Automatic Floor Cleaner

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Abstract

With the advancement of technology, robots are getting more attention of researches to make life of mankind comfortable. This projects presents the design, development and fabrication of prototype automatic floor cleaner. This robot operates autonomous mode with additional features like dirt container with air vacuum mechanism and pick and place mechanism. This work is very useful in improving life style of mankind.

Keywords

Arduino, Solar Pannel, IR Sensor, Ultrasonic Sensor, Driver IC, Bluetooth, Solenoid Valve

I. Introduction

In recent years, robotic cleaners have taken major attention in robotic research due to their effectiveness in assisting humans in floor cleaning applications at homes, hotels, restaurants, offices, hospitals, workshops etc. Basically, robotic cleaner are distinguished on their cleaning expertise like floor mapping, dry vacuum cleaning etc. Each cleaning and operating mechanism of robotic floor cleaners has its own advantages and disadvantages.

In this work, "Automatic Floor Cleaner" have been designed for offices, homes also in collages. In one of the mode this robot is fully automatic and making decisions on the basis of humans or various sensors which are used in this cleaning robot. These sensors are controlled by Arduino controller also controls the DC motors with the help of driving circuitry. In manual mode, the robot can also be used to clean specific area of a room. The mechanical design of robot including vacuum cleaning mechanism, phenol tank, DC fan, pick and place etc. The main objective of this project is to provide a substantial solution to the problem of manufacturing robotic cleaner utilizing local resources while keeping it low costs.

Manual work is taken over the robot technology and many of the related robot appliances are being used extensively also. Here represents the technology that proposed the working of robot for Floor cleaning. This floor cleaner robot can work in any of two modes i.e. Automatic and Manual. RF modules have been used for wireless communication between remote and robot. This robot is incorporated with IR sensor for obstacle detection.

II. Related Work

Power supply(5-12V). From solar panel we charge the battery. Voltage which is coming from the sun is not constant for that we use charge controller. This voltage is stored in battery. But this voltage is more than the required voltage of Arduino so that we use voltage regulator. Here we use relay driver, A relay as we all know is an electromechanical device which is used in the form of a switch .it is connected to solenoid valve. It consists of one input and one output. By using the relay driver we can operate dc motor and cleaning mechanism. Also for hardware controlling purpose we use RF transmitter and receiver. Here IR sensor is used for obstacle detection and ultrasonic sensor is used for fall detection. Driver circuit is connected to Arduino. Driver circuit is connected to motor. For moving the wheels in clockwise or anticlockwise direction motor is used also for pick and place operation we use motor.
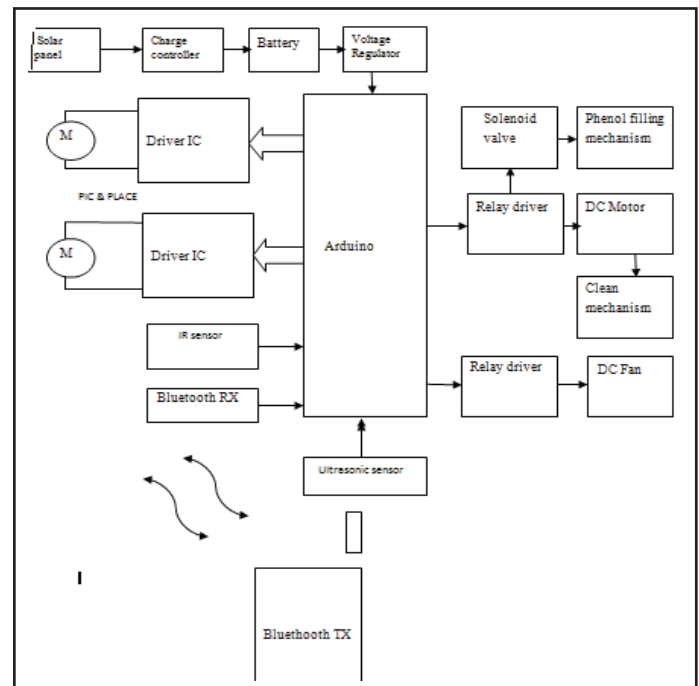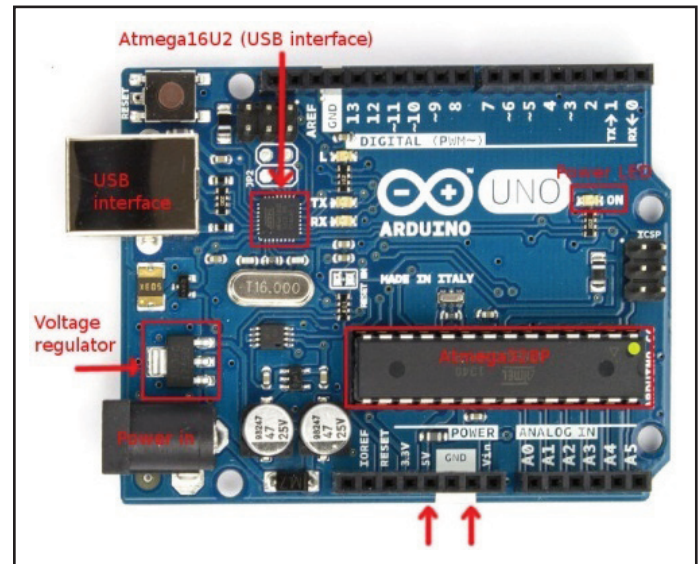

