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E-Dustbin and Its Mobile App

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Abstract

When everything around the world is shifting itself to technology, then why not the dustbin? Dustbin is an essential part of the cleanliness mission and thus need to be looked after well. The present methodology being followed for waste collection has many flaws in it so an immediate step has to be taken before it breaks down the whole system. Adding a bit of smartness to our dustbins will solve most of our problems and the smart-bin has a lot of advantages. The product which is designed to make every dustbin smart is very handy.

We have observed that the municipal officer or the government authorized person will monitor the status of dustbins. Or generally we see that they have a regular schedule of picking up these garbage bins. It can be once in a two days or once in a week .However we see that in case there is some festival or some function lots of garbage material is generated by people in that particular area. In such cases garbage dustbins gats immediately and then it overflows which creates many problems. Many animals like dog or goat enters inside or the dustbins. This creates a bad scene.

Introduction

The sluggish clearance of garbage is leading to potentially hazardous health situations at several places in the cities. Also it creates ugliness to that place. At the same time bad smell is also spread.

Figure1.1.Typical dustbins

To avoid all such situation we are going to implement a project called ‘E-Dustbin’. Here we have figured out a new model for the municipal dustbins which intimates the centre of municipality for immediate cleaning of dustbin. In this project we are going to place transreceiver under the dustbins. When weight reaches a particular level, sms will send to the respective municipality authority person. Then that person sends a vehicle to collect the full garbage dustbins.

Necessity

Due to rapid population growth, disorganization of city governments, a lack of public awareness and limited funding for programs waste management is become a global problem. The Central Public Health and Environmental Engineering Organization (CPHEEO) has estimated that waste generation in India is as much as 1.3 pounds per person per day. This figure is relatively low, compared to the 4.6 pounds of waste generated per person per day in the United State (U.S.).

In past few decades there is a rapid growth in the rate of urbanization and thus there is a need of sustainable urban development plans. Now using new age technology and strategic approach, the concept of smart cities is coming up all around the world. A smart city is incomplete without a smart waste management system. The network of sensors enabled smart bins connected through the cellular network generates a large amount of data, which is further analyzed and visualized at real time to gain insights about the status of waste around the city. This aims at encouraging further research in the topic of waste management.

Objective and Scope

With increase in population, the scenario of cleanliness with respect to garbage management is degrading tremendously. The overflow of garbage in public areas creates the unhygienic condition in the nearby surrounding. It may provoke several serious diseases amongst the nearby people. It also degrades the valuation of the area.

A model of ‘E-Dustbin’ is designed which indicates directly that the dustbin is filled to a certain level by the garbage and cleaning or emptying them is a matter of immediate concern. This prevents lumping of garbage in the roadside dustbin which ends up giving foul smell and illness to people.

Need of Project

The customer needs are the following:

- Reduced a Man Power
- Easy to Maintain System
- Help for Updation
- Time and Power Saving

Bad waste management can easily result in air pollution and soil contamination. They have an adverse effect on human health. It is learnt from the primary survey done in Guwahati, a city in Assam that garbage accumulation causes 41% of the air pollution .They cause air pollution which generally leads to various respiratory problems like COPD, asthma etc. Breeding of mosquitoes and houseflies occur mainly in garbage which are a major cause for various diseases like malaria, dengue, chikungunya etc. This also causes headache, nauseous sensation and increase in the stress level. A city with poor sanitation and smelly environment can never be a healthy place to live in. There are about 235 million people currently suffering from asthma for which foul smelling of garbage is also a vital reason. Almost 90% of chronic obstructive pulmonary disease (COPD) occur in low and middle income countries which is caused by foul smelling. More than 3 million people died of COPD in 2005. Improper management of garbage is identified to be one of the major causes for 22 human diseases causing premature death every year.

Literature Review

In E-Dustbin, the level of garbage in the dustbins is detected with the help of Sensor systems, and communicated to the authorized control room through GSM system. The E-Dustbin works in such a way that as the waste material or garbage reaches a certain height in the dustbin, the sensors are used to detect that garbage level and as it reaches to a certain height a message is send to the authorized number that the particular dustbin is filled and hence this will avoid the overflow of dustbin. This prevents lumping of garbage in the roadside dustbin which ends up giving foul smell and illness to people. This is the smart of managing the waste material.

Embedded System

An embedded system is a computer system with a dedicated function within a larger mechanical or electrical system, often with real-time computing constraints. It is embedded as part of a complete device often including hardware and mechanical parts. Embedded systems control many devices in common use today. 98 percent of all microprocessors are manufactured as components of embedded systems.

Examples of properties of typically embedded computers when compared with general-purpose counterparts are low power consumption, small size, rugged operating ranges, and low per-unit cost. This comes at the price of limited processing resources, which make them significantly more difficult to program and to interact with. However, by building intelligence mechanisms on top of the hardware, taking advantage of possible existing sensors and the existence of a network of embedded units, one can both optimally manage available resources at the unit and network levels as well as provide augmented functions, well beyond those available. For example, intelligent techniques can be designed to manage power consumption of embedded system.

Embedded Systems are classified into three types based on the performance of the microcontroller such as

- Small scale embedded systems
- Medium scale embedded systems
- Sophisticated embedded systems
- Small Scale Embedded Systems

These types of embedded systems are designed with a single 8 or 16-bit microcontroller, that may even be activated by a battery. For developing embedded software for small scale embedded systems, the main programming tools are an editor, assembler, cross assembler and integrated development environment (IDE).

Medium Scale Embedded Systems

These types of embedded systems design with a single or 16 or 32 bit microcontroller, RISCs or DSPs. These types of embedded systems have both hardware and software complexities. For developing embedded software for medium scale embedded systems, the main programming tools are C, C++, JAVA, Visual C++, RTOS, debugger, source code engineering tool, simulator and IDE.

Sophisticated Embedded Systems

These types of embedded systems have enormous hardware and software complexities, that may need ASIPs, IPs, PLAs, scalable or configurable processors. They are used for cutting-edge applications that need hardware and software Co-design and components which have to assemble in the final system.

Embedded C

Embedded C is a set of language extensions for the C Programming language by the C Standards committee to address commonality issues that exist between C extensions for different embedded systems. Historically, embedded C programming requires nonstandard extensions to the C language in order to support exotic features such as fixed-point arithmetic, multiple distinct memory banks, and basic I/ O operations. In 2008, the C Standards Committee extended the C language to address these issues by providing a common standard for all implementations to adhere to. It includes a number of features not available in normal C, such as, fixed-point arithmetic, named address spaces, and basic I/ O hardware addressing. Embedded C uses most of the syntax and semantics of standard C, e.g., main() function, variable definition, datatype declaration, conditional statements (if, switch, case), loops (while, for), functions, arrays and strings, etc.

