SMART FLOOR CLEANING ROBOT

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Abstract: Smart floor cleaning robot is a compact robotics system which provides floor cleaning services in room ,big offices reducing human labor .Robot can achieve the function of intelligent obstacle avoidance, automatic sweeping and mopping. The aim of this project work is to develop and modernized process for cleaning the floor with wet and dry. This smart floor cleaning robot work in any of two modes i.e." Automatic and Semi-automatic". This robot can perform sweeping and mopping operation. All hardware and software operations are controlled by Arduino ATmega328 microcontroller. Bluetooth module have been used for wireless communication between android mobile(semi-automatic) and robot having range 100m.

I. INTRODUCTION

Now days robot are entering market to reduce human efforts and energy to get accurate work. The purpose of choosing this project is to modern technology as well as reducing human efforts. The robot is an device in which whole program is fed in brain. Robot is an electromechanical machine and used for various purposes in industrial and domestic applications. Robots play an important role in each every field of life.

The smart floor cleaning robot based on ATmega328 controller which works in two modes as per user convenience automatic and semi-automatic .The mode can be selected by using switch which was embedded on circuit board. The Robot can perform two operations sweeping and mopping i.e. wet and dry cleaning. It operates on 12V power supply. When we select automatic mode the robot perform all operations itself without human interference. The IR sensor and Ultrasonic sensor are used for obstacle detection and distance measurement. Bluetooth module has been used for serial communication purpose between robot and mobile in semi-automatic mode. In semi-automatic mode, the robot can perform operation according to human message. In automatic mode, if any obstacle is detected in front of robot then it will stop operation ,change path and resume all operation , then move in forward direction. IC ULN2003 relay driver is used to drive the water pump and cleaner motor. IC L293D driver used to control two Dc motor simultaneously.

II. SYSTEM ARCHITECTURE

The above fig.1.shows the system architecture of Smart floor cleaning robot. It contains three types of sensors Ultrasonic and IR sensors,float sensor. These two sensors are used to detect the obstacle. float sensor are used to detect the water level in water tank.When the sensor senses the presence of obstacle it gives signal to the Arduino controller. The Bluetooth module provides wireless communication between robot and mobile for the serial communication. operates on 5v supply and its operating range is 100m. DC gear motors are used to drive the robot. L293D IC used to drive the wheel motor because of better features like: 600ma output current capability per channel, 1.1A peak output current, inbuilt diodes, over temperature protection and having high noise immunity and it requires 12V power to work .

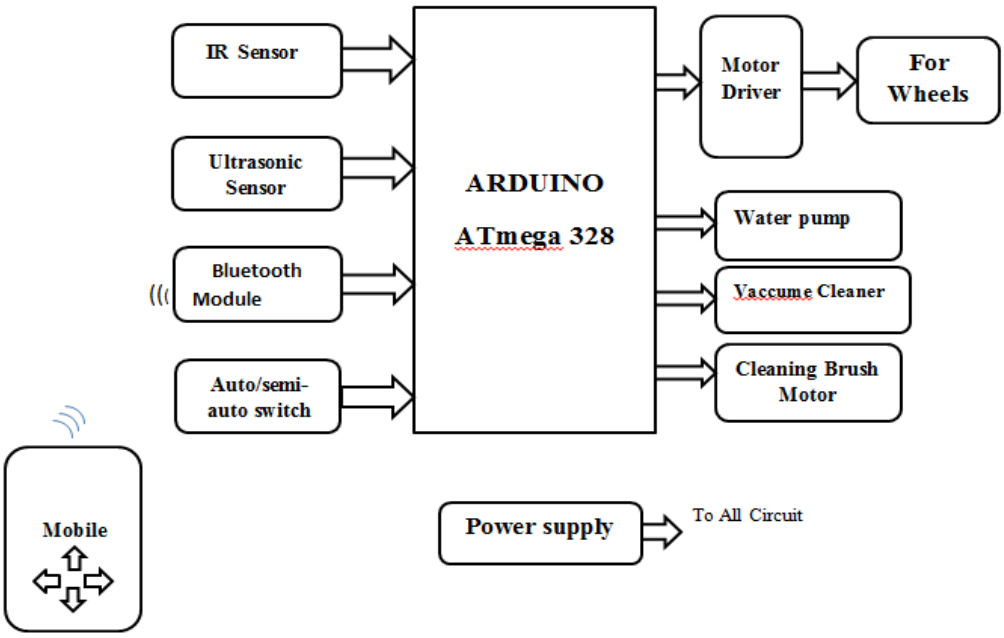

Fig1. Block Diagram Of Smart Floor Cleaning Robot

III. ARDUINO ATMEGA328

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. Arduino is an open source electronics board or minicomputer. Arduino is designed to make electronic more accessible to artists, hobbyists and anyone interested in creating interactive objects or environments . The first Arduino was introduced in 2005, which is aimed to provide an inexpensive and easy way to professionals, to create devices, or different attractive projects. Arduino boards are in preassembled form. For programming Arduino board, Arduino integrated development environment (IDE) is used, which supports for C and C++ programming languages. An Arduino board consists of an Atmel 8, 16, 32 bit AVR controller. We are using the Arduino ATmega328 controller in this project. The device operates between 1.8-5.5.