Fig. 1:

A. Arduino

Fig. 2:

The Arduino Uno is a microcontroller board based on the ATmega328 (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, 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 a AC-to-DC adapter or battery to get started

Arduino is open source prototyping platform based on easy to use hardware and software.

"Uno" means one in Italian and is named to mark the upcoming release of Arduino 1.0. The Uno and version 1.0 will be the reference versions of Arduino, moving forward. The Uno is the latest in a series of USB Arduino boards, and the reference model for the Arduino platform; for a comparison with previous versions

B. DC Motor

Fig. 3:

A DC motor is any of a class of electrical machines that converts direct current electrical power into mechanical power. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic, to periodically change the direction of current flow in part of the motor. Most types produce rotary motion; a linear motor directly produces force and motion in a straight line. DC motors were the first type widely used, since they could be powered from existing direct-current lighting power distribution systems. A DC motor's speed can be controlled over a wide range, using either a variable supply voltage or by changing the strength of current in its field windings.
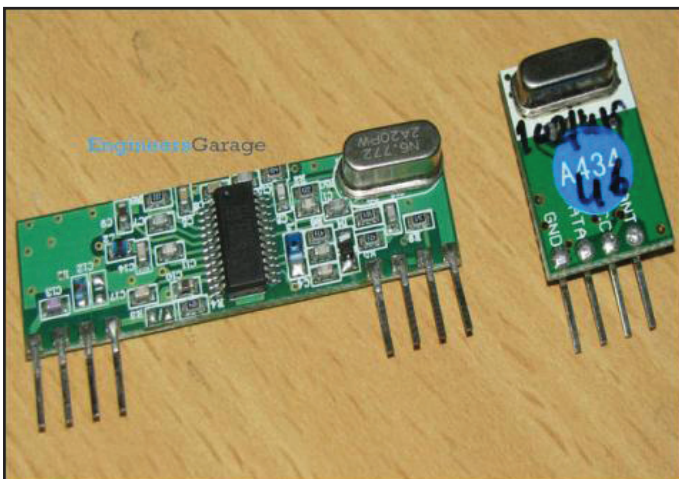
C. RF Transmitter and Receiver

Fig. 4:

The RF module, as the name suggests, operates at Radio Frequency. The corresponding frequency range varies between 30 kHz & 300

GHz. In this RF system, the digital data is represented as variations in the amplitude of carrier wave. This kind of modulation is known as Amplitude Shift Keying (ASK).

signals through RF can travel through larger distances making it suitable for long range applications. Also, while IR mostly operates in line-of-sight mode, RF signals can travel even when there is an obstruction between transmitter & receiver. Next, RF transmission is more strong and reliable than IR transmission. RF communication uses a specific frequency unlike IR signals which are affected by other IR emitting sources.