System Development

Analysis

As the world is in a stage of up gradation, there is one stinking problem we have to deal with. Garbage! In our daily life, we see the pictures of garbage bins being overfull and all the garbage spills out. This leads to the number of diseases as large number of insects and mosquitoes breed on it. A big challenge in the urban cities is solid waste management not only in India but for most of the countries in the world. Hence, such a system has to be build which can eradicate this problem or at least reduce it to the minimum level. The project gives us one of the most efficient ways to keep our environment clean and green.

Now, with the upcoming large number of smart cities, large numbers of responsibilities are also required to be fulfilled. The prime need of a smart lifestyle begins with cleanliness and cleanliness begins with dustbin. A society will get its waste dispatched properly only if the dustbins are placed well and collected well. The main problem in the current waste management system in most of the Indian cities is the unhealthy status of dustbins. We have tried to upgrade the trivial but vital component of the urban waste management system, i.e. dustbin.

Design

Embedded Control Unit

This is the heart of project. In this project we use micro-controller IC 89C51 which has following features:

89C51 pin numbers general purpose I/ O lines, 32 general purpose working registers, three flexible Timer/ Counters with compare modes, internal and external interrupts. Micro controller 89C51 is classified as an eight bit family CMOS microcomputer of mcs-51. It needs 3 capacitors, 1 resistor and 1 crystal as well as 5-volt power supply in operating. Micro controller 89C51 is provided with memory not only RAM but also ROM, parallel and serial port (Universal Asynchronous Receiver/Transmitter), etc which all are in one single chip With Flash EPROM in micro control 89C51 chip, the advantages are the designing of a system basis on micro controller can be more cheap and easier. Flash EPROM is loaded with programs include the instructions that will be compiled by the micro controller. Besides that, it can be reused for many times. Microcontroller 89C51 has 40 pins, 32 pins for parallel port. One port includes 8 pins, so 32 pins formed 4 parallel ports, each of them is recognized as port 0, port 1, port 2 and port 3. Number of each pin of parallel port starts from 0 through 7, first pin of port 0 is named P0.0 and the last pin of port 3 is named P3.7. Pins diagram of AT 89C51 can be seen in Figure.

The AT89C51 is a low-power, high-performance CMOS 8-bit microcomputer with 4K bytes of Flash programmable and erasable read only memory (PEROM). The device is manufactured using Atmel’s high-density nonvolatile memory technology and is compatible with the industry-

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standard MCS-51 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 Flash on a monolithic chip, the Atmel AT89C51 is a powerful microcomputer which provides a highly-flexible and cost-effective solution to many embedded control applications.

89c51 Programmed IC

This is one of the important ingredients of our project it required coding program to run. We have done program to this IC according to our requirement. You can assemble the circuit on any general- purpose PCB. An actual-size, single side PCB for the stepper motor controller is shown in Fig. 4 and its component layout Mount a 40-pin IC base for the microcontroller on the PCB, so you can remove the chip easily when required. Normally, six wires of different colours (two being red) are available for connection to the stepper motor. The sequence for connecting the stepper motor coils to the driver card is shown in you are done with the hardware part, assemble the program (stpb1.asm) using ASM51 assembler. Load the hex file generated by ASM51 into a programmer and burn it into the chip. Now put the programmed chip on the IC base on the PCB. Switch on the power supply to the circuit using switch S1. If motor rotation is not stable, press S2 momentarily. If the motor does not move at all, check the connections.

Pin Description

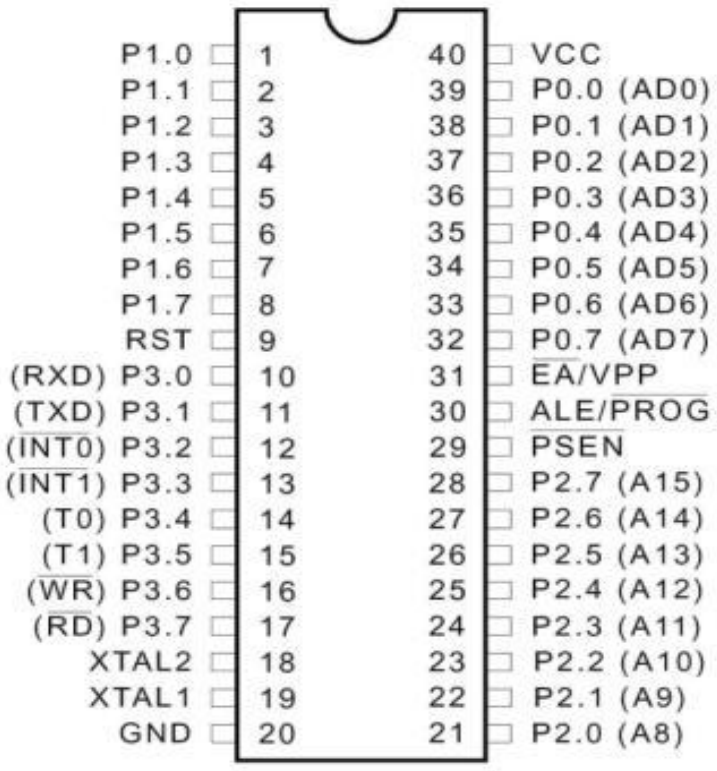

Figure 3.1.Pin Diagram of 89c51

VCC

Supply voltage

GND

Ground

PORT 0

Port 0 is an 8-bit open-drain bi-directional I/O port. As anoutput 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 may 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 pullups. 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 pullups. 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 pullups 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 pullups. 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 pullups. 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 pullups and can be used as inputs. As inputs, Port 2 pins that are externally being pulled low will source current (IIL) because of the internal pullups. 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, it uses strong internal pull-ups when emitting 1s. During accesses to external data memory that uses 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.

PORT 3

Port 3 is an 8-bit bi-directional I/O port with internal pullups. 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 pullups and can be used as inputs. As inputs, Port 3 pins that are externally being pulled low will source current (IIL) because of the pullups. Port 3 also serves the functions of various special features of the AT89C51 as listed below Port 3 also receives some control signals for Flash programming and verification.

Table 1.Port functions

	Alternate Functions
P3.0	RXD (serial input port)
P3.1	TXD (serial output port)
P3.2	INT0 (external interrupt 0)
P3.3	INT1 (external interrupt 1)
P3.4	T0 (timer 0 external input)
P3.5	T1 (timer 1 external input)
P3.6	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.