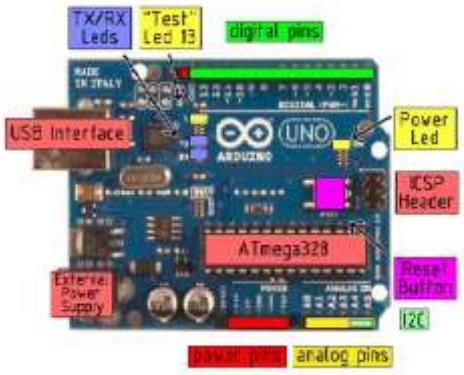

Fig.2 Arduino pin description

IV. BLUETOOTH MODULE

V. 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 Bluecore04-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.

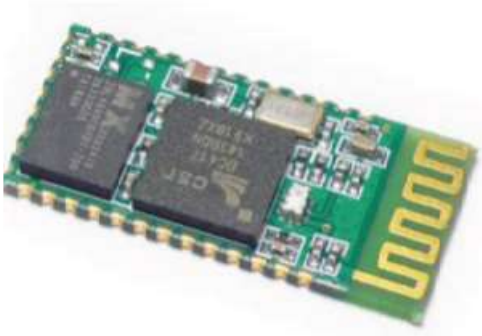

Fig.3 bluetooth module

VI. IR SENSOR

The basic concept of an Infrared Sensor which is used as Obstacle detector is to transmit an infrared signal, this infrared signal bounces from the surface of an object and the signal is received at the infrared receiver. The IR sensor used for obstacle detection. IR sensor transmit infrared signal, this infrared signal struck on the surface of an object which comes in front of it & reflects back which is received at the infrared receiver. Infrared sensor consists of infrared source and infrared detector. Infrared source is generally an IR LED or LASER diode. Infrared detector includes photodiodes or phototransistors. The energy emitted by the IR LED is reflects back from an object and falls on the IR detector. When object is detected by IR sensor it produces LOW output, and in absence of object IR sensors output is HIGH. This output can be directly connected to Arduino controller. Below figure shows the working principle of IR sensor.

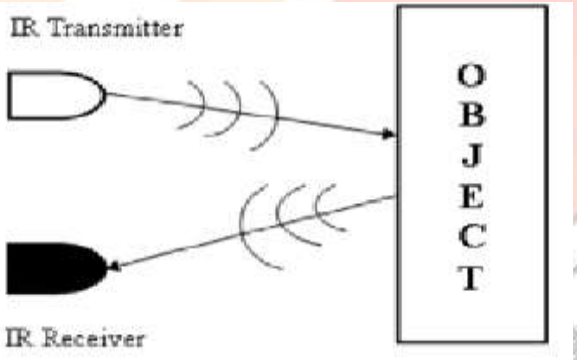

Fig.4 working principle of IR sensor

VII. ULTRASONIC SENSOR

This is an ultrasonic sensor of 40 kHz frequency specification. It requires power supply of 5 volt with working current specification as 15 mA .It detects around 13ft of distance. It triggers the pulses in the interval of 10 us. It has 4 terminals namely V_{cc}, trig, echo and GND pin . Vcc = 5v ,Trig pin =connected to Arduino board PWM pin ,Echo pin = connected to Arduino ,GND = negative terminal .Through trig pin we set the pulses and emit it to the environment and after emitting square waves the signals are received from the echo pin of this sensor module which ultimately fed to the Arduino board.

Fig.5 Ultrasonic sensor

VIII. FLOAT SENSOR

Float Switch is device used to sense the level of liquid within tank. When float ball rises or falls with the liquid to the level of the switch , the magnetic force of magnet which inside of the float ball will cause reed switch to turn on .The LVR500 series is a general purpose continuous float level transmitter that provides a loop power 420mA output . The 420mA output can be used to provide proportional level of liquid in any tank or vessel the signal can be connected to any device that accept loop power.

Fig.6 Float sensor

IX. MOTOR DRIVER

A motor driver is an integrated circuit chip which is usually used to control motors in autonomous robots. Motor driver act as an interface between Arduino and the motors . The most commonly used motor driver ICs are from the L293 series such as L293D,L293NE, etc. These ICs are designed to control 2 DC motors simultaneously. L293D consist of two H-bridge. H-bridge is the simplest circuit for controlling a low current rated motor. We will be referring the motor driver IC as L293D only. L293D has 16 pins.