This RF module comprises of an RF Transmitter and an RF Receiver. The transmitter/receiver (Tx/Rx) pair operates at a frequency of 434 MHz. An RF transmitter receives serial data and transmits it wirelessly through RF through its antenna connected at pin4. The transmission occurs at the rate of 1Kbps - 10Kbps. The transmitted data is received by an RF receiver operating at the same frequency as that of the transmitter.
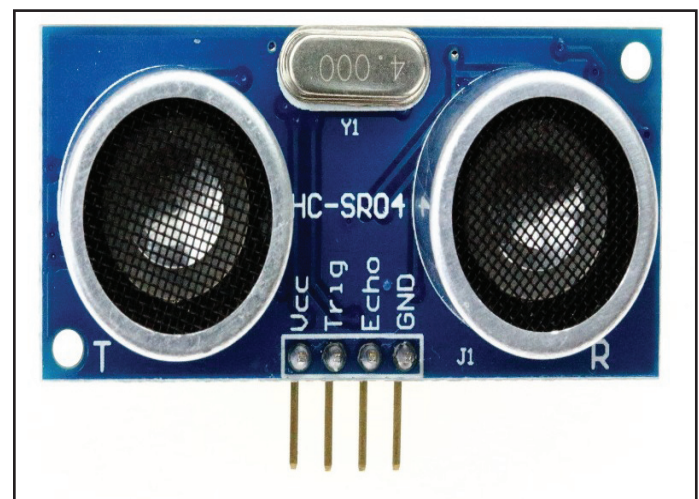
D. Ultrasonic Sensor

Fig. 5:

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.

The basic principle of work:
1. Using IO trigger for at least 10us high level signal,
2. The Module automatically sends eight 40 kHz and detect whether there is a pulse signal back.
3. IF the signal back, through high level , time of high output IO duration is the time from sending ultrasonic to returning.

Test distance = (high level time × velocity of sound (340M/S) / 2

E. Motor Driver IC

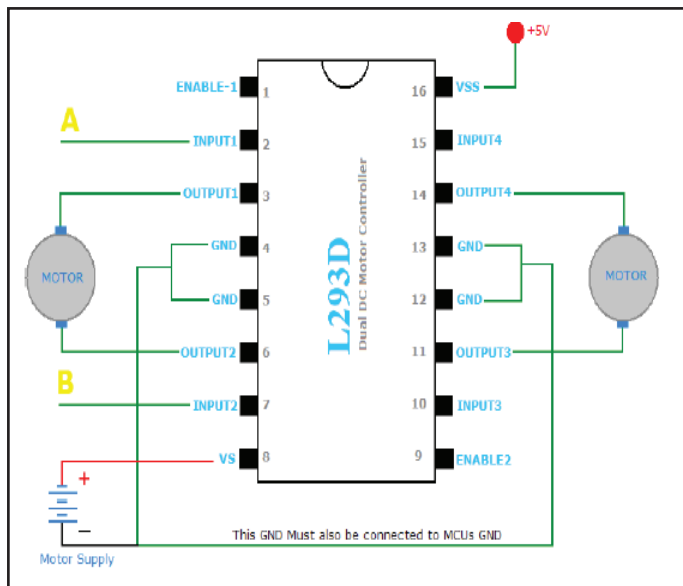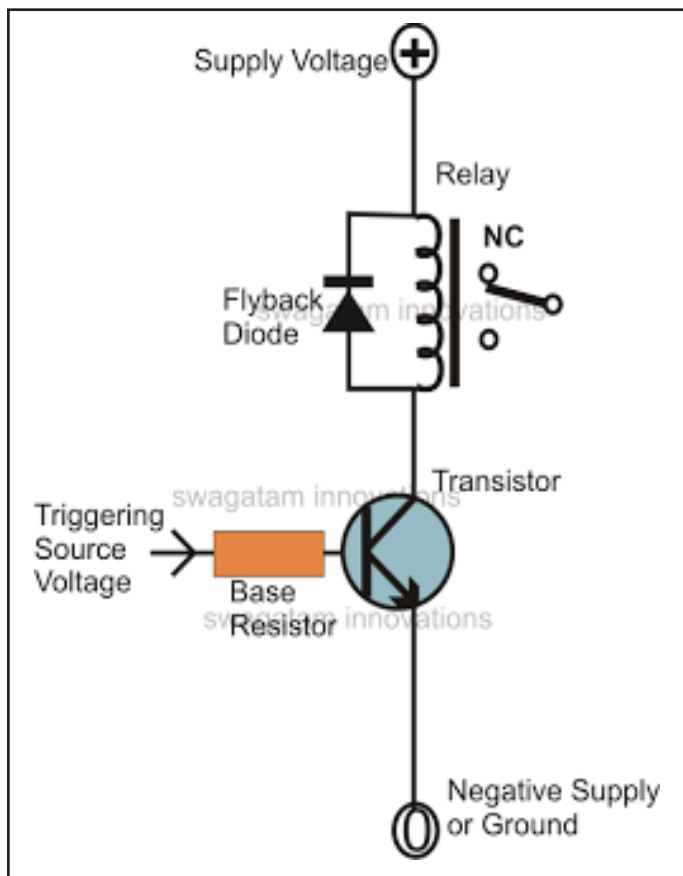| The behavior of motor for various input conditions are as follows		
	A	B
Stop	Low	Low
Clockwise	Low	High
Anti Clockwise	High	Low
Stop	High	High