ALE/PROG

Address Latch Enable 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/ 6the 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 microcontroller is in external execution mode.

PSEN

Program Store Enable is the read strobe to external program memory. When the AT89C51 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.

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, for parts that require 12-volt VPP.

XTAL1

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

XTAL2

Output from the inverting oscillator amplifier.

Oscillator Characteristics

XTAL1 and XTAL2 are the input and output, respectively, of an inverting amplifier which be configured for use as an on-chip oscillator, as shown in Figure 1. 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 as shown in Figure 2. 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 maximum 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. It should be noted that when idle is terminated by a hard ware reset, the device normally resumes program execution, from where it left off, up to two machine cycles before the internal reset algorithm takes control. On-chip hardware inhibits access to internal RAM in this event, but access to the port pins is not inhibited. To eliminate the possibility of an unexpected write to a port pin when Idle is terminated by reset, the instruction following the one that invokes Idle should not be one that writes to a port pin or to external memory.

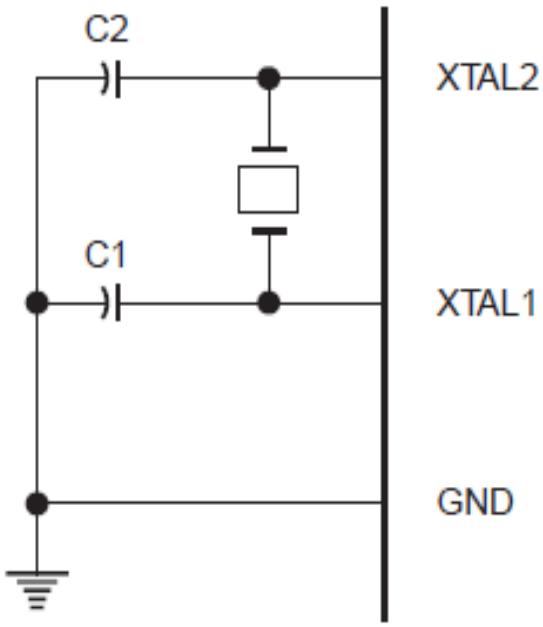

Figure 3.2.Oscillator Connections

An embedded microcontroller is a chip which has a computer processor with all its support functions (clock & reset), memory (both program and data), and I/O (including bus interface) built into the device. These built in functions minimize the need for external circuits and devices to be designed in the final application.

Types of Microcontroller

Creating applications for microcontrollers is completely different than any other development job in computing and electronics. In most other applications one probably have a number of subsystem and interfaces already available for his/her use. This is not the case with a microcontroller where one is responsible for –

- Power distribution
- System clocking
- Interface design and wiring
- System programming
- Application programming
- Device programming

Before selecting a particular device for an application, it' s important to understand what the different options and features are and what they can mean with regard to developing application.[3]

Three Terminal Voltage Regulator

A voltage regulator is a circuit that supplies constant voltage regardless of change in load current. IC voltage regulators are versatile and relatively cheaper. The 7800 series consists of three terminal positive voltage regulators. These ICs are designed as fixed voltage regulator and with adequate heat sink, can deliver o/p current in excess of 1A. These devices do not require external component. This IC also has internal thermal overload protection and internal short circuit and current limiting protection. For our project we use 7805 voltage regulator IC.

Embedded Computing

Driven by the accelerated pace of semiconductor integration during the past three decades, the computer industry has steadily moved from mainframes and minicomputers to workstations and PCs. In accordance with a corollary of Moore's law, computing power becomes half as expensive every 18 to 24 months. Over a decade, this reduces the cost by a factor of 30 to 100, making computing affordable to an exponentially larger number of users and dramatically changing the key applications of this computing power. Manufacturers have for several years incorporated embedded computers in so-called smart products such as video games, DVD players, televisions, printers, scanners, cellular phones, and robotic vacuum cleaners. Using embedded computers in devices that previously relied on analog circuitry-such as digital

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cameras, digital camcorders, digital personal recorders indicant amount of additional computation. The reduction in memory cost more than pays for the extra processing power. Power is of great concern in many smart products. It is obviously important in mobile smart products, in which battery life is a primary factor, but it can also be important in office and computer-room products in which electrical operating and cooling costs are increasingly significant.

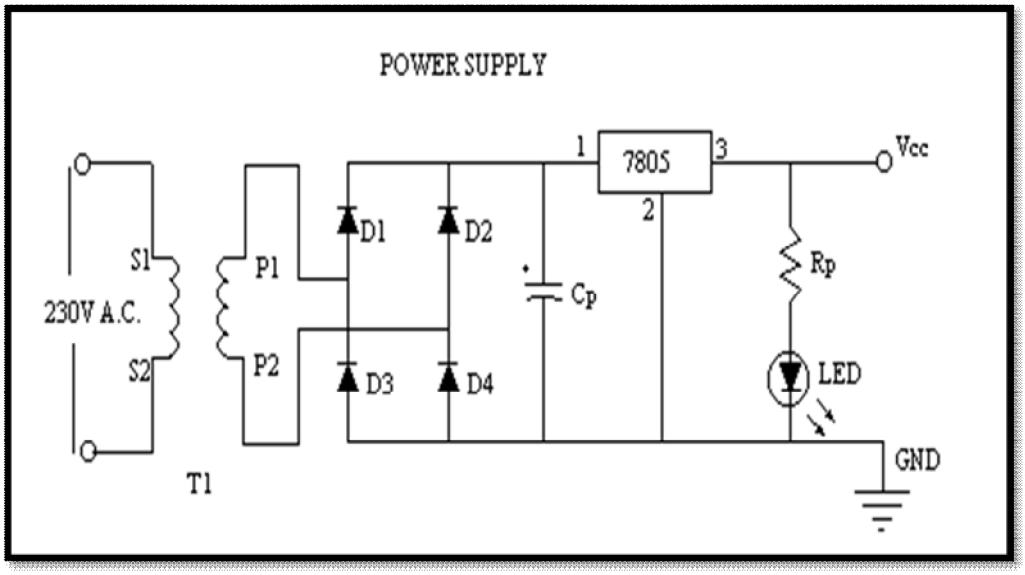

Figure 3.3.Circuit Diagram of Power Supply

Some Common Characteristics of Embedded

- Single-functioned
- Executes a single program, repeatedly
- Tightly-constrained
- All computing systems have constraints on design metrics, but embedded systems are especially tight.
- Low cost, low power, small (must fit in a small space), fast, etc.
- Reactive and real-time
- Continually reacts to changes in the system's environment
- Must compute certain result in real-time without delay.

