Voice Operated Floor Cleaning Robot

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Abstract : Voice Operated Floor Cleaning Robot (Mark) is a mobile robot whose motions can be controlled by the user by giving specific voice commands. The speech is received by a mobile Bluetooth device and processed by the voice module. When a command for the robot is recognized, then voice module sends a command message to the robot's microcontroller. The microcontroller analyzes the message and takes appropriate actions. The objective is to design a mobile robot which is controlled by servo motors. When any voice commands are given on the android application, the voice module will take the voice commands and convert the voice commands into digital signals. Then these digital signals are transmitted via BLUETOOTH module to the robot. On the receiver end the other BLUETOOTH module receives the command from the transmitter end and then performs the respective operations. The arduino used here is ATmega 328 Microcontroller. In ATmega 328 there are 15 PWM channels which are needed to drive the servo motors. Addition to this there is camera which is mounted in the head of the robot will give live transmission and recording of the area. The speech-recognition circuit functions independently from the robot's main intelligence. This is a good thing because it doesn't take any of the robot's main CPU processing power for word recognition. The CPU must merely poll the speech circuit's recognition lines occasionally to check if a command has been issued to the robot. The software part is done in Arduino IDE using Embedded C. Hardware is implemented and software porting is done.

Keywords- Arduino, ATmega 328, Bluetooth,Motor Drivers,camera

I. INTRODUCTION

Speech Recognition i.e., making the system to understand human voice. Speech Recognition is a technology where the system understands the words (not its meaning) given through speech. Speech is an ideal method for robotic control and communication.

The speech recognition circuit we will outline, functions independently form the robot's main intelligence . This a good thing because it doesn't takes any of the robots main CPU processing power for word recognition.

Voice system has one integrated module i.e. Bluetooth module. In voice system, user gives voice commands through an android phone using Bluetooth as a medium. Human voice of 50-110 db can be easily accepted by system. Voice system identifies, recognize the voice and then convert it from analog to digital command. Further that command goes from serial port Bluetooth module to the Ardiuno UNO R3, which is another module. Ardiuno board is interfaced with ATmega 328 micro-controller chip which is suitable to convert the digital command into machine understandable code.

If given command matches with the saved command then robot will read command and perform the action. If wrong command is given or some error occurred then it will check in loop and go again to previous stage and try to retrieve command again. When action is going to perform by the robotic device the LED will glow green and when there is some error it will blink red.

1.1 Bluetooth Module

1. HC 05 Bluetooth module consists two things one is Bluetooth serial interface module and a Bluetooth adaptor.

2. Bluetooth serial module is used for converting serial port to Bluetooth.

Component description in Bluetooth module

ATmega 328 Microcontroller: ATmega328 is a microcontroller chip found on Arduino Uno board. ATmega328 microcontrollers are from the 8-bit AVR microcontroller family.

Servo motor: Servo motors are self-contained mechanical devices that are used to control the machines with great precision. The servo motor working principle based on the PWM (pulse width modulation) pulses.

1.2 Robotic module

Robots are indispensable in many manufacturing industries. The reason is that the cost per hour to operate a robot is a fraction of the cost of the human labor needed to perform the same function. More than this, once programmed, robots repeatedly perform functions with a high accuracy that surpasses that of the most experienced human operator. Human operators are, however, far more versatile. Humans can switch job tasks easily. Robots are built and programmed to be job specific. You wouldn't be able to program a welding robot to start counting parts in a bin. Today's most advanced industrial robots will soon become "dinosaurs." Robots are in the infancy stage of their evolution. As robots evolve, they will become more versatile, emulating the human capacity and ability to switch job tasks easily. While the personal computer has made an indelible mark on society, the personal robot hasn't made an appearance. Obviously there's more to a personal robot than a personal computer. Robots require a combination of elements to be effective: sophistication of intelligence, movement, mobility, navigation, and purpose.