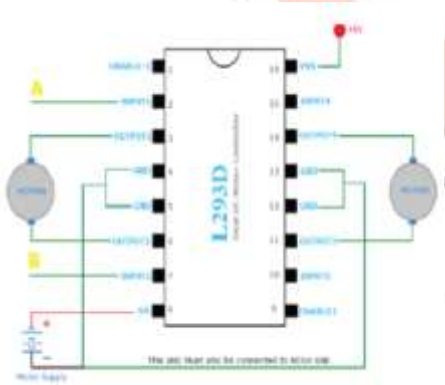

Fig.7 Motor driver

X. FLOW CHART

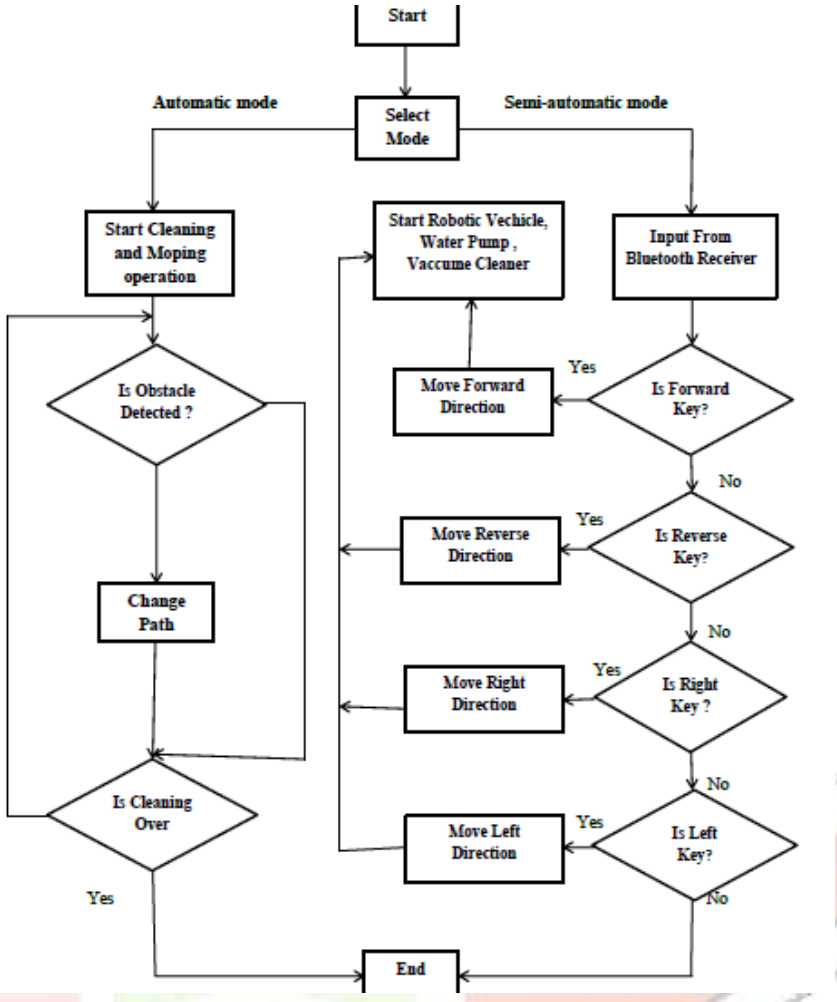

Fig.8 System flow chart

XI. SOFTWARE

The whole system is depend on the Arduino controller. Arduino controller is programmed using Arduino Integrated Development Environment (IDE), Programming languages used are C or C++. Program is compiled & burned using Arduino Integrated Development Environment (IDE). It contains a text editor for writing code, a text console, a toolbar etc. Program written in Arduino Software (IDE) is called sketch. The extension used for Arduino sketches is in. The editor has features for cutting or pasting and for searching or replacing text. The console is used to display text output by the Arduino Software (IDE), including error messages and other information. The toolbar contains buttons to verify and upload programs, create, open, and save sketches, and open the serial monitor. We have used the Arduino IDE version 1.6.7.

XII. FUTURE SCOPE

It can more advance in staircase floor, providing image to the robot for cleaning which area we have to clean. Also we can enhance automatic speed control technique and time setting of robot as per user convince.

XIII. CONCLUSION

This research facilitates efficient floor cleaning with Sweeping and mopping operations. This robot works in two modes automatic and semi-automatic for user convenience. This proposed work provides the hurdle detection in case of any obstacle that comes in its way . Since in project the floor cleaner is incorporated with different devices like DC motor(s), ultrasonic sensors etc., so it will be easy to handle it also saves time.

XIV. AKNOWLEDGEMENT

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