Autonomic Computing

The advances in computing and communication technologies and software have resulted in a growth in various ways in computing systems and applications that impact all aspects of new technology. However, as the scale and complexity of these systems and applications grow, their development, configuration and management challenges are beginning to break current programs, overwhelm the capabilities of existing tools and methodologies, and rapidly render the

systems and applications brittle, unmanageable and insecure. This has led researchers to consider alternative approaches based on strategies used by biological systems to successfully deal with similar challenges of complexity, dynamism, heterogeneity and uncertainty. Autonomic computing is emerging as a significant new strategic and holistic approach to the design of complex distributed computer systems. It is inspired by the functioning of the human nervous system and is aimed at designing and building systems that are self-managing. Automation of library with embedded system is very much important and it can be used in various ways many of the world wide over popular libraries used this concept.

GSM Module

Figure 3.4.GSM Module

GSM (Global System for Mobile)/GPRS (General Packet Radio Service) TTL –Modem is SIM900 Quad-band GSM/GPRS device, works on frequencies 850 MHZ, 900 MHZ, 1800 MHZ and 1900 MHZ. It is very compact in size and easy to use as plug in GSM Modem. The Modem is designed with 3V3 and 5V DC TTL interfacing circuitry, which allows User to directly interface with 5V Microcontrollers (PIC, AVR, Arduino, 8051, etc.) as well as 3V3 Microcontrollers (ARM, ARM Cortex XX, etc.). The baud rate can be configurable from 9600-115200 bps through AT (Attention) commands. This GSM/GPRS TTL Modem has internal TCP/IP stack to enable User to connect with internet through GPRS feature. It is suitable for SMS as well as DATA transfer application in mobile phone to mobile phone interface. The modem can be interfaced with a Microcontroller using USART (Universal Synchronous Asynchronous Receiver and Transmitter) feature (serial communication).[5]

Features

- Quad Band GSM/GPRS : 850/900/1800/1900 MHz
- Built in RS232 to TTL or vice versa Logic Converter (MAX232)
- Configurable Baud Rate
- SMA (Subminiature version A) connector with GSM L Type Antenna

- Built in SIM (Subscriber Identity Module) Card holder
- Built in Network Status LED
- Inbuilt Powerful TCP/IP (Transfer Control Protocol/Internet Protocol) stack for

Internet data transfer through GPRS (General Packet Radio Service)

- Audio Interface Connectors (Audio in and Audio out)
- Most Status and Controlling pins are available
- Normal Operation Temperature : -20 °C to +55 °C
- Input Voltage : 5V to 12V DC
- LDB9 connector (Serial Port) provided for easy interfacing

Max232 IC

The MAX232 is an integrated circuit that converts signals from an RS-232 serial port to signals suitable for use in TTL compatible digital logic circuits, so that devices works on TTL logic can share the data with devices connected through Serial port (DB9 Connector).

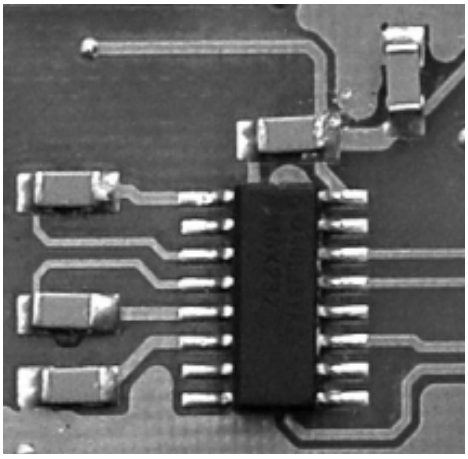

Figure 3.5.MAX232 IC

Serial Port/Db9 Connector

User just needs to attach RS232 cable here so that it can be connected to devices which has Serial port/DB9 Connector.

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Figure 3.6.Serial port/ DB9 connector

Power Supply Socket

This power supply socket which actually named as AC/DC Socket provides the functionality to user to connect external power supply from Transformer, Battery or Adapter through *DC* jack. User can provide maximum of 12V AC/ DC power supply through *AC/ DC* socket. This is power supply designed into maximum protection consideration so that it can even prevent reverse polarity DC power supply as well as DC conversion from AC power Supply. It also includes LM317 Voltage Regulator which provides an output voltage adjustable over a1.2V to 37V.

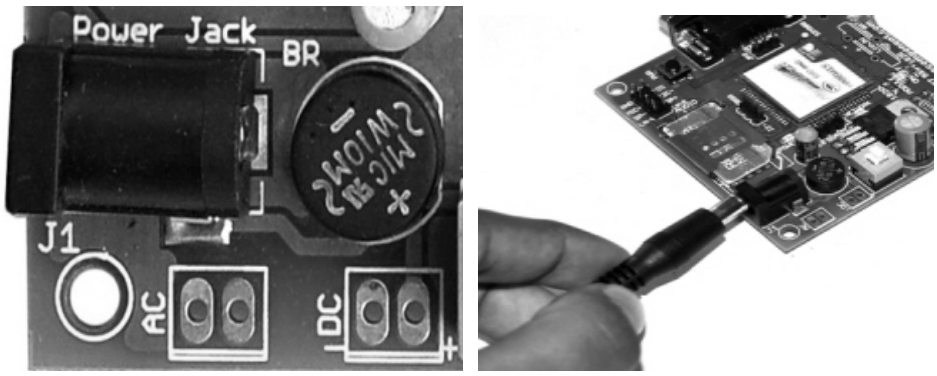

Figure 3.7.Power Supply Socket

Power On/ Off and GSM On Switch

Power On/ Off switch is type of push-on push-off DPDT switch which is used for only make power supply on/ off provided through AC/ DC Socket indicated by ‘Power LED’. GSM On Switch is type of Push on DPST tactile switch which is used for only to make GSM module ‘On’ indicated by ‘Module On/ Off LED’ while initiating with Network indicated by ‘Network Indication *LED’*.