Fig. 6:

F. Relay Driver

Fig. 7:

Relays are one of the most important components in electronic circuits. Especially in circuits where high power transfer or mains AC load switching is involved, relays play the major role in implementing the operations. A relay, as we all know is an electromechanical device which is used in the form of a switch.

It is responsible for switching an external load connected to its contacts in response to a relatively smaller electrical power applied across an associated coil.

Basically the coil is wound over an iron core, when a small DC is applied to the coil, it energizes and behaves like an electromagnet.

A spring loaded contact mechanism placed at a close proximity to the coil immediately responds and gets attracted toward the energized coil electromagnet force. In the course the contact connects one of its pair together and disconnects an complementary pair associated with it.

The reverse happens when the DC is switched OFF to the coil and the contacts return to its original position, connecting the previous set of complementary contacts and the cycle may be repeated as many times as possible.

An electronic circuit will normally need a relay stage in order to converter it's low power DC switching output into a high power mains AC switching output.

However the low level signals from an electronic which may be derived from an IC stage or a low current transistor stage may be be pretty incapable of driving a relay directly. Because, a relay requires relatively higher DC currents which may be normally not available from an IC source or a low current transistor stage.

In order to overcome the above issue, a relay driver stage becomes imperative for all electronic circuits which need this service.

A relay driver circuit is nothing but an additional transistor stage attached with the relay which needs to be operated. The transistor is typically and solely employed for operating the relay in response to the commands received from the preceding control stage.
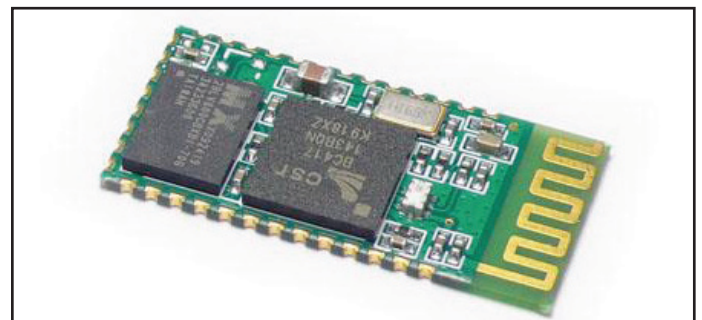
G. Bluetooth

Fig. 8:

HC-05 module is an easy to use Bluetooth 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.

III. Process Desceiption
In this Project we use Arduino Microprocessor which is connected to Power supply(5-12V). From solar panel we charge the battery. Voltage which is coming from the sun is not constant for that we

use charge controller. This voltage is stored in battery. But this voltage is more than the required voltage of Arduino so that we use voltage regulator. Here we use relay driver, A relay as we all know is an electromechanical device which is used in the form of a switch .it is connected to solenoid valve. It consists of one input and one output. By using the relay driver we can operate dc motor and cleaning mechanism. Also for hardware controlling purpose we use RF transmitter and receiver. Here IR sensor is used for obstacle detection and ultrasonic sensor is used for fall detection. Driver circuit is connected to Arduino. Driver circuit is connected to motor. For moving the wheels in clockwise or anticlockwise direction motor is used also for pick and place operation we use motor.

A. Hardware Implementation

Fig. 9:

IV. Conclusions

This setup of hardware with a combination of software gives better accuracy and reduces the work load. Man power is minimized. It have Low cost. It is aTime Consuming Device Making a small machine brings a flexibility to do work.

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