- Voice Detection: A Bluetooth module is used to receive command from android phone and Arduino UNO is used for controlling the whole system.
- Command transferred from RF signal (analog signal) to Digital Signal
- Communication port is serial port.
- Pins on the serial port accept the commands.
- Movements of wheels controlled by DC motors, which works on batteries.
- It includes the transmitter and receiver circuits.
- We can guide the robot with its travel path using voice commands like "go" "stop" "left" "right" in order to clean we use another voice command like "clean" then robot will activate the servo motor which is connected with the cleaning mechanism.
- If robot is not accepting the commands or error occurs then it will go back to the Arduino for again receiving the commands.
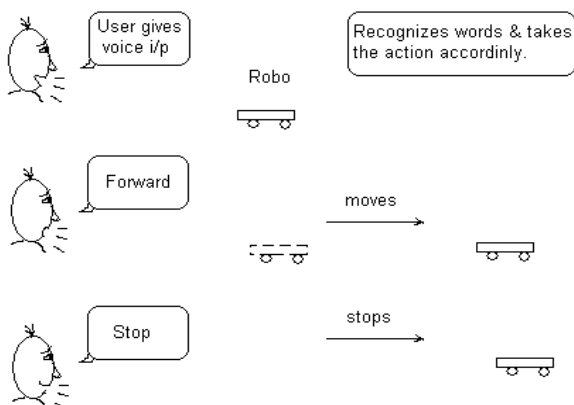
1.3 Task

Fig 1.3 Robot operated through user command

The purpose of this project is to build a robotic floor cleaning device which could be controlled using voice commands. Generally these kinds of systems are known as Speech Controlled Automation Systems (SCAS). Our system will be a prototype of the same.

We are not aiming to build a robot which can recognize a lot of words. Our basic idea is to develop some sort of menu driven control for our robot, where the menu is going to be voice driven. What we are aiming at is to control the robot using following voice commands. The robot can do these basic tasks:-

1. move forward
2. move back
3. turn right
4. turn left
5. Clean
6. Rotate
7. stop (stops doing the current job)
8. Etc..

1.4 Robotic command table

Input (Speaker speaks)	Output (robot does)
Forward	Moves forward
Back	Move reverse
Right	Turns right
Left	Turns left
Rotate	Rotate in specific angle
Stop	Stops current job
Clean	clean floor

. II. SYSTEM DESCRIPTION

2.1 Existing System

1. Before introducing the vacuum cleaner and floor cleaner it was manual and time consuming task. Now days in busy life human beings can't spend time on cleaning

2. With the introduction of vacuum cleaner and floor cleaners this task is bit easy but still manual efforts are needed to perform it.

So the robots for cleaning are proving as a solution to deal with cleaning. There are many robots used for cleaning but they are mainly categorized into two parts.
1. Automatic robots
2. Human controlled robots

Automatic Robots

This kind of robots works based on the obstacle detection or fix path follow. But obstacle detection cannot produce good result because when the obstacle is detected robots stops by keeping safe distance between robot and obstacle. So it will

not cover all the corners of the room. And when these robots are used in home it will not produce the good result because there are many obstacles to stop them.

Disadvantages: If we consider the structure and placement of appliances in the Indian home it is very difficult to cover all the corners of the home using automatic robots in such cases controlling robots plays a more efficient role.

2.2 PROPOSED WORK:

Voice module :

While speech recognition is the process of converting speech to digital data, voice recognition is aimed toward identifying the person who is speaking. Voice recognition works by analysing the features of speech that differ between individuals.