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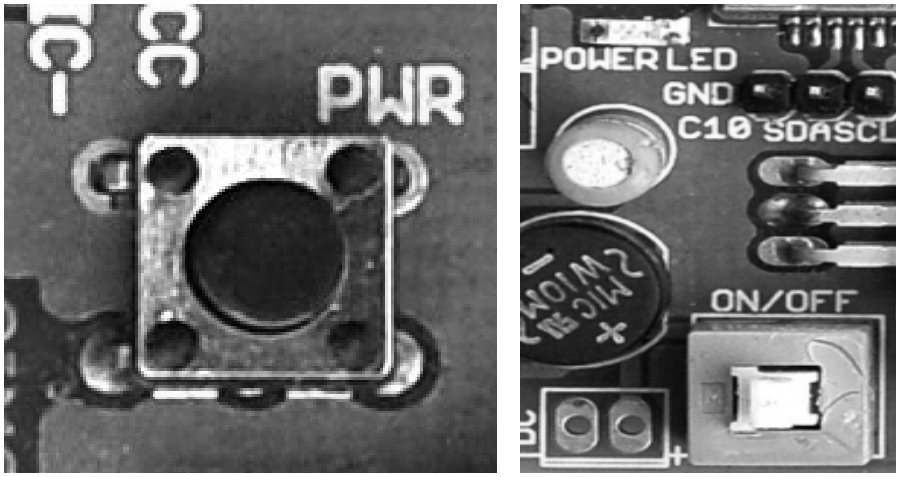

Figure 3.8.Power On/ Off and GSM on Switch

SIM (Subscriber Identity Module) Card Slot

This onboard SIM card slot provide User functionality of insert a SIM (GSM only) card of any service provider. While inserting in and removing out SIM card from SIM card slot, User needs to take precaution that power supply should be OFF so that after making Power supply ON it will be easy to reinitialize with SIM for this module.

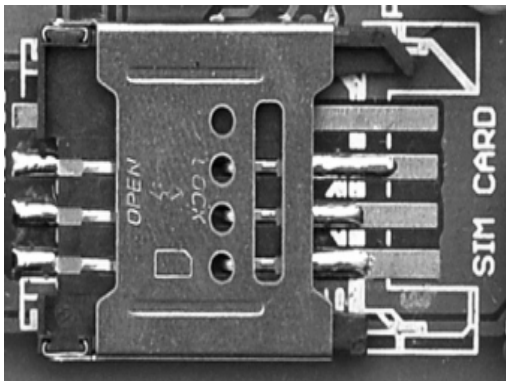

Figure 3.9.SIM (Subscriber Identity Module) Card Slot

RXD, TXD and GND Pins (Jp2)

These pins are used to connect devices which needs to be connected to GSM module through USART (Universal Synchronous Asynchronous Receiver and Transmitter) communication. Devices may be like Desktop or Laptop Computer System, Microcontrollers, etc. RXD (Receive Data) should be connected to TXD (Transmit Data) of other device and vice versa, whereas GND (Ground) should be connected to other device's GND pin to make ground common for both systems.

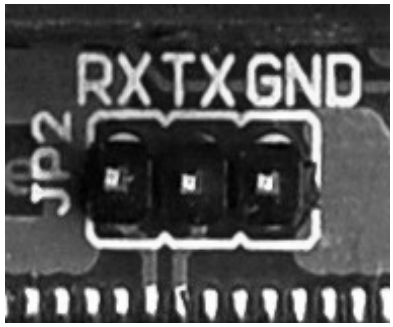

Figure 3.10: RXD, TXD and GND pins (JP2)

Audio Connectors

Audio Connectors deals with Audio related operations. These pins already shown in hardware description diagram. These are eight pins in a group of two each denoted by SV4. GND (0V Supply) and VCC (+5V Supply) are used to have source for external device. MIC+ and MICused to connect Microphone (abbr. as Mic) through which user can give audio input while calling. SP- and SP+ used to connect Speaker (can be connected to amplifier circuit if necessary) through which User can hear audio output. LN-L and LN-R used to connect Line in to GSM module.

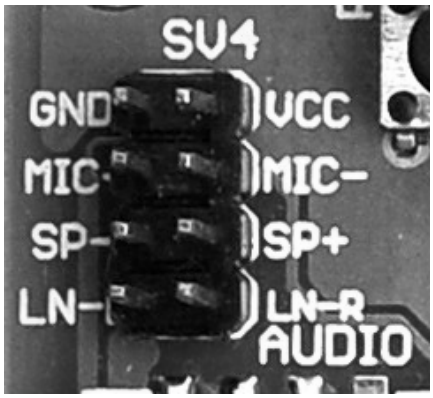

Figure 3.11.Audio Connectors

Debugger (DBG-R and DBG-T) Connectors (J2)

These connectors are 2-wire null modem interface DBG_TXD and DBG_RXD. These Pins can be used for debugging and upgrading firmware. User generally no need to deal with these pins.

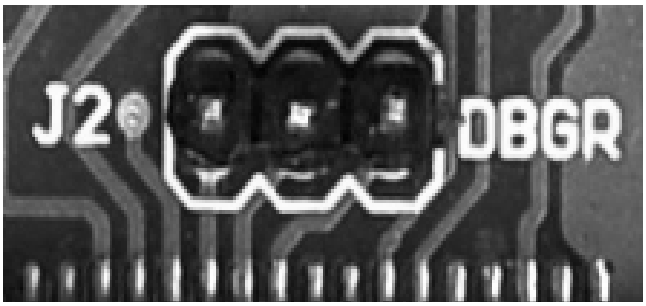

Figure 3.12.Debugger (DBG-R and DBG-T) Connectors (J2)

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Sim300 Module

Designed for global market, SIM300 is a Tri-band GSM/ GPRS engine that works on frequencies EGSM 900 MHz, DCS 1800 MHz and PCS1900 MHz. SIM300 provides GPRS multi-slot class 10 capability and support the GPRS coding schemes CS-1, CS-2, CS-3 and CS-4.

With a tiny configuration of 40mm x 33mm x 2.85 mm, SIM300 can fit almost all the space requirement in your application, such as Smart phone, PDA phone and other mobile device.

The physical interface to the mobile application is made through a 60 pins board-to-board connector, which provides all hardware interfaces between the module and customers' boards except the RF antenna interface.

SIM300 provide RF antenna interface with two alternatives: antenna connector and antenna pad. The antenna connector is MURATA MM9329-2700. And customer's antenna can be soldered to the antenna pad.

The SIM300 is designed with power saving technique, the current consumption to as low as 2.5mA in SLEEP mode.

The SIM300 is integrated with the TCP/ IP protocol, Extended TCP/ IP AT commands are developed for customers to use the TCP/ IP protocol easily, which is very useful for those data transfer applications.[5]

Figure 3.13.SIM300 Module

Circuit Diagram

A GSM module has an RS232 interface for serial communication with an external peripheral. In this case, the transmit pin (Tx) of the computer's Serial port is connected with the receive pin (Rx) of the GSM module's RS-232 interface. The transmit pin (Tx) of the RS-232 of GSM module is connected to receive pin (Rx) of microcontroller's serial transmission pin. And the serial transmit pin of the microcontroller is connected to the receive pin of the computer's Serial

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port. Therefore the commands and their results are transmitted and received in a triangular fashion as depicted below.

