IOT BASED SMART FLOOR CLEANING ROBOT

MINI PROJECT REPORT

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BONAFIDE CERTIFICATE

Certified that this project **"IOT BASED SMART FLOOR CLEANING ROBOT"** is the bonafide work of,

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Who carried out the work under my supervision, Certified further that to the best of my knowledge the work reported here in does not form part of any other thesis or dissertation on the basis of which a degree or award was conferred on an earlier occasion on this or any other candidate.

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Submitted for the Anna University Project viva-voce held on …….....

Internal Examiner **External Examiner**

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I would like to extend my gratitude to our chairman **Dr.Lion.K.Mohan** Vice chairman **Mr.K.Palaniyappan**, Secretary **Dr.J.V.Sezhiyan**,Treasurer **Mr.S.Nallippan**, Joint Secretary **Mr.K.R.Krishnamoorthy**, **Mr.R.Ganapathi** and director **Mr.S.Balakumar**.

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ABSTRACT

The advancements made in technology of robotics have made life of mankind very much easier and comfortable. This project describes a smart floor cleaning robot that allows cleaning the floor by giving instructions to the robot. This robot makes floor cleaning process easy and fast utilizing a wireless robotic cleaning system. This wireless system consists of a transmitter application that runs on an android mobile app which allows the robot to follow commands given by the user through the transmitter app.

The proposed robot consists of Arduino UNO controller which has fourteen digital input/output pins, robotic arm with cleaning pad with a water sprayer for efficient cleaning. The Arduino UNO, on receiving the commands from android device through Bluetooth receiver, decodes the given commands and controls the motors to achieve the desired path and direction.

Automatic floor cleaner is a system that enables cleaning of the floor with the help of highly stabilized and rapidly functionalized electronic and mechanical control system. While designing the robot we must broadly understand that how the domestic service robots can be used for cleaning purpose and secondly, we must consider that how the robot fits into our home. In this project our targets to design an automatic floor cleaner for household purposes. The cleaning purpose is specifically carried out by continuous relative motion between a mopping and the floor vacuum.

For example, robots utilizing laser mapping are relatively faster, less time consuming and energy efficient but costly, while obstacle avoidance based robots are relatively time consuming and less energy efficient due to random cleaning but less cost.

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CHAPTER 1

INTRODUCTION

In recent years, robotic cleaners have taken major attention in robotics research due to their effectiveness in assisting humans in floor cleaning applications at homes, hotels, restaurants, offices, hospitals, workshops, warehouses and universities etc. Basically, robotic cleaners are distinguished on their cleaning expertise like floor mopping, dry vacuum cleaning etc.

Some products are based on simple obstacle avoidance using infrared sensors while some utilize laser mapping technique. Each cleaning and operating mechanism of robotic floor cleaners has its own advantages and disadvantages. Importing them from abroad increases their costs. The main objective of this work is to provide a substantial solution to the problem of manufacturing robotic cleaner utilizing local resources while keeping it low costs.

For example, robots utilizing laser mapping are relatively faster, less time consuming and energy efficient but costly, while obstacle avoidance based robots are relatively time consuming and less energy efficient due to random cleaning but less costly. Countries like Pakistan are way back in manufacturing robotic cleaners. Importing them from abroad increases their costs.

The main objective of this work is to provide a substantial solution to the problem of manufacturing robotic cleaner utilizing local resources while keeping it low costs.

In this work, “smart floor cleaning robot (CLEAR)” has been designed for consumer/office environments and its each component in accordance with IEEE Standard is discussed. Proposed design is being operated in dual modes.

In one of the modes, the robot is fully autonomous and making decisions on the basis of the outputs of infrared proximity sensors, ultrasonic sensors and tactile sensors after being processed by Arduino (mega) controller and control the actuators (2 DC encoder motors) by the H-bridge driving circuitry.

In manual mode, the robot can also be used to clean a specific area of a room by controlling it manually from laptop with a Graphical User Interface (GUI) in Visual Studio (C# programming language) via Bluetooth connectivity. After cleaning the wet floor, it can drain the dirty water into the required container as per the commands given to it.

The robotic arm is used for efficient and effective wet floor cleaning purpose. This system can also be used to pick up the objects and carry them within the Bluetooth range. The proposed system is a manual system because it is controlled by android application which is operated by human. The proposed system functioning is entirely depended on the commands that are received from the android app

EXISTING SYSTEM

A robot vacuum cleaner is an autonomous robotic vacuum cleaner which includes self-drive mode and cleans the floor autonomously without human control. This robot vacuum cleaner consists of spinning brushes, mopping, UV sterilization and security cameras for cleaning purpose. This vacuum cleaner had some drawbacks like colliding with obstacles and stopped at a shorter distance from walls and other objects.

It was not able to reach to all corners and edges of the room and left those areas unclean . An automatic floor cleaner robot has brushes attached to its sides to collect the dust. This robot uses ultrasonic sensors to avoid obstacles and change its direction and it has a suction unit that sucks in the dust while moving around the room freely. But the drawback of this robot is that it cannot clean the wet floor .

Roomba vacuum cleaner robot is arranged at 27o angle, the sweeping brush placed under it sweeps the dust and waste from corners and edges. It has a powerful motor suction unit which sucks in the dirt into the filtered dust bin. A robotic vacuum cleaner is an autonomous electronic device that is intelligently programed to clean a specific area through a vacuum cleaning assembly.

PROPOSED SYSTEM

Robot is an electro-mechanical machine and is used for various purposes in industrial and domestic applications. Robot appliances are entering in the consumer market.

Initially the main focus was on having a cleaning device. As the time pass on many improvements were made and more efficient appliances were developed. In this research work a floor cleaner robot based on ATMEGA 2560- has been developed. This cleaner robot is an electric home appliance,

Which works in two modes as per the user convenience "Automatic and Manual"? Unlike other floor cleaner robots this is not a vacuum cleaner robot. It performs sweeping and mopping operation. Detachable mop is usedfor wet mopping. It works on 12V supply.

In the automatic mode, robot performs all operations itself. Firstly robot starts it moves forward and perform cleaning action. For obstacle detection and to avoid hurdle Laser TOF sensor have been used. If any hurdle detected then robot change the lane automatically, does not stop cleaning action. It follows zigzag path for user convenience, water sprayer is attached which automatically spray water for mopping, therefore no need to attach wet cloth again and again for mopping.

Motor driver circuit has been used to drive the motors. In the manual mode, user itself operates the robot via an android application using smart phone. Bluetooth module is used to control the robot using mobile phone application within a range. The IR sensor used here is used to detect the obstacle and gives indication of a obstacle using buzzer.

This research facilitates efficient floor cleaning with sweeping and mopping operations. This robot works in two modes automatic and manual for user convenience.

User can also operate this robot manually with the help of Smartphone. It reduces the labor cost and saves time also and provides efficient cleaning. In automatic mode, the robot operates autonomously. The operations such as sweeping, mopping and changing the path in case of hurdle are performed automatically nevertheless, there are still new ideas to improve the developed system and to add new functionality to it.

The additional features that may be added in autonomous cleaner robot are GSM control system using mobile phones for cleaning process. the relay works as switch so that it controls the water pump whenever the user receives the commands from transmitter app.

The control is also enhanced by controlling the robot by Bluetooth or zigbee. And by implementing solar panel in the robot we can charge the battery using light energy which can enhance the robot to operate in power failure condition. This robot works in two modes automatic and manual for user convenience. This proposed work provides the hurdle detection in case of any obstacle that comes in its way. By implementing the fuzzy logic in the autonomous cleaner robot we can enable artificial intelligence in cleaning robot.

