      ",0x80);
 //       lcd_line("   MOTOR ON         ",0xC0);

        if(SW==0)
        {
          lcd_line("FUEL THEFT FOUND         ",0xC0); BUZZ=1;
           serial_line_trans(" LEVEL EMPTY FUEL THEFT FOUND");
serial_trans('#');delay(10000);
    }
        else
        {
          lcd_line("                    ",0xC0);          BUZZ=0;
          }
}
        }
}
```

```
void lcd_init(void)//LCD Module Inilization
{
	lcd_command(0x38);
	delay(1000);
	lcd_command(0x38);
	delay(1000);
	lcd_command(0x38);
	delay(1000);
	lcd_command(0x38);
	delay(1000);
	lcd_command(0x06);
	delay(1000);
	lcd_command(0x0c);
	delay(1000);
	lcd_command(0x01);
}
void lcd_command(unsigned char addr)// LCD Command
{
	lcd_dat=addr;
	RS=0;
	EN=1;
	delay(300);
	EN=0;
	delay(1000);
}

void lcd_data(unsigned char dat)// LCD Data
{
	lcd_dat=dat;
```

```
        RS=1;
        EN=1;
        delay(200);
        EN=0;
        delay(200);
}
void lcd_line(unsigned char *disp,unsigned char addr)// LCD Line Display
{
        lcd_command(addr);
        while(*disp)
        {
        lcd_data(*disp);
        disp++;
        }
}
void delay(unsigned long count)// Delay
{
        while(count--);
}
void serial_init(void)
{
        TMOD=0x20;
        SCON=0x40;
        TH1=0xFD;
        TR1=1;
}
void serial_trans(unsigned char dat)
{
        SCON=0x40;
```

```
        TR1=1;
        SBUF=dat;
        while(TI==0);
        TI=0;
}
void serial_line_trans(unsigned char const*line_dat)
{
        while(*line_dat)
        {
                serial_trans(*line_dat);
                line_dat++;
        }
}
```

CHAPTER-9

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