Voice Operated Intelligent Fire Extinguisher Vehicle

PreetiDhiman, Noble Tawra, Rakesh Nagar, Rishab Singh and Varun Kaushik

***Abstract*-This paper demonstrates the research and implementation of voice automated fire extinguisher vehicle. The vehicle is controlled through connected speech input. The language input allows a user to interact with the robot which is familiar to most of the people. The advantages of speech activated robots are hands-free and fast data input operations. The speech recognition system is trained in such a way that it recognizes defined commands and the designed robot navigates based on the instruction through the Speech Commands. The medium of interaction between humans and computers is on the processing of speech. The complete system consists of three subsystems, the speech recognition system, transmitter section and the receiver section (on vehicle) .We have studied the various factors such as noise which interferes speech recognition and distance factor. The results prove that proposed robot is capable of controlling fire, avoiding obstacles and understanding the meaning of speech commands.**

***Keywords*-Transmitter, Receiver, Speech recognition system, Visual Basic, Microsoft speech SDK 5.1**.

I. INTRODUCTION

The project aims at designing an intelligent voice operated fire extinguishing robotic vehicle which can be controlled wirelessly through RF communication. The Robotic vehicle has a camera mounted on it whose direction can also be controlled using voice commands. The proposed vehicle has a water jet spray which is capable of sprinkling water. The sprinkler can be moved towards the required direction.

A lot of work has been done earlier in the field of word recognition.Using a traditional recognizer an accuracy of around 60% has previously been obtained for both a 156 town name task and 1108 road name task. Techniques presented in [Azzopardi/Semnani_et_al:1998]has resulted in an accuracy of 90% for an automated corporate directory system with 120,000 entries. As an input method for rapidly spreading small portable information devices, and advanced robotics applications, development of speaker independent speech recognition technology which can be embedded on a single DSP chip has been developed by [Hoshimi/Yamada_et_al:1998].

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When the newly proposed noise robustness method was tested with 100 isolated word vocabulary speech of 50 subjects, recognition accuracy of 94.7% was obtained under various noisy environments. Software engineering for research and development in the area of signal processing is by no means unimportant. A programming paradigm which allows software components to be advantageously combined witheach other in a way that recalls the concept of hardware plug-and-play, without the need for incorporating complex schedulers to control data flows has been developed by [Dutoit/Shroeter:1998].Earlier similar work in a limited input domain was done using wireless for e.g. remote control of electrical switches (this is currently one of the ingenuity problems). We read a newspaper report about an year ago (TheHindu - Thursday Science & Technology Section) about such a project. A suggested application was for hospitalized patients who usually are dependent on someone else for to switch on/off the lights,fan, etc. But what if the patient's hands are broken. Obviously a voice based system ought to be used in such a case.

A voice recognition unit built around a high speed processor that ensures various operations of the system to be performed by voice command. The Program of the project is written in Visual basic language for controlling robot motor from the PC's parallel port termed as printer port (LPT). The Program accepts the input in decimal numbers and outputs at the data output pins of the PC's parallel port for controlling the connected devices. Our project controls left, right, forward and backward movement of robot wirelessly within 500m range using 433 MHz RF frequency. The special feature of our project is that our visual basic program control window based voice recognizing software. So for controlling any movement of robot we have to just speak name of movement. The voice recognizing software compare our voice with already stored voice, if match found robot start executing command according to voice command, otherwise it give error massage. At the receiver side of robot 8051 microcontroller is also used. The microcontroller takes command wirelessly transmitted by PC. The role of microcontroller is to drive 7 segments, drive DC motor, take input from temperature sensor and night light sensor and drive relays.

II.IMPLEMENTATION FRAMEWORK

The controlling devices of the whole system are Microcontrollers. Speechrecognition module, wireless transceiver modules, obstacle detector, lamp, waterjetspray, DC motors and buzzer are interfaced to Microcontroller. When the user fed the voice commands to the speech recognition module, the microcontroller interfaced to itreads

the command and sends relevant data of that command wirelessly using transceiver module. This data is received by the transceiver module on the robotic vehicle and feds it to microcontroller which acts accordingly on motors, pump and lamp. The vehicle is mounted with a camera which helps in viewing the live images on TV.