BLOCK DIAGRAM

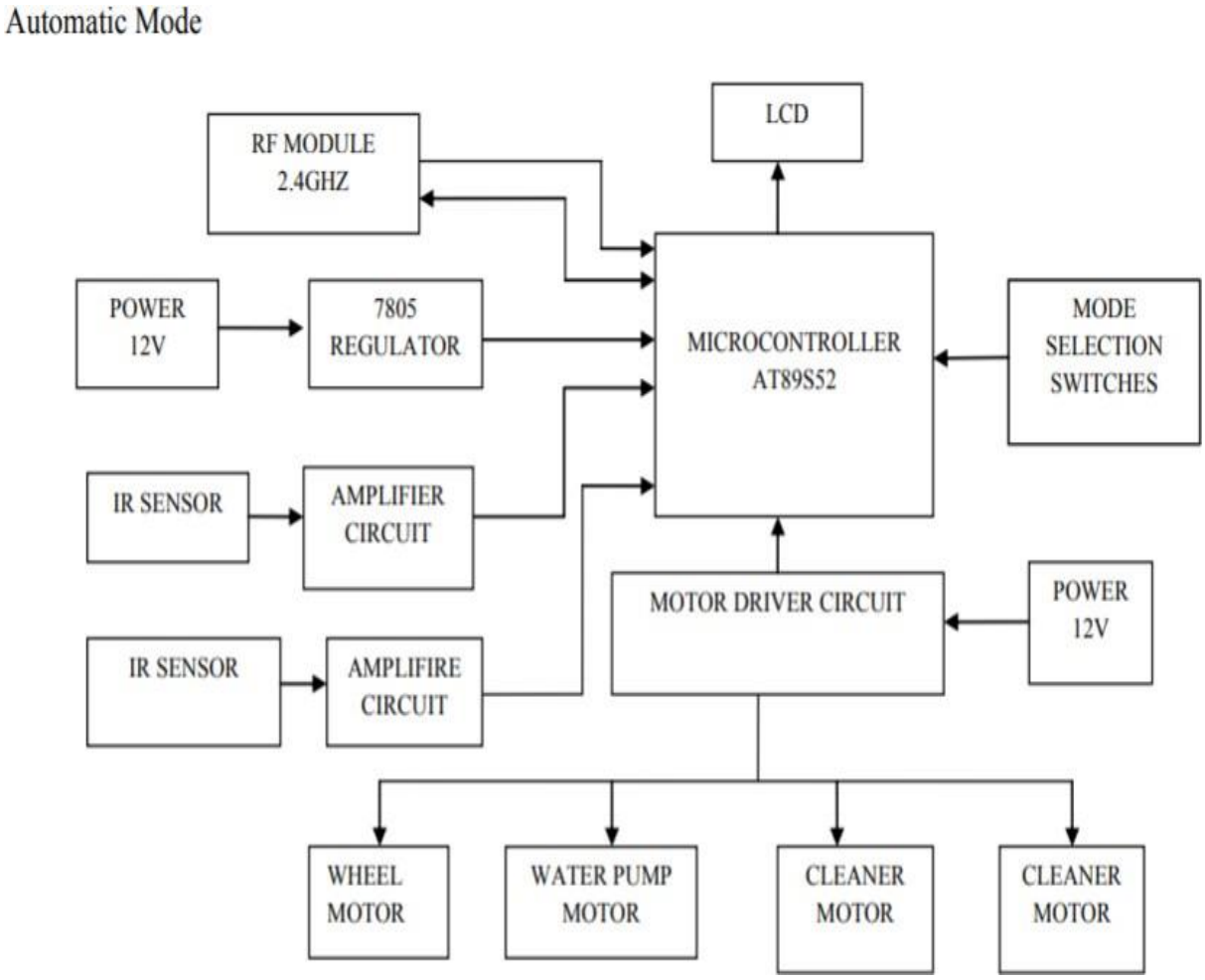


Fig 1.1 BLOCK DIAGRAM OF SMART FLOOR CLEANING ROBOT

CIRCUIT DIAGRAM

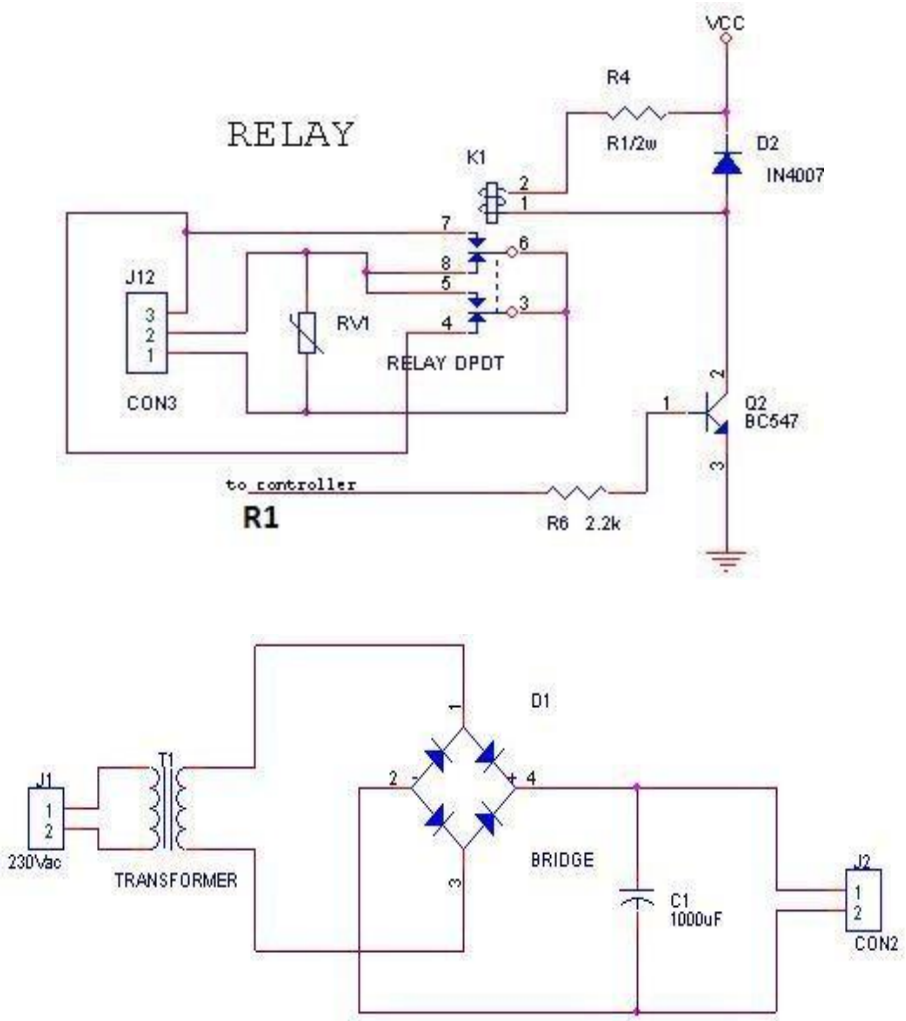


Fig 1.2 CIRCUIT DIAGRAM OF SMART FLOOR CLEANING ROBOT

EXPLANATION (BLOCK DIAGRAM)

Mechanical body consists of four parts i.e., chassis, brushing mechanism, vacuum cleaning and dirt disposal mechanism. Combination all these four parts makes a complete prototype for testing, as shown in Figure 1. Before fabrication, complete CAD Model was designed using a commercially available software.

Chassis The base of the body comprises of acrylic sheet, two encoder motors along with Teflon tires having O-rings on them for avoiding friction, two ball casters of adjustable height having frictionless steel balls, aluminum angular brackets and aluminum holders for two lead acid batteries of 12V and 1.2Ah rating. Thesemotorsare independently powered and mounted diagonally and two ball casters are placed at other diagonal of acrylic sheet so that motors can move along its axis easily and bear more weight as compared to chain mechanism. Cleaning assembly includes a DC geared motor, sprockets for moving chain from geared motor to rotating brush and two aluminum rods for supporting vacuum cleaner mechanism and dirt compartment.

This DC geared motor has been fitted on one side of acrylic sheet with aluminum holder and sprockets installed with it which have been fitted into shaft of motor. All components are installed on lower side of acrylic sheet so that center of gravity should be lower and robot would be stable. The direction of voltage or current flow will be decided by the H-bridge.Brushing Brushing mechanism consists of one rolling brush.

One rolling brush mounted on aluminum holders with bearings inside them. This mechanism is attached through mild steel strip to the base of robot. Brush is used to broom the dirt particles into the vacuum chamberin case of carpeted floor for efficient cleaning.