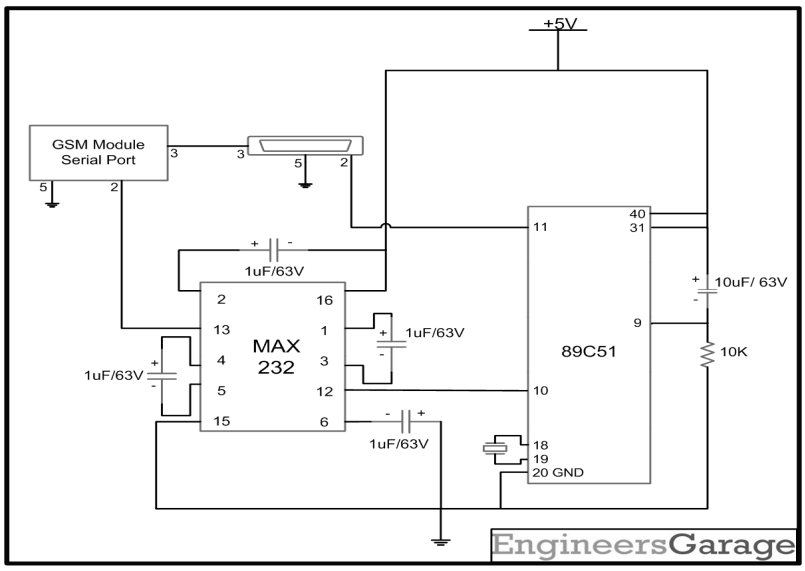

Figure 3.14.Circuit Diagram

The microcontroller is programmed to receive and transmit data at a baud rate of 9600. For more details on setting the baud rate of microcontroller, refer serial communication with 8051. The controller can receive data signals either by polling or by making use of serial interrupt (ES). Serial interrupt has been explained in interrupt programming. In polling, the controller continuously scans serial port for incoming data from the GSM module.

In this project, interrupt has been used for monitoring and controlling the flow of data by the controller instead of the polling method.

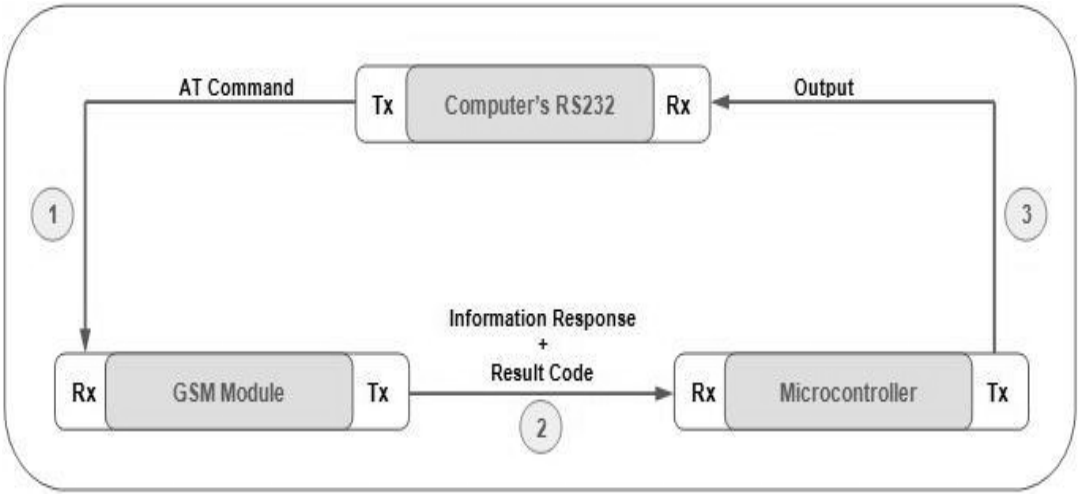

Figure 3.15.Interfacing of GSM Module with Microcontroller

The project explains interfacing of the AT89C51 microcontroller with the GSM module and the HyperTerminal. HyperTerminal is a Windows application. The AT commands are sent by the HyperTerminal to the GSM module. The Information Response and/ or Result Codes are received at the microcontroller and retransmitted to the HyperTerminal by the controller.

PCB Design

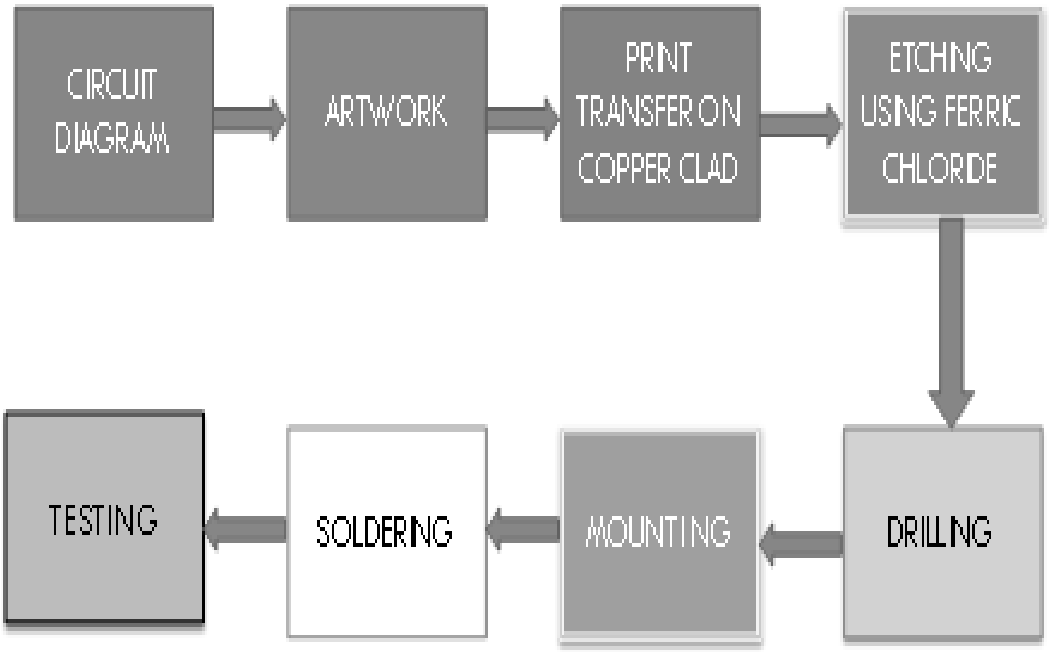

Figure 3.16.Block Diagram of PCB Design

PCB Making

PCB is printed circuit board which is of insulating base with layer of thin copper-foil. The circuit diagram is then drawn on the P. C. B. with permanent marker and then it is dipped in the solution of ferric chloride so that unwanted copper is removed from the P.C.B., thus leaving components interconnection on the board. The specification of the base material is not important to know in most of the application, but it is important to know something about copper foil which is drawn through a thin slip. The resistance of copper foil will have an effect on the circuit operation. Base material is made of lamination layer of suitable insulating material such as treated paper, fabric; or glass fibers and binding them with resin. Most commonly used base materials are formed paper bonded with epoxy resin.