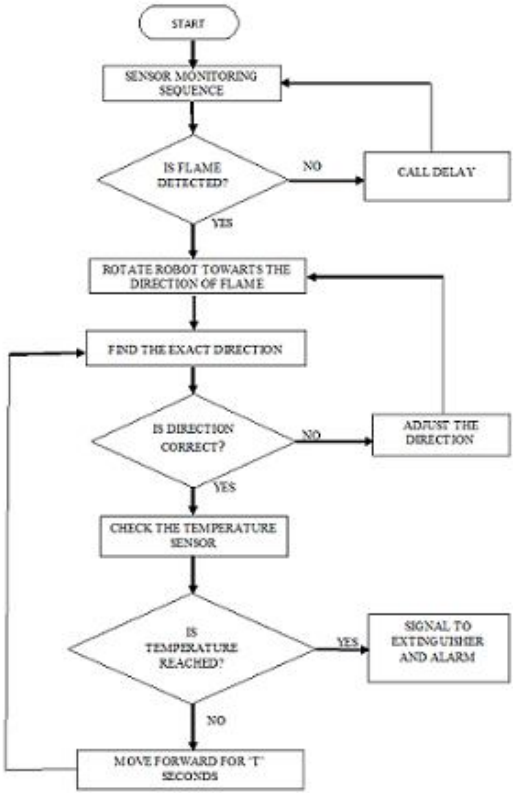

Figure.1 Functional flow chart

A. TRANSMITTER SECTION

Optocouplers are used which consists of an infrared light-emitting diode (LED) and an npn phototransistor. When a high going pulse is available on the data pin, the internal LED drives the phototransistor of optocoupler MCT2E and it provides an enable pulse to HT12E encoder. All address pins of HT12E is grounded. Thus the data encoded by HT12E will be 0111. This encoded data is available at pin 17 of HT12E. The RF transmitter frequency modulate data signal and transmits using antenna. For RF transmission purposed it is needed to encode the signal generated at computer parallel port with the help visual basic code. *B.RECEIVER SECTION*

HT 12D Receive and decode 12 bit encoded data transmitted by HT12E, for further processing. The HT12D is 12 bit decoders are a series of CMOS LSIs for remote control system applications. They are paired with Holtek's 2^12 series of encoders. For proper operation, a pair of encoder/decoder with the same number of addresses and data format should be chosen. The decoders receive serial addresses and data from a programmed 2^12 series of encoders that are transmitted by a carrier using an RF transmission medium. They compare the serial input data three times continuously with their local addresses. If no error or unmatched codes are found, the input data codes are decoded and then transferred to the output pins. The VT pin also goes high to indicate a valid transmission. The 2^12 series of decoders are capable of decoding information that consist of N bits of address and 12_N bits of data. Of this series, the HT12D is arranged to provide 8 address bits and 4 data bits.