Vacuum Cleaning and Dirt Disposal Vacuum cleaning and dirt disposal mechanism consists of vacuum motor, propeller, steel holders for fixing motor, filter mounted on two steel rods, aluminum alloy sheet, steel sheet, servo motor, aluminum brackets and aluminum strips. Propeller mounted to a vacuum motor fixed by steel holders and filters are placed on inside of aluminum alloy.

Steel sheet has been molded in such a shape that it gave a shape of a robot. Aluminum alloy is also molded into a shape just like steel sheet but of bigger size. Bother sheets are attached together results in narrow tunnel from front side and broad compartment at backside.

The device operates between1.8-5.5volts. The device achieves through put approaching 1 MIPS per MHz Serial data to the MCU is clocked on the rising edge and data from the MCU is clocked on the falling edge. Power is applied to VCC while RESET and SCK are set to zero. ATmega328 is commonly used in many projects and autonomous systems where a simple, low-powered, low-cost microcontroller is needed.The Arduino Uno is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button.

It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started. The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega8U2 programmed as a USB-to-serial converter.Ultrasonic ranging module HC - SR04 provides 2cm -400cm non-contact measurement function, the ranging accuracy can reach to 3mm. The modules includes ultrasonic transmitters, receiver and control circuit.

Suction unit (vacuum)

The suction unit in the project have a dirt bag attached and it sucks all the dirt into it, for this purpose it will also have a DC motor which will be synchronized with the DC motor used for rotating purpose (i.e. wheels).The propeller is made up of steel and it has the diameter is of 5 cm which is divided into 8 equal plates, each rotated at angle of 22 degrees. It requires the current of 0.4 amperes. It has a narrow nozzle which is 1 cm wide.

The vacuum assembly is enclosed in the rigid plastic chamber, in order to prevent dust enter this section. It is made waterproof against splash water. It rotates and suck in the dust and which can further removed by detaching the unit. The automatic floor cleaner is intelligently programmed to clean a specific area through a vacuum cleaning a robot. The cleaner is cost effective, convenient, environment friendly that saves the valuable time of any person.

DC motor is used to change direction of wheels which is connected to the platform. If the enough current produced then DC motors can be operated directly otherwise a motor driver is required so as to provide it a high current i.e. upto 0.7 to 1.2 ampere. Driver Used is named as L293D with H-Bridge Configuration. The cleaner is handy and can spin anywhere in any direction.Sensors are basically used to set up a communication link between the outside world and the digital device and to fulfil the purpose use two Ultrasonic Sensors (HC-SR04)are incorporated in the project.

One of it is used to detect the obstacles or hurdles in front of the cleaner so it moves back andchange its path or lane and the other is used to detect the height in order to prevent the cleaner from falling down

Motor Controllers

Motor controllers commonly known as H-Bridge, are used for driving motors in both direction that is clockwise and counter-clockwise with current rating of 15 A. This controller consists of two parts. First part is to energize relays through Arduinocontroller and drive motors while second part is for controlling the speed of motors. Relays are used for switching purposes while transistors are used for speed control.

Relays used in this circuit have rating of 12V dc coil and 15A current while lead acid battery of a 12V and 1.2Ah rating. Since encoder motors have a stall current of 7A so for safe purpose 15A relays have been used. Two diodes are implemented in fly back diode configuration. This is a condition in which a diode is put in reverse state between battery terminals and is commonly known as free-wheeling diode.

At de-energizing of relay huge voltage is produced in backward state and can damaged other components so to avoid this damage a diode in fly back configuration is used along with relay.Pulse width modulation (PWM) is used for speed control. PWM is given to transistor BJT 2N2222 along with some duty cycle to compel motor to start at some intervals resulting in controlling speed.

Vacuum Cleaning Controller

The circuit used for controlling of vacuum cleaner consists of one transistor, one relay, one diode and two batteries. One Lead acid battery of 12V and 1.2Ah ratings is for power controlling (ON/OFF) of vacuum cleaner by energizing coil of relay having diode in a position while one LIPO battery of 18V and 5Ah is for supplying power to vacuum cleaner with different ground terminals to avoid short circuit currents and properly isolate the batteries from circuit including a separate Yellow LED for Disconnected stateowing to section.

Signal from Arduino controller is given to transistor BJT 2N2222 which energizes relay and relay switches. After switching, relay will allow 18V battery to supply power through it and turns on vacuum cleaner through an ON/ OFF switch.

Battery Meters

This circuit consists of two buffer ICs, six colored LED‟s (3-Red &3-Green) indicating battery power status and four resistors for voltage divider.

Positive terminal of circuit battery is connected to one resistor and output taken from second resistor gives a fixed voltage that fixed voltage goes to buffer IC so that no current should be drawn from circuit and process can be done easily. That fixed voltage after buffer IC goes to arduino where it is programmed and processed; results in turning ON/OFF of LED‟s showing whether battery is charged or discharged depending on value of voltage being fed into Arduino. Resistors should have values in kilo ohms so that current would be in mille amperes to meet the offset of buffer IC.

If resistors of high wattage and values of mega ohm used then current will be in micro amperes and buffer IC offset will not reached and IC would not be in working state. This feature of power level indication using average power over an extended period affecting long term energy consumption on hardware separately is in accordance withfrom section.

Brushing Motor Controller

The circuit consists of two transistors. One transistor takes a signal from Arduino controller and drives other transistor. Transistor which takes a signal is BJT 2N2222 and other one is TIP-122. Circuit works on 12V DC supply connected through a switch and fuse. Two transistors are used because single TIP- 122 has high current rating and cannot be activated by Arduino directly.

Transistor BJT 2N2222 is not used solely because stall current of brush motor is much high and BJT will not provide necessary currentTwo transistors are used .

Power Supply to Sensors

All sensors used are rated at 5V but batteries are of 12V and 18V. So to give 5V to five IR sensors, 2 encoder sensors, one magnetometer and one Bluetooth module, this circuit has been designed and implemented. Regulator IC 7805 is used for converting 12V to 5V with current in milliamperes range. Capacitors are also used for voltage regulation and if there is some impulse which can disconnect power to sensors then these capacitors will act as source for maintaining connection to sensors.

Sensors are basically used to set up a communication link between the outside world and the digital device and to fulfil the purpose use two Ultrasonic Sensors (HC-SR04)are incorporated in the project. One of it is used to detect the obstacles or hurdles in front of the cleaner so it moves back and change its path or lane and the other is used to detect the height in order to prevent the cleaner from falling down.

Precautionary Circuit

This circuit serves as a main circuit consisting of bridge rectifiers, relays, transistors, diodes, fuses, Positive voltage adjustable regulator, LEDs, terminal blocks, and slim headers. This circuit consists of three parts. One is for motor battery safety and regulation of voltage, second for circuit battery voltage safety and third is for controlling motor battery through circuit battery and giving power to Arduino controller. In first part, one relay with diode in fly back mode, one transistor, one fuse, terminal blocks, one regulator and variable resistor are used. Firstly battery terminals are connected to terminal block shorted with inputs on robot.

Bridge rectifier is used to keep the supply voltage positive and secure the circuitsif the battery terminals are connected in positive or negative direction. Signal from Arduino controller is given to transistor BJT 2N2222 which energizes relay and relay will allow motor voltage to go to fuse from rectifier and then it will go to regulator input.

Regulator used is LM338k which is positive adjustable voltage regulator having a rating of 15A and can regulate voltage from 12V to 6V. This regulator is used so that there will be no fluctuations in output and motor works steadily. After adjusting voltage to 12V output will be shorted with terminal block and that block is now used for battery output both for encoder motors and brush motor. For more safety,fuse holders are used so that if there is any shot circuiting occurs then it will not harm other components and fuse can easily be changed.