The PCB design starts right from the selection of the laminates .The two main types of base laminate are epoxy glass and phenolic paper laminates are generally used for simple circuits. Though it is very cheap and can easily be drilled, phenolic paper has poor electrical

characteristics and it absorbs more moisture than epoxy glass. Epoxy glass has higher mechanical strength

Manufacturing Process

The steps involved in manufacture are

- Resist preparation.
- Resist application a fixing.
- Acid etches.
- Cleaning and inspection.
- Resist removal.

PCB Fabrication

The fabrication of a PCB includes basically of four steps.

- Preparing the PCB pattern.
- Transferring the pattern onto the PCB.
- Developing the PCB.
- Finishing i.e.) drilling, cutting, smoothing, turning etc.

Pattern designing is the primary step in fabricating a PCB in this step, all

interconnection between the components in the given circuit are converted into PCB tracks several factors such as positioning, the diameter of holes, the area that each component would occupy, and the type of end terminal should be considered.

Transferring the PCB Pattern

The copper side of the PCB should be thoroughly cleaned with the help of alcoholic spirit or petrol must be completely free from dust and other contaminants. The mirror image of the pattern must be carbon copied and to the laminate the complete pattern may now be made each resistant with the help of paint and thin brush.

Developing

In this developing all excessive copper is removed from the board and only the printed pattern is left behind. About 100ml of tape water should be heated to 75 ° C and 30.5 grams of $FeCl_3$ added to it, the mixture should be thoroughly stirred and a few drops of HCl may be added to speed up the process.

The board with its copper side facing upward should be placed in a flat bottomed plastic tray and the aqueous solution of $FeCl_2$ poured in the etching process would take 40 to 60 min to complete.

After etching the board it should be washed under running water and then held against light .the printed pattern should be clearly visible. The paint should be removed with the help of thinner.

Finishing Touches

After the etching is completed, hole of suitable diameter should be drilled, then the PCB may be tin plated using an ordinary 35 Watts soldering rod along with the solder core, the copper side may be given a coat of varnish to prevent oxidation.

Drilling

Drills for PCB use usually come with either a set of collects of various sizes or a 3-Jaw chuck. For accuracy however 3-jaw chunks aren't brilliant and small drill below 1 mm from grooves in the jaws preventing good grips.

Soldering

Begin the construction by soldering the resistors followed by the capacitors and the LEDs diodes and IC sockets. Don't try soldering an IC directly unless you trust your skill in soldering. All components should be soldered as shown in the figure. Now connect the switch and then solder/ screw if on the PCB using multiple washers or spaces. Soldering it directly will only reduce its height above other components and hamper in its easy fixation in the cabinet. Now connect the battery lead.

Assembling

The circuit can be enclosed in any kind of cabinet. Before fitting the PCB suitable holes must be drilled in the cabinet for the switch, LED and buzzer. Note that a rotary switch can be used instead of a slide type. Switch on the circuit to be desired range. It will automatically start its timing cycles. To be sure that it is working properly watch the LED flash. The components are selected to trigger the alarm a few minutes before the set limit.