In voice system, user gives voice commands through an android phone using Bluetooth as a medium. Human voice of 50-110 db can be easily accepted by system. Voice system identifies, recognize the voice and then convert it from analog to digital command. Further that command goes from serial port Bluetooth module to the Ardiuno UNO R3, which is another module. Ardiuno board is interfaced with ATmega 328 micro-controller chip which is suitable to convert the digital command into machine understandable code. if given command matches with the saved command then robot will read command and perform the action. If wrong command is given or some error occurred then it will check in loop and go again to previous stage and try to retrieve command again. When action is going to perform by the robotic device the LED will glow green and when there is some error it will blink red.
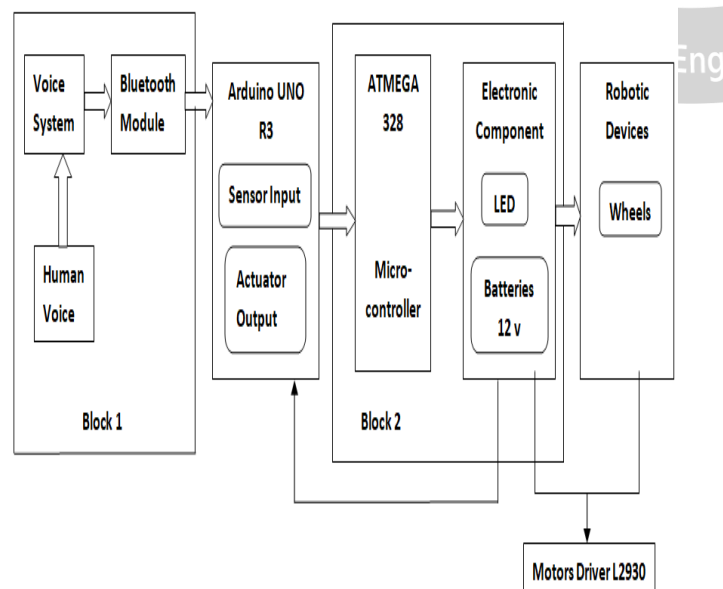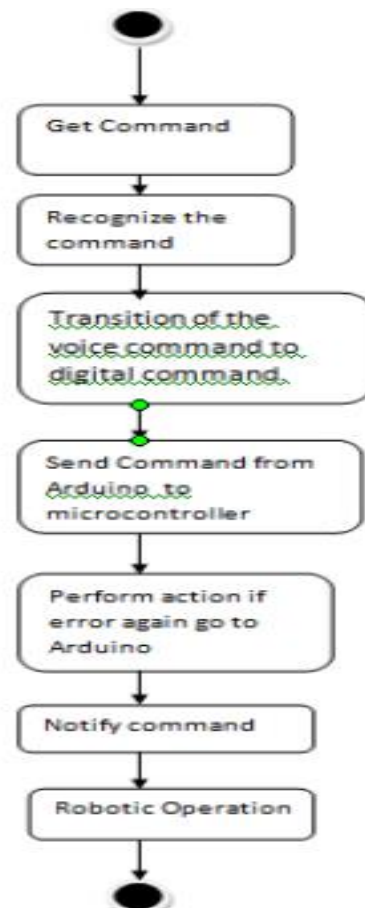
Proposed Architecture:

Fig 2.1 Sequence diagram

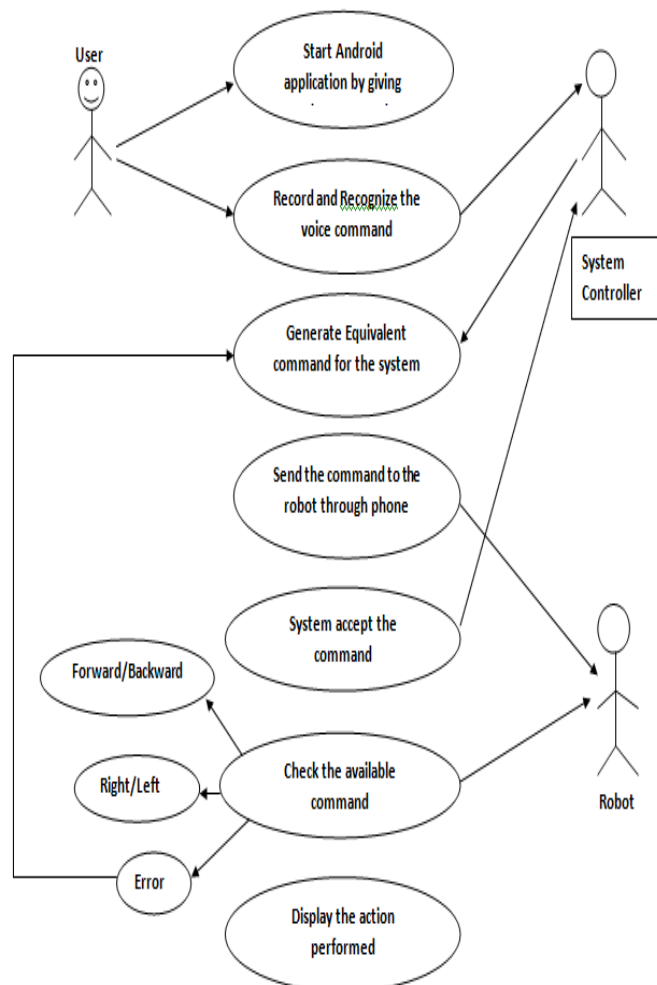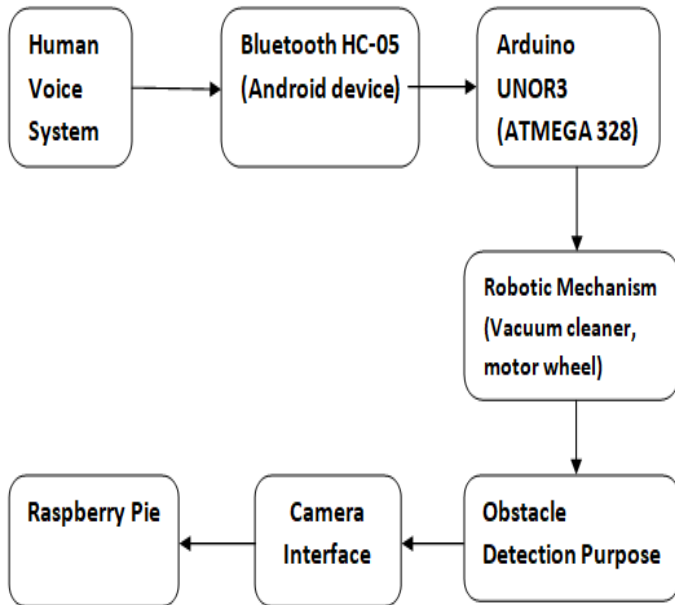**Fig 2.2 System Architecture**