CHAPTER 2

LITERATURE SURVEY

A robotic vacuum cleaner is an autonomous electronic device that isintelligently programed to clean a specific area through a vacuum cleaning assembly. Some of the available products can brush around sharp edges and corners while others include a number of additionalfeatures such as wet mopping and UV sterilization rather than vacuuming. Some of the available products are discussed below. Initially, iRobot decided to manufacture limited number of units but Roomba immediately became a huge consumer sensation. Due to its increased market demand, a series of following robots have been launched in the market:

A robot vacuum cleaner is an autonomous robotic vacuum cleaner which includes self-drive mode and cleans the floor autonomously without human control. This robot vacuum cleaner consists of spinning brushes, mopping, UV sterilization and security cameras for cleaning purpose. This vacuum cleaner had some drawbacks like colliding with obstacles and stopped at a shorter distance from walls and other objects.

It was not able to reach to all corners and edges of the room and left those areas unclean An automatic floor cleaner robot has brushes attached to its sides to collect the dust. This robot uses ultrasonic sensors to avoid obstacles and change its direction and it has a suction unit that sucks in the dust while moving around the room freely.But the drawback of this robot is that it cannot clean the wet floor . Roomba vacuum cleaner robot is arranged at 27o angle, the sweeping brush placed under it sweeps the dust and waste from corners and edges. It has a powerful motor suction unit which sucks in the dirt into the filtered dust bin.

CHAPTER 3

MICROCONTROLLER

FEATURES

1. Compatible with MCS-51™ Products
2. 4K Bytes of In-System Reprogrammable Flash Memory– Endurance: 1,000 Write/Erase Cycles
3. Fully Static Operation: 0 Hz to 24 MHz.
4. Three-level Program Memory Lock
5. 128 x 8-bit Internal RAM
6. 32 Programmable I/O Lines
7. Two 16-bit Timer/Counters
8. Six Interrupt Sources
9. Programmable Serial Channel
10. Low-power Idle and Power-down Modes

DESCRIPTION

The AT89C51 is a low-power, high-performance CMOS 8-bit microcomputer with 4Kbytes of Flash programmable and erasable read only memory (PEROM). The deviceis manufactured using Atmel‟s high-density nonvolatile memory technology and iscompatible with the industry-standard MCS-51 instruction set and pinout. Some commercial refrigerating system have one condensing unit connected to two or more evaporators. Multiple (two or more) evaporator refrigeration systems are commonly used in commercial refrigeration applications.

If the evaporator temperatures are identical, the system uses only a low side float or the TEV to control the refrigerator.If two or more evaporating temperatures are desired (a frozen food temperature and a water cooling temperature, for example) a device must be used to keep one of the evaporators at a higher low side pressure [2]. According to the requirement, vapour compression system.The on-chipFlash allows the program memory to be reprogrammed in-system or by a conventionalnonvolatile memory programmer.

According to the requirement, vapour compression system is further modified for better performance and control. Such systems are compound systems, cascade systems and multi evaporator systems. In many refrigeration installations, different temperature are required to be maintained at various point in the plant such as in hotels, large restaurants, institutions, industrial plants and food markets where the food products are received in large quantities and stored at different temperatures.

ARCHITECTURE

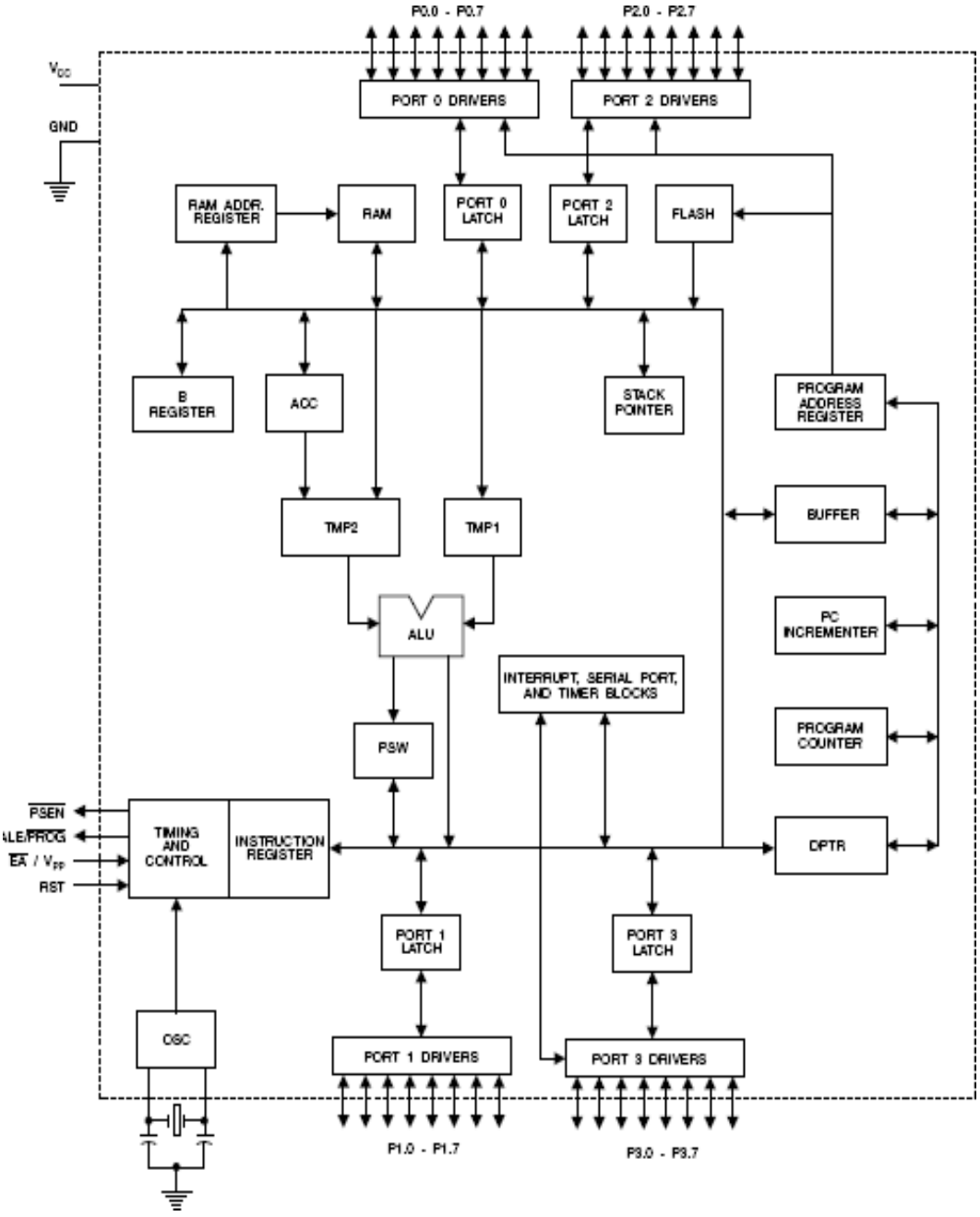
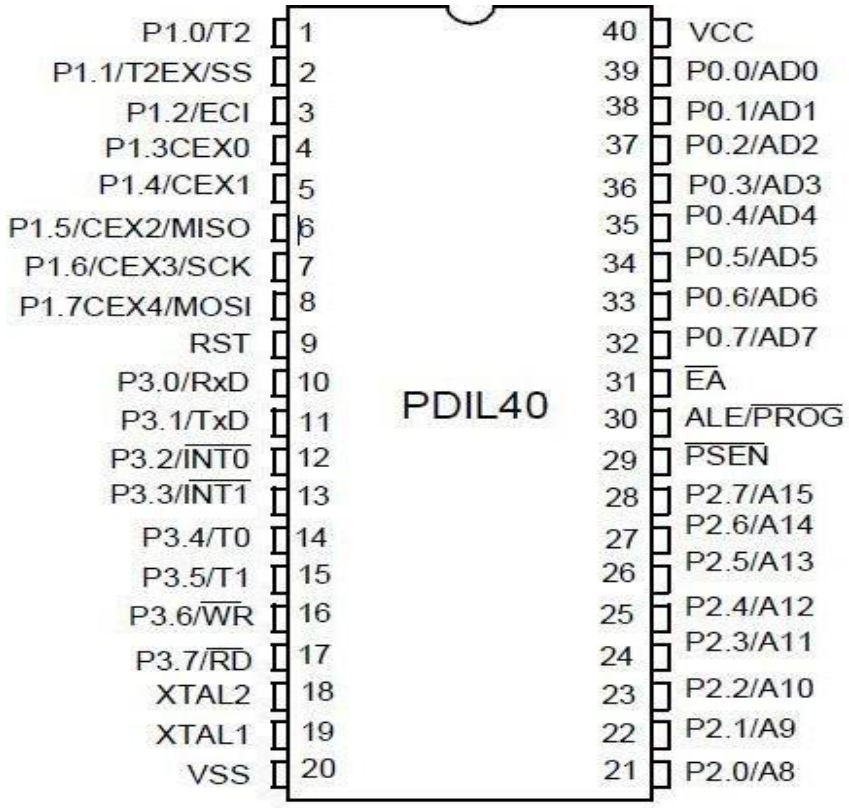


Fig 3.1 A 8051

PIN DIAGRAM



PIN DESCRIPTIONS

VCC-Supply voltage.