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Flow of Project

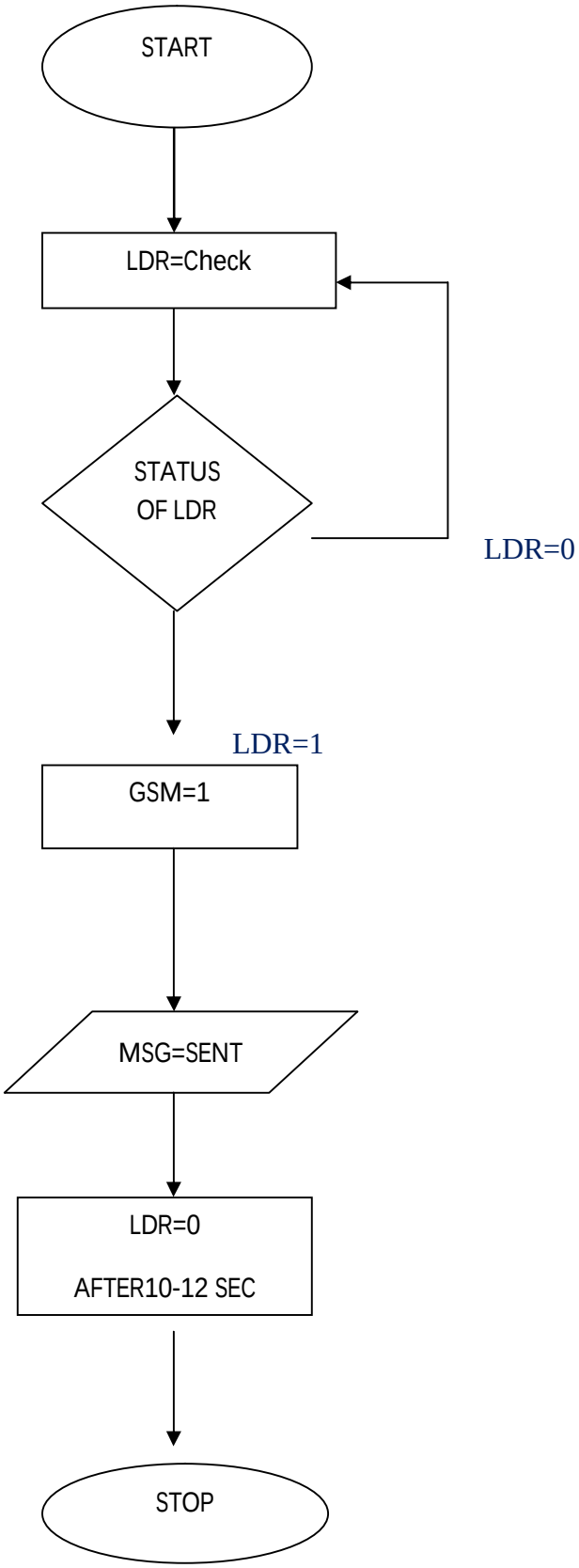

Figure 3.17.Flowchart of Project

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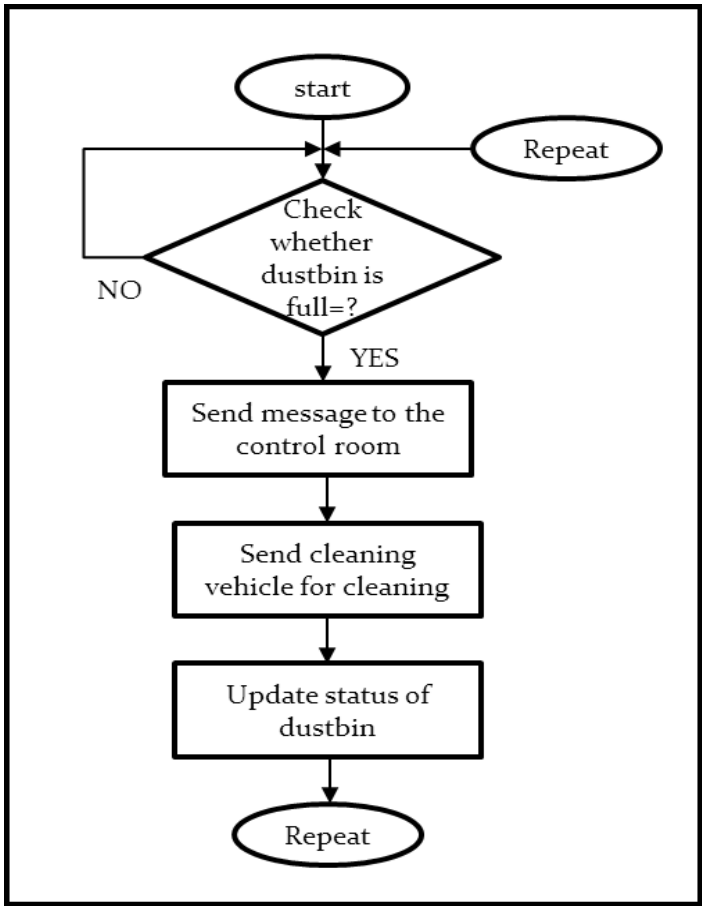

Figure 3.18.Flow of Project

The flowchart of the project is shown above. At the start, when the waste material is thrown in the dustbin, LDR is used to detect the level of waste material inside the dustbin. LDR checks the level of waste material inside the dustbin. If the dustbin is not filled, it allows the waste material to be collected in the dustbin. Whenever the dustbin gets filled, LDR detects it and thus sends a message to authorized number that the dustbin is filled. The Message contains the ID and address of that particular dustbin. Each dustbin is assigned a unique ID so that it is easily traceable. Thus as the message is received by the municipality servants, they come and clean the dustbin. Hence the same procedure can be repeated again. This provides a very convenient way to keep the environment clean.[9]

Conclusion

This proposal for the management of wastes is efficient and time saving process than the currently employing method in which concerned municipal employee has to look for the filled waste bins manually across different spots in an area/street for checking regularly.

Urbanization is at its rapid growth stage around the world, as more number of people desire to live in the city lights with more opportunities for growth and success. Cities are expanding like never before to accommodate this growth and in this process the concept of smart cities came

into action. The parameters like cleanliness and hygiene are the topic of concern in these smart cities and concrete measures should be taken for that. Also, the growth should go hand in hand with the green environment and research should be further done on such technology. Our work is a small but efficient step towards cleanliness and we believe that this paper would encourage people to do good work on the similar topics. We have successfully made and tested the model of our smart dustbin so we believe with encouragement from the side of government we can successfully transform this model into product.

Future Scope

- We can add GPS modem to this project. This will help to track the position in case there are more dustbins.
- When somebody dumps trash into a dustbin, the bin can flashes unique code which can be used to gain access to free Wi- Fi.
- It can also be operated using batteries.
- It can also work on solar energy.

Result

While developing the project we have learn many things such as the different methods used for programming an IC and developed an embedded system For the implementation of this project we have used Keil Proteuse software for the programing of microcontroller. Hence while developing this project we have studied the different commands and function which are mainly get used for an embedded system application.[3]

Figure 8.1.E-Dustbin

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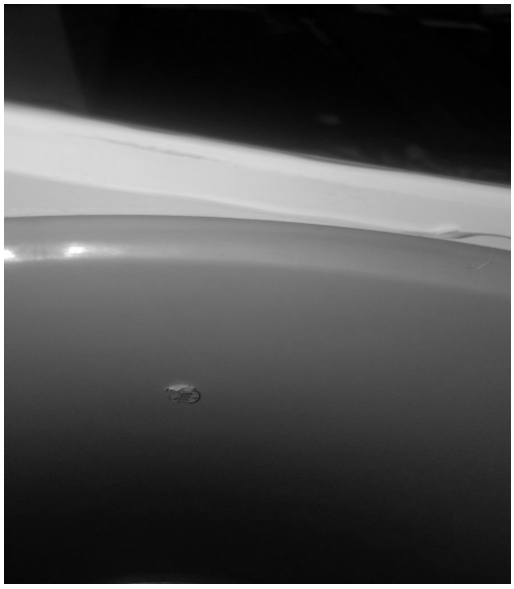

Figure 8.2.Sensor inside dustbin

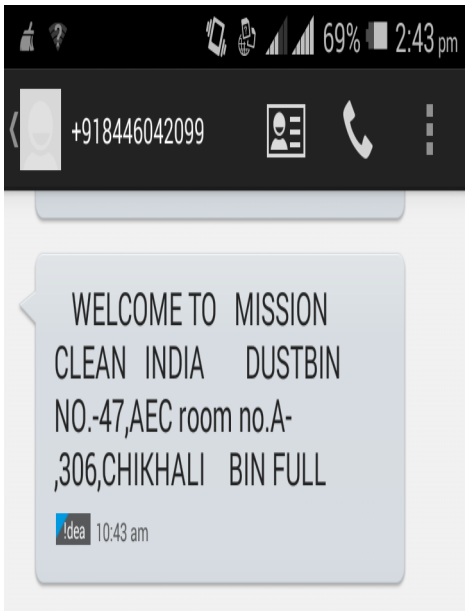

Figure 8.3.Final message format

When the dustbin gets filled up, a message is send to the authorized number consisting of the Dustbin's ID and address as shown above.

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