Fig 2.4 Use case diagram

Fig 2.3 Implemented system flow

III. ALGORITHM

1. The voice commands should be trained to the Easy VR module.

2. Then the stored voice commands are represented in the form of binary numbers such as move forward – 001, move backward – 010 etc.

3. These binary values are transmitted via Bluetooth module which is a transceiver.

4. The transmitted binary values are then received by another Bluetooth module which is present on the receiver side (Robot).

5. Microcontroller will take those binary values and performs action (servo motors) according to the binary values.

IV. DISADVANTAGES OF EXISTING SYSTEM

1. Even the best speech recognition systems sometimes make errors. If there is noise or some other sound in the room (e.g. the television or a kettle boiling), the number of errors will increase.

2. Speech Recognition works best if the microphone is close to the user (e.g. in a phone, or if the user is wearing a microphone). More distant microphones (e.g. on a table or wall) will tend to increase the number of errors.

3. The structure and placement of appliances in the Indian home it is very difficult to cover all the corners of the home using automatic robots in such cases controlling robots plays a more efficient role.
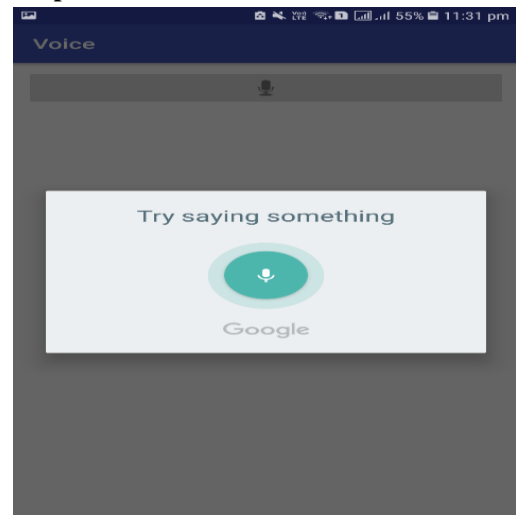
V. RESULTS

Robotic operation

Fig 5.1 Application accept command through voice

The mobile application is receiving the voice command through Bluetooth and sending to Arduino so that robot can perform the action as user needs.
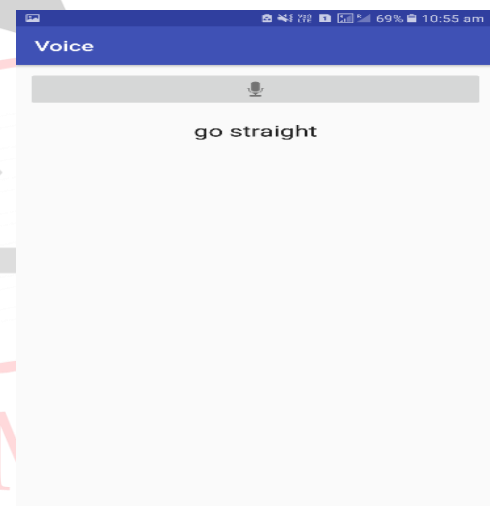