GND-Ground.

Port 0

It is an 8-bit open-drain bi-directional I/O port. As an output port, each pin can sink eight TTL inputs.When 1s are written to port 0 pins, the pins can be used as high impedance inputs it may also be configured to be the multiplexed pin.

In this mode P0 has internal pull-ups. Port 0 also receives the code bytes during Flash programming, and outputs the code bytes during program verification. External pull-ups are required during programVerification.

port 1

It is an 8-bit bi-directional I/O port with internal pull-ups.Port 1 also receives the low-order address bytes during Flash programming and verification.The Port 1 output buffers can sink/source four TTL inputs. When 1s are written to Port 1 pins they are pulled high by the internal pull-ups and can be used as inputs.

As inputs,Port 1 pins that are externally being pulled low will source current (IIL) because of the internal pull-ups. Port 1 also receives the low-order address bytes during Flash programming and verification. The training system is a multipurpose module with all features of a complete refrigeration system.Pressure guages are provided for the sunction and discharge pressures.

Port 2

It is an 8-bit bi-directional I/O port with internal pull-upsAs inputs, Port 2 pins that are externally being pulled low will source current (IIL) because of the internal pull-ups.Port 2 emits the high-order address byte during fetches from when 1s are written to port 0 pins, the pins can be used as high impedance inputs it may also be configured to be the multiplexed low order address/data bus during accesses to external program and data memory.In this application, it uses strong internal pull-ups when emitting 1s.

As inputs, Port 2 pins that are externally being pulled low will source current (IIL) because of the internal pull-ups.Port 2 emits the high-order address byte during fetches from external program memory and during accesses to external data memory that uses 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

It is an 8-bit bi-directional I/O port with internal pull-ups. The Port 3 output buffers can source of four TTL inputs. As inputs, Port 3 pins that are externally being pulled low will source current (IIL) because of the pull-ups.Port 3 also serves the functions of various special features of the The Port 3 output buffers can sink/source four TTL inputs.

Port 3 also receives some control signals for Flash programming and verification. . It is based on the concept of H-bridge. the direction of voltage or current flow will be decided by the H-bridge.

When 1s are written to Port 3 pins they are pulled high by the internal pull-ups.As inputs, Port 3 pins that are externally being pulled low will source current (IIL) because of the pull-ups.Port 3 also serves the functions of various special features of the AT89C51 as listed below.

Propeller mounted to a vacuum motor fixed by steel holders and filters are placed on inside of aluminum alloy. Steel sheet has been molded in such a shape that it gave a shape of a robot. Aluminum alloy is also molded into a shape just like steel sheet but of bigger size.

Function of table

Port Pin	Alternate Functions
P3.0	RXD (serial input port)
P3.1	TXD (serial output port)
P3.2	$\overline{\text{INT0}}$ (external interrupt 0)
P3.3	$\overline{\text{INT1}}$ (external interrupt 1)
P3.4	T0 (timer 0 external input)
P3.5	T1 (timer 1 external input)
P3.6	$\overline{\text{WR}}$ (external data memory write strobe)
P3.7	$\overline{\text{RD}}$ (external data memory read strobe)

Port 3 also receives some control signals for Flash programming and verification. **RST-Reset** input

A high on this pin for two machine cycles whilethe oscillator is running resets the device.This pin is also the program pulse input (PROG) during Flashprogramming.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.

ALE/PROG

Address Latch Enable output pulse for latching the low byteof the address during accesses to external memory.

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.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 isweakly pulled high. Setting the ALE-disable bit has no effect if the microcontroller is in external execution mode.

Propeller mounted to a vacuum motor fixed by steel holders and filters are placed on inside of aluminum alloy. Steel sheet has been molded in such a shape that it gave a shape of a robot. Aluminum alloy is also molded into a shape just like steel sheet but of bigger size.

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.

The fresh fruits, fresh vegetables, fresh cut meats, frozen products, dairy products, canned goods, bottled goods have all different conditions of temperature and humidity for storage. In such cases, each location is cooled by its own evaporator in order to obtain more satisfactory control of the condition. For these type of case, system with more than one evaporator**.** Steel sheet has been molded in such a shape that it gave a shape of a robor.

EA/VPP

EA must be strapped to GND inorder to enable the device to fetch code from external programmemory locations starting at 0000H up to FFFFH.This pin also receives the 12-volt programming enable voltage(VPP) during Flash programming, for parts that require12-volt VPP.

It performs 1600 hops per second, with adaptive frequency-hopping (AFH) enabled.The starting frequency of first channel starts at 2402MHz and continues up to 2480MHz in 1MHz steps. It performs 1600 hops per second, with adaptive frequency-hopping (AFH) enabled.Bluetooth operating range is 2400-2483.5MHz.

XTAL1- Input to the inverting oscillator amplifier and input to theinternal clock operating circuit.

XTAL2- Output from the inverting oscillator amplifier.

ABSOLUTE MAXIMUM RATINGS

The maximum ratings are operating temperature, storage temperature and maximum operating voltage in table.

Operating Temperature	-55ºC to +125ºC
Storage Temperature	-65C to +150C
Voltage on any Pin with Respect to Ground	-1.0V to +7.0V
Maximum Operating Voltage	6.6V
DC Output Current	15.0mA

CHAPTER 4

SENSORS

HC-05 Bluetooth Bluetooth® wireless technology is becoming a popular standard in the communication. it is one of the fastest growing fields in the wireless technologies. It is convenient, easy to use and has the bandwidth to meet most of today‟s demands for mobile and personal communications. Bluetooth technology handles the wireless part of the communication channel; it transmits and receives data wirelessly between these devices.

It uses CSR Bluecore 04-External single chip Bluetooth system with CMOS technology and with AFH(Adaptive Frequency Hopping Feature). It has the footprint as small as 12.7mmx27mm. Hope it will simplify your overall design/development cycle. It can be easily interfaced with Arduino Board, Raspberry Pi, Microcontrollers through serial UART interface.

It delivers the received data and receives the data to be transmitted to and from a host system through a host controller interface (HCI). The most popular host controller interface today is either a UART or a USB .Here, I will only focus on the UART interface, it can be easily show how a Bluetooth module can be integrated on to a host system through a UART connection and provide the designer an optimal solution for Bluetooth enabled systems If the command is successfully understood by the module. can be easily interfaced with Arduino Board, Raspberry Pi, Microcontrollers through serial UART interface.

The bluetooth module I will use today is HC-05 which is so familiar and cheap. It is easily available in local indian markets. You can go either offline or online. You may find in about ~600 ₹. May be if you search better, you can get as low as 450 ₹. HC-05 Bluetooth Module is one of the most popular bluetooth module used in embedded projects. It can be easily interfaced with Arduino Board, Raspberry Pi, Microcontrollers through serial UART interface.

HC-05 module is an easy to useBluetooth SPP (Serial Port Protocol) module, designed for transparent wireless serial connection setup.Serial port Bluetooth module is fully qualified Bluetooth V2.0+EDR (Enhanced Data Rate) 3Mbps Modulation with complete 2.4GHz radio transceiver and baseband. It uses CSR Bluecore 04-External single chip Bluetooth system with CMOS technology and with AFH(Adaptive Frequency Hopping Feature). It has the footprint as small as 12.7mmx27mm. Hope it will simplify your overall design/development cycle.