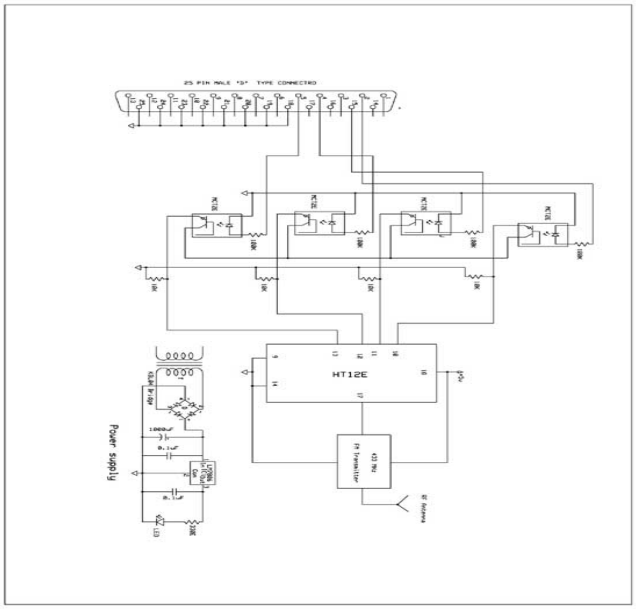

Figure.2 Transmitter circuit

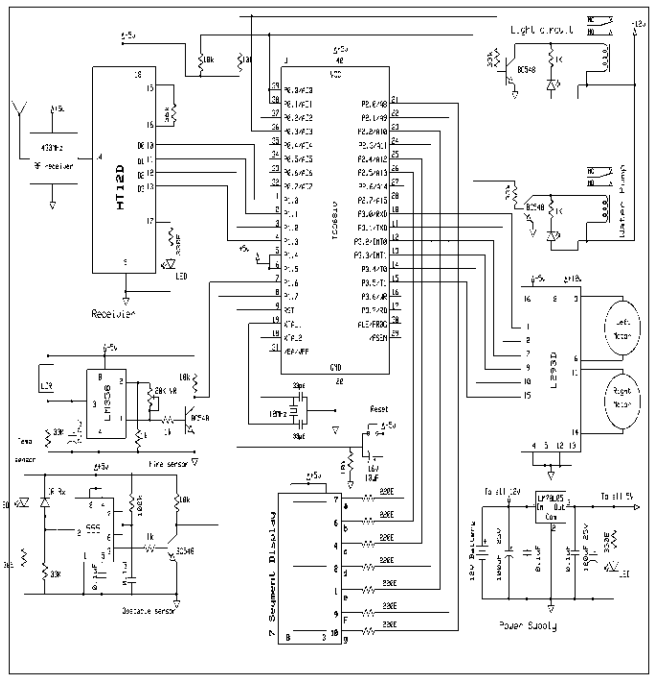

Fig.3 Receiver circuit

C.SPEECH RECOGNITION SYSTEM

The speech is received by a microphone and processed on a PC. When a command for the robot is recognized, the PC sends a command message to the robot, built-in computer using RF signals. The robot computer analyzes the message and takes appropriate actions. For the speech processing we will focus on Microsoft SDK5.1 for VISUAL BASIC 6.

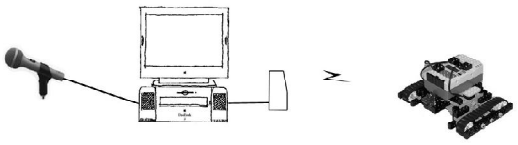

Fig.4 PC-Robot interface

D.VOICE CAPABILITIES IN VISUAL BASIC

I.Text-to-Speech Capabilities

One feature of the voice engine, with immediate application for experimental procedures, is the capability it provides to program a computer to read text aloud. What follows is a step-by-step example that illustrates how straightforward it is to implement this capability using the Speech SDK within Visual Basic.

II.Voice Recognition Capabilities

Apart from the text-to-speech capabilities described above, the Speech SDK offers a powerful human speech recognition system. Although a simple example may readily be built using Visual Basic, its use is more complex than the Text-To-Speech capability, and thus some knowledge of Visual Basic programming is required to fully understand the example.