Fig 5.2 Robot moves straight

The straight command is given to the application from the user and Arduino will accept this command and will start the servo motor then robot will move straight

Fig 5.3 Robot moves left

The left command is given to the application from the user and Arduino will accept this command and will start the servo motor then robot will turn left.
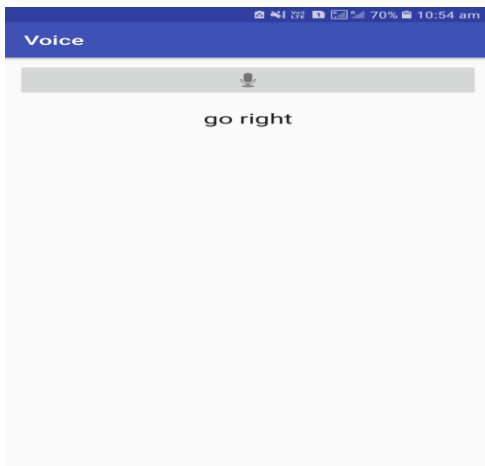

Fig 5.4 Robot moves right

The right command is given to the application from the user and Arduino will accept this command and will start the servo motor then robot will turn right.

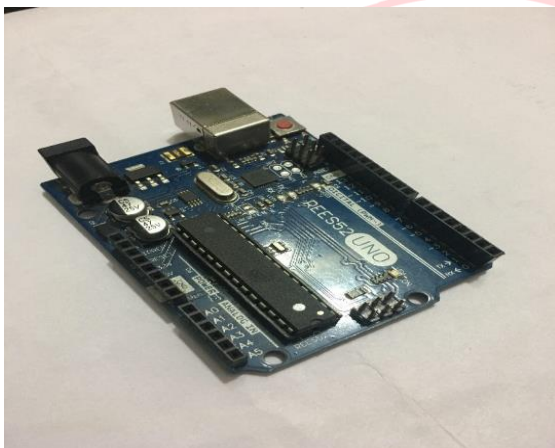### 5.3. *Hardware Implementation*

Fig 5.3.1 The Arduino with ATmega 328

In our project we are using Arduino UNO3 with ATmega 328 micro-controller as 24 to 32 kb is memory space is required for programming and also it is SPI serial port
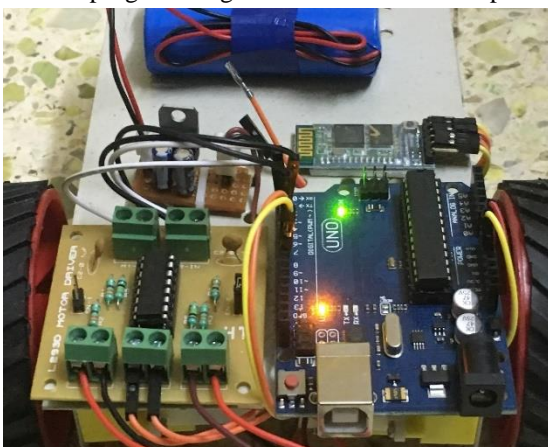

Fig 5.3.2 Arduino installed on robot

The Arduino is fitted on the aluminium platform which has 2 wheels at the back and 1 servo motor to move wheel left or right and acceleration.

VI. SCOPE FOR FUTURE WORK

1. This research work has been narrowed down to short range Bluetooth module. Using a long range modules will result in connectivity with the robot for long distances.

2. Power Optimization such sleep and wakeup schedules can be incorporated.

3. Image processing can be implemented in the robot to detect the colour and the objects.

4. For more accurate working servo motors can be deployed.

5. Automatic Targeting System can be implemented in the robot for tracking the target

VII. CONCLUSION

Facilitates efficient floor cleaning ROBOT with suction, sweeping and mopping operations. It reduces the labour cost and saves time and also provides efficient cleaning. There are still new ideas to improve the developed system and to add new functionality to it. the robot can be made to move randomly in any direction and its speed can be controlled.

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