Specifications

Frequency : 2.4GHz ISM Band

Bluetooth Protocol : Bluetooth Specification v2.0 + EDR

Emission Power : ≤4dBm, Class 2

Operating Voltage : 3.3V

Input Power Supply : 3.6V ~ 6V

Working Temperature : -20°C ~ +75°C

Dimensions : 35.7mm x 15.2mm x 5.6mm

Features

3.3V TTL Compatible

Wide Input Voltage Range : 3.3V ~ 6V

Supported Baud Rates : 9600, 19200, 38400, 57600, 115200, 230400, 460800.

Auto Connect to Last Device on power as default Supports Master and Slave Mode

This module works on AT Commands. Lets have a look at important AT commands.

KEY: if set to HIGH module goes into command mode for configuration

RXD: the RXD signal line – 5V safe

TXD: the TXD signal line – 5V safe

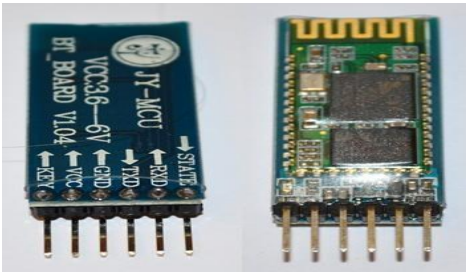
Vcc: connection for 5V supply voltage

GND: Ground

State : Not connected

The Module has two modes of operation namelyit can be programmed using Arduino IDE via a type B USB cable.

Input voltage range of Arduino UNO lies between 7 to 20 volts but the operating voltage of Arduino UNO is 5V. The Clock speed of Arduino UNO is 16MHz. It has 32KB flash memory, 2KB SRAM and 1KB EEPROM.This module works on AT Commands.



AT Command Mode

It is a mode of the module where a set of commands (AT Commands) are used to setup and configure the module. In this mode, the module can‟t be detected by other Bluetooth Devices.Devicesll For this mode take Key pin to HIGH. All the Commands are sent to the module serially as a string. This string must be capital letters (case sensitive) and each command should be ended by “\r\n”.

If the command is successfully understood by the module, the module will reply back with a response string usually contains the string“OK”.Otherwise, the module returns back the error string “ERROR()” with a specific code that defines the type of this error.Motor controllers commonly known as H-Bridge, are used fordriving motors in both direction that is clockwise and counter-clockwise with current rating of 15 A.

This controller consists of two parts. First part is to energize relays through Arduinocontroller and drive motors while second part is for controlling the speed of motors. Relays are used for switching purposes while transistors are used for speed control.

Relays used in this circuit have rating of 12V dc coil and 15A current while lead acid battery of a 12V and 1.2Ah rating. Since encoder motors have a stall current of 7A so for safe purpose 15A relays have been used. Two diodes are implemented in fly back diode configuration.

This is a condition in which a diode is put in reverse state between battery terminals and is commonly known as free-wheeling diode. At de-energizing of relay huge voltage is produced in backward state and can damaged other components so to avoid this damage a diode in fly back configuration is used along with relay. Pulse width modulation (PWM) is used for speed control. PWM is given to transistor BJT 2N2222 along with some duty cycle to compel motor to start at some intervals resulting in controlling speed**.**

Connection Mode

In this mode the device can directly communicate with other devices. We can search this device on other devices and can connect via entering the passkey. Then we need a terminal program at Laptop side. For the i used RealTerm. You can use Putty, Terminal or HyperTerminal even. If you want download links for them here are some of them.the default passkey is „1234“. In this mode we cannot change its configuration serially, but can only communicate with it.

Key pin should be NC for this case.. It uses CSR Bluecore 04-External single chip Bluetooth system with CMOS technology and with AFH(Adaptive Frequency Hopping Feature). has the footprint as small as 12.7mmx27mm. Hope it will simplify your overall design/development cycl. . It performs 1600 hops per second, with adaptive frequency-hopping (AFH) enabled.

Microcontroller section:

You can use any of your favorite microcontrollers, but the condition is it should be having atleast one serial port.Because the default baudrate of module was 38400 hence not easy to direct communicate with microcontroller. So i changed few of settings of HC-05 and changed its baudrate.

I did it via my Laptop and a USB to TTL converter. You may use any it of any type such as FTDI, Prolific PL2303 or Scilab CP2021. Then we need a terminal program at Laptop side. For the i used RealTerm. You can use Putty, Terminal or HyperTerminal even. If you want download links for them here are some of them.

CHAPTER 5

POWER SUPPLY

Block Diagram

The ac voltage, typically 220V rms, is connected to a transformer, which steps that ac voltage down to the level of the desired dc output. A diode rectifier then provides a full-wave rectified voltage that is initially filtered by a simple capacitor filter to produce a dc voltage. This resulting dc voltage usually has some ripple or ac voltage variation.

A regulator circuit removes the ripples and also remains the same dc value even if the input dc voltage varies, or the load connected to the output dc voltage changes. This voltage regulation is usually obtained using one of the popular voltage regulator IC units.

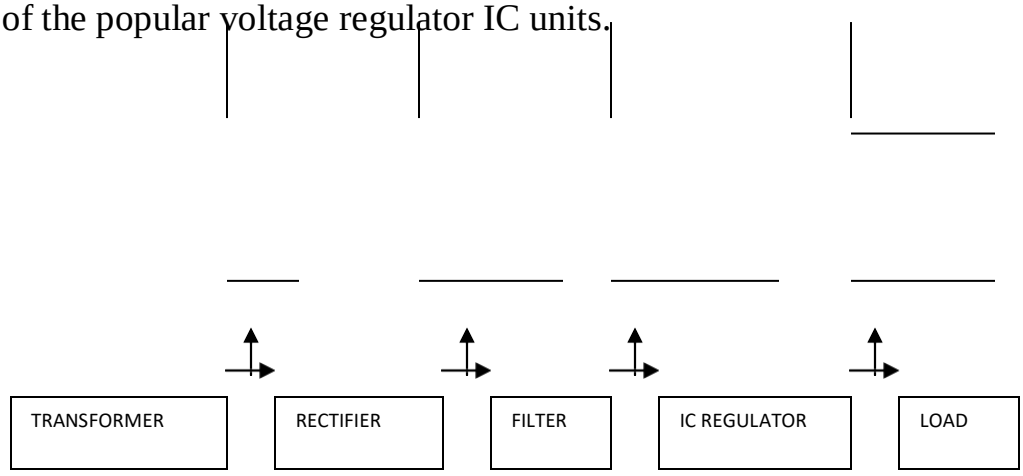


Fig 5.1 BLOK DIAGRAM OF POWER SUPPLY

Transformer

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

Therefore, the peak output voltage across the load resistor is nearly 1000 volts. With both circuits using the same transformer, the bridge rectifier circuit produces a higher output voltage than the conventional full-wave rectifier circuit.

Bridge rectifier

When four diodes are connected as shown in figure, the circuit is called as bridge rectifier. The input to the circuit is applied to the diagonally opposite corners of the network, and the output is taken from the remaining two corners. Let us assume that the transformer is working properly and there is a positive potential, at point A and a negative potential at point B.the positive potential at point A will forward bias D3 and reverse bias D4.

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

In the bridge rectifier shown in view B, the maximum voltage that can be rectified is the full secondary voltage, which is 1000 volts.The regulators can be selected for operation with load currents from hundreds of milli amperes to tens of amperes, corresponding to power ratings from milli watts to tens of watts.

Therefore, the peak output voltage across the load resistor is nearly 1000 volts. With both circuits using the same transformer, the bridge rectifier circuit produces a higher output voltage than the conventional full-wave rectifier circuit. The circuit used for controlling of vacuum cleaner consists of one transistor, one relay, one diode and two batteries.

One Lead acid battery of 12V and 1.2Ah ratings is for power controlling (ON/OFF) of vacuum cleaner by energizing coil of relay having diode in a fly back position while one LIPO battery of 18V and 5Ah is for supplying power to vacuum cleaner with different ground terminals to avoid short circuit currents and properly isolate the batteries from circuit including a separate Yellow LED for Disconnected stateowing to section.