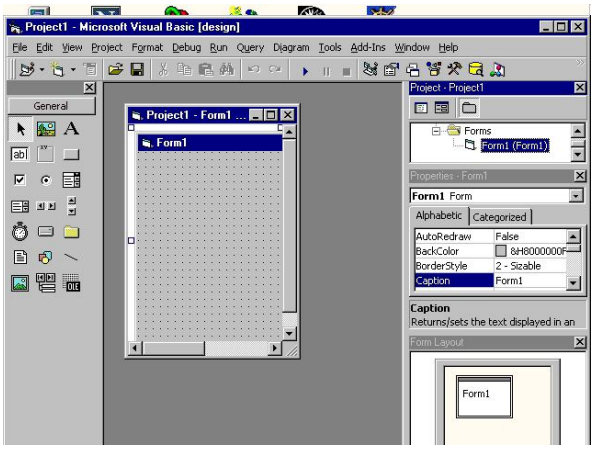

Fig.5Visual Basic environment

E.80S51 MICROCONTROLLER

We are using 8 bit microcontroller but our data is 4 bit so thelower nibble of port ie P 1.0-P 1.3 are connected to D0-D3 and in higher nibble of port i.e. P1.4 –P1.7 all bit are CMOS 8-bit microcontroller with 8K bytes of in-system programmable Flash memory. The device is manufactured using Atmel's high-density nonvolatile memory technology and is compatible with the industry-standard 80C51 instruction set and pin out. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional nonvolatile memory programmer. By combining a versatile 8-bit CPU with in-system programmable Flash on a monolithic chip, the Atmel AT89S52 is a powerful microcontroller which provides a highly-flexible and cost effective solution to many embedded control applications.

The AT89S52 provides the following standard features: 8K bytes of Flash, 256 bytes of RAM, 32 I/O lines, Watchdog timer, two data pointers, three 16-bit timer/counters, a six vector two-level interrupt architecture, a full duplex serial port, on-chip oscillator, and clock circuitry. In addition, the AT89S52 is designed with static logic for operation down to zero frequency and supports two software selectable power saving modes. The Idle Mode stops the CPU while allowing the RAM, timer/counters, serial port, and interrupt system tocontinue functioning. The Power-down mode saves the RAM contents but freezes the oscillator, disabling all other chip.

F.OBSTACLE SENSOR

The infrared intruder sensor is used to sense some unknown person like thief entering in your house without your permission. The board can be used in two modes – as an obstacle sensor and in the other as an IR signal receiver and transmitter. The two modes can be selected with the mode selector jumper. Putting the jumper in one position (SNS) will make the sensor work as an obstacle sensor and putting it in the other position (Tx) will put the sensor in the IR signal receiving and transmitting mode.

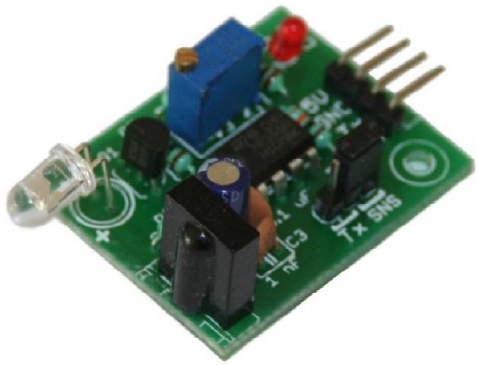

Fig.6Obstacle sensor

G.7 SEGMENTDISPLAY

The seven segment display is used to display the code received by receiver. Different codes are being used for different operations, so the user finds it easy to tele the code on display for correct operation.

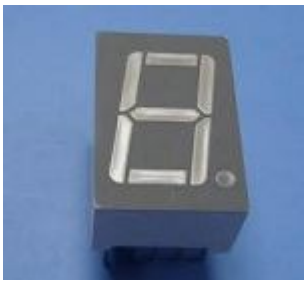

Fig.7 Seven segment display

H.FIRE SENSOR

Here thermistor is used as fire sensor. Usually the temperature sensor produces a voltage signal that increases as the temperature increases. The inverted temperature sensor (cold sensor) produces a voltage signal that increases as the temperature decreases. If the temperature sensor is being used with a digital process unit then it needs to be followed by a comparator or Schmitt inverter to give a sharp change of signal from low to high. The temperature sensing circuit uses an NTC (negative-temperature coefficient) thermistor to monitor temperature. The resistance of a NTC thermistor falls as its temperature increases.

Fig.8Fire sensor

III. APPLICATIONS

1. It guides the blind persons to reach a particular destination by using the voice feature.
2. It is used in hazardous places.
3. The photo electric sensor in