ICIC voltage regulators

Voltage regulators comprise a class of widely used ICs. Regulator IC units contain the circuitry for reference source, comparator amplifier, control device, and overload protection all i.driver IC has 16 pinswhich are used to control a set of two DC motors simultaneously in any direction.

The regulators can be selected for operation with load currents from hundreds of milli amperes to tens of amperes, corresponding to power ratings from milli watts to tens of watts.The input to the circuit is applied to the diagonally opposite corners of the network, and the output is taken from the remaining two corners.L293D is a Motor Driver IC which allows DC motor to drive on either direction. L293D motor driver IC has 16 pinswhich are used to control a set of two DC motors simultaneously in any direction.

ItThe regulators can be selected for operation with load currents from hundreds of milli amperes to tens of amperes, corresponding to power ratings from milli watts to tens of watts.The maximum voltage that appears across the load resistor is nearly-but never exceeds-500 v0lts, as result of the small voltage drop across the diode. In the bridge rectifier shown in view B, the maximum voltage that can be rectified is the full secondary voltage, which is 1000 volts.

Circuit diagram:

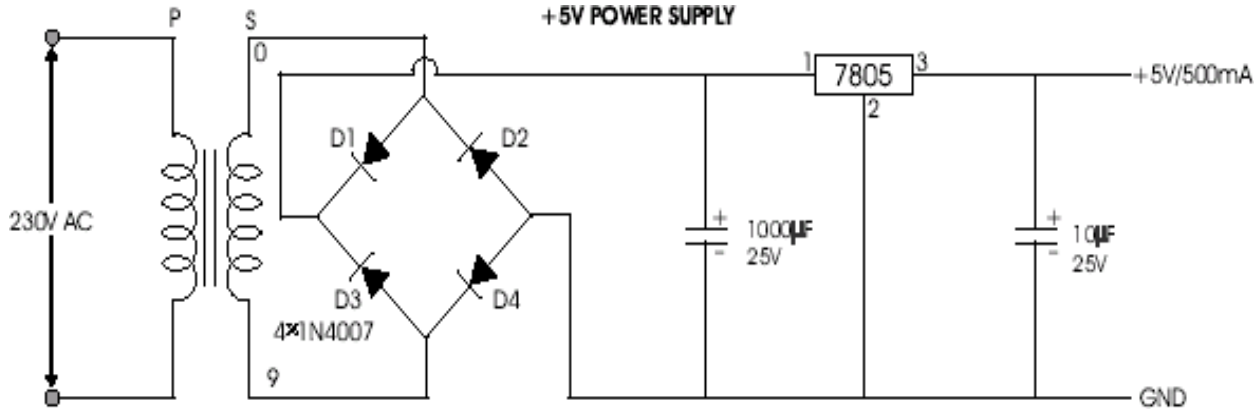


Fig 5.2 CIRCUIT DIAGRAM OF POWER SUPPLY

A fixed three-terminal voltage regulator has an unregulated dc input voltage, Vi, applied to one input terminal, a regulated dc output voltage, Vo, from a second terminal, with the third terminal connected to ground.The series 78 regulators provide fixed positive regulated voltages from 5 to 24 volts. Similarly, the series 79 regulators provide fixed negative regulated voltages from 5 to 24 volts.

- For ICs, microcontroller, LCD --------- 5 volts

For alarm circuit, op-amp, relay circuits----------12 volts

Mechanical body consists of four parts i.e., chassis, brushing mechanism, vacuum cleaning and dirt disposal mechanism. Combination all these four parts makes a complete prototype for testing, as shown in Figure Before fabrication, complete CAD Model was designed using a commercially available software.

Chassis

The base of the body comprises of acrylic sheet, two encoder motorsalong with Teflon tires having O-rings on them for avoiding friction, two ball casters of adjustable height having frictionless steel balls, aluminum angular brackets and aluminum holders for two lead acid batteries of 12V and 1.2Ah rating.These motorsare independentlypowered and mounted diagonally and two ball casters are placed at other diagonal of acrylic sheet so that motors can move along its axis easily and bear more weight as compared to chain mechanism.

Cleaning assembly includes a DC geared motor, sprockets for moving chain from geared motor to rotating brush and two aluminum rods for supporting vacuum cleaner mechanism and dirt compartment.

This DC geared motor has been fitted on one side of acrylic sheet with aluminum holder and sprockets installed with it which have been fitted into shaft of motor. All components are installed on lower side of acrylic sheet so that center of gravity should be lower and robot would be stable.

Brushing

Brushing mechanism consists of one rolling brush, steel sheet for cover, two aluminum holders, two ball-bearing and one mild steel strip. One rolling brush mounted on aluminum holders with bearings inside them. This mechanism is attached through mild steel strip to the base of robot. Brush is used to broom the dirt particles into the vacuum chamberin case of carpeted floor for efficient cleaning.

Vacuum Cleaning and Dirt Disposal

Vacuum cleaning and dirt disposal mechanism consists of vacuum motor, propeller, steel holders for fixing motor, filter mounted on two steel rods, aluminum alloy sheet, steel sheet, servo motor, aluminum brackets and aluminum strips.

Propeller mounted to a vacuum motor fixed by steel holders and filters are placed on inside of aluminum alloy. Aluminum alloy is also molded into a shape just like steel sheet but of bigger size. Both sheets are attached together results in narrow tunnel from front side and broad compartment at back side. This circuit consists of two buffer ICs, six colored LED‟s (3-Red &3-Green) indicating battery power status.

Arduino UNO

The Arduino UNO board consists of fourteen digital input/output pins and six analog input pins. It can be programmed using Arduino IDE via a type B USB cable. Input voltage range of Arduino UNO lies between 7 to 20 volts but the operating voltage of Arduino UNO is 5V. The Clock speed of Arduino UNO is 16MHz. It has 32KB flash memory, 2KB SRAM and 1KB EEPROM3.2. Bluetooth ModuleBluetooth operating range is 2400-2483.5MHz.

Frequency-hopping spread spectrum technology is used by Bluetooth. The data transmission is done in packets and each packet is transmitted on any one of the Bluetooth channel which has a bandwidth of 1MHz. Bluetooth 4.0 allows spacing of 2MHz for 40 channels. The starting frequency of first channel starts at 2402MHz and continues up to 2480MHz in 1MHz steps.

It performs 1600 hops per second, with adaptive frequency-hopping (AFH) enabled.3.3. L293D Motor Driver ICL293D is a Motor Driver IC which allows DC motor to drive on either direction. L293D motor driver IC has 16 pins which are used to control a set of two DC motors simultaneously in any direction. It is based on the concept of H-bridge. The direction ofvoltage or current flow will be decided by the H-bridge**.**This circuit consists of two buffer ICs, six colored LED‟s(3-Red &3-Green) indicating battery power statusand four resistors for voltage divider.

Positive terminal of circuit battery is connected to one resistor and output taken from second resistor gives a fixed voltage that fixed voltage goes to buffer IC so that no current should be drawn from circuit and process can be done easily. That fixed voltage after buffer IC goes to arduino where it is programmed and processed; results in turning ON/OFF of LED‟s showing whether battery is charged or discharged depending on value of voltage being fed into Arduino.

Resistors should have values in kilo ohms so that current would be in mille amperes to meet the offset of buffer IC. If resistors of high wattage and values of mega ohm used then current will be in micro amperes and buffer IC offset will not reached and IC would not be in working state. This feature of power level indication using average power over an extended period affectinglong term energy consumption on hardware separately is in accordance withfrom section.

After switching, relay will allow 18V battery to supply power through it and turns on vacuum cleaner through an ON/ OFF switchThe vacuum cleaner is able to clean, brush and auto dispose-off. The robot named as CLEAR (cleaning entresol autonomous robot), it has variable speed and power efficient.

Mode Toggle

The robot can be used in two different modes i.e., automatic mode & manual mode.

When the robot is in automatic mode, the icon shows M, showing that the user can click on it to convert the robot to manual mode. Whenever mode is toggled, it is notified to user by a buzzer sound owing to section.The objective ofthis project is to make a vacuum cleaning robot which is fully autonomous and manual featured with user friendly interface. The vacuum cleaner is able to clean, brush and auto dispose-off.

The robot named as CLEAR (cleaning entresol autonomous robot), it has variable speed and power efficient. The testing of the robot showed that it can achieve almost all the functionalities which were planned to implement originally. CLEAR can be used in autonomous and manual modes as per user‟s will. During its autonomous mode, this robot can be scheduled with a proper date and time.

CHAPTER 6

SOURCE CODE

```
#include<stdio.h>
#include<intrins.h>
#include <string.h>
//#include <ds1307.h>
//#include <p89v51rz2.h>
#include <stdlib.h>
//#include <REG8252.H>
#include <REGX52.H>
sbit RS    = P3^5;
sbit RW    = P3^3;
sbitlcd_e = P3^4;

#define DATA P1

void ds( long intct)
{  // mSec Delay 11.0592 Mhz

while(ct--);
}
void lcd_cmd(unsigned char cmnd)
{
char cd;
```

```
cd=cmnd   ;
RS=1;ds(25);
RS = 0;ds(5);
DATA = cmnd ;
lcd_e = 1;
ds(15);
lcd_e = 0;
}
void lcd_init(void)
{
lcd_cmd(0x38);          //  0x38 2x16 Character 5x7 dot
ds(5);                          //matrix LCD,8-bit
format
lcd_cmd(0x0c);          //Display On, cursor off
ds(5);
lcd_cmd(0x06);          //Shift Cursor to right
ds(5);
lcd_cmd(0x01);          //Clear display screen
ds(5);
}

void lcd_gotoxy( int x, int y)

{
int address;
if(y==1)
```

```
if(y==2)
address=0xc0;  //c0
if(y==3)
address=0x94;
if(y==4)
address=0xd4;
address+=x; // -1
lcd_cmd(0x80|address);
}
void lcd_putc(unsigned char dat)
{

RS = 1;
ds(15);
DATA = dat ;
ds(15);
lcd_e = 1;
ds(10);
lcd_e = 0;
}
void srg(const char *q)
  // mSec Delay 11.0592 Mhz
while(ct--);
}
void lcd_cmd(unsigned char cmnd)
```

```
{
char cd;
cd=cmnd   ;
RS=1;ds(25);
RS = 0;ds(5);
DATA = cmnd ;
lcd_e = 1;
ds(15);
lcd_e = 0;
}
void lcd_init(void)
{
lcd_cmd(0x38);          //  0x38 2x16 Character 5x7 dot
ds(5);                          //matrix LCD,8-bit
format
lcd_cmd(0x0c);          //Display On, cursor off
ds(5);
lcd_cmd(0x06);          //Shift Cursor to right
ds(5);
lcd_cmd(0x01);          //Clear display screen
ds(5);
{
while (*q) {
lcd_putc(*q++);
}
```

```
}
void main(void)
{
char its;
enable     */

ds(1048);printf("E556,-321,982\n");
lcd_cmd(0x80 +0x00);;srg("welcome");

ds(5000);
lcd_cmd(0x80 +0x00);; srg(" From rx =");
do
{
ds(1048);printf("E556,-321,982\n");ds(25);
ds(1048);printf("E256,-721,982\n");
ds(1048);printf("E556,-321,982\n");
ds(1048);printf("E756,-721,982\n");
ds(1048);printf("E156,-521,982\n");
its = getchar();     // read a response from the user
ds(25);
lcd_cmd(0x80 +0x0A);lcd_putc(its);
if (its=='A'){lcd_cmd(0x80 +0x44);
lcd_putc(its);printf("\n\r1 ON [%c]",its);P2|=0x01;}
if (its=='a'){lcd_cmd(0x80 +0x44);
lcd_putc(its);printf("\n\r1 OFF [%c]",its);P2&=~0x01;}
```

```
if (its=='B'){lcd_cmd(0x80 +0x45);
lcd_putc(its);printf("\n\r1 ON [%c]",its);P2|=0x02;}
if (its=='b'){lcd_cmd(0x80 +0x45);
lcd_putc(its);printf("\n\r1 OFF [%c]",its);P2&=~0x02;}
if (its=='C'){lcd_cmd(0x80 +0x46);
lcd_putc(its);printf("\n\r1 ON [%c]",its);P2|=0x04;}
if (its=='c'){lcd_cmd(0x80 +0x46);
lcd_putc(its);printf("\n\r1 OFF [%c]",its);P2&=~0x04;}
if (its=='D'){lcd_cmd(0x80 +0x47);
lcd_putc(its);printf("\n\r1 ON [%c]",its);P2|=0x08;}
if (its=='d'){lcd_cmd(0x80 +0x47);
lcd_putc(its);printf("\n\r1 OFF
[%c]",its);P2&=~0x08;}
if (its=='F'){lcd_cmd(0x80 +0x47);
lcd_putc(its);printf("\n\r1 ON [%c]",its);P2|=0x10;}
if (its=='f'){lcd_cmd(0x80 +0x47);
lcd_putc(its);printf("\n\r1 OFF [%c]",its);P2&=~0x10;}
ds(5);
{
while (*q) {
lcd_putc(*q++);
}
void main(void)
{
char its;
enable     */
```

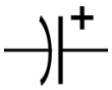
```
ds(1048);printf("E556,-321,982\n");
lcd_cmd(0x80 +0x00);;srg("welcome");
ds(5000);
lcd_cmd(0x80 +0x00);; srg(" From rx =");
do
putc(its);printf("\n\r1 OFF
[%c]",its);P2&=~0x01;P2&=~0x02;P2&=~0x04;P2
&=~0x08;P2&=~0x10;}
if (its=='S'){lcd_cmd(0x80 +0x47);
lcd_putc(its);printf("\n\r1 ON
[%c]",its);P2|=0x01;P2|=0x02;P2|=0x04;P2|=0x08;P2|=
0x10;}
}
while(1);
}
```

CHAPTER 7

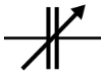
HARDWARE SETUP

1) Capacitor

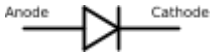
2) Capacitor, polarized



3) Capacitor, variable



4) Diode



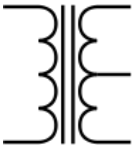
5) Zener diode

6) LED

7) Photodiode

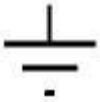
8) Inductor

9) Transformer



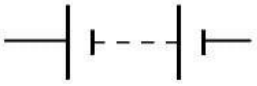
10) NPN transistor

11) Earth or ground



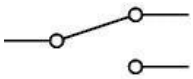
12) Fuse

13) Battery

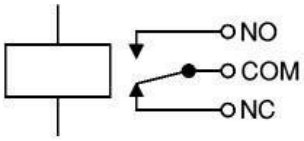


14)SPST (on-off switch)

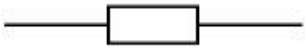
14) 15) SPDT (2-way switch)



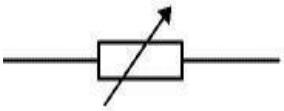
16) Relay



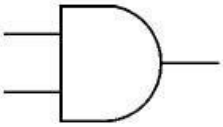
17) Resistor



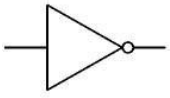
18) Variable resistor



19) And gate



20) Not gate



CHAPTER 8

CONCLUSION

This project shows the implementation of IEEE Standard 1621 IEEE Standard for User Interface Elements in Power Control of Electronic Devices Employed in Office/Consumer Environments in terms of smart floor cleaning robot. This project shows a better and simple approach to provide an overview of design of a simple robotic cleaners control design using gadgets and instruments easily available in Pakistani market.

This robot (CLEAR) is specially made on the basis of modern technology. CLEAR has all the features which are required for a vacuum cleaner. It can work automatically and manuallyAs it has scheduling feature which can be operated with computer only, android and windows app can be made to make it little more user friendly The target audience with all the features is middle and upper class of Pakistani community. It can also be used for the industries where cleaning with the help of human is toxic, vacuum cleaner can easily be used.

As it has scheduling feature which can be operated with computer only, android and windows app can be made to make it little more user friendly. The target audience with all the features is middle and upper classIt can also be used for the industries where cleaning with the help of human is toxic, vacuum cleaner can easily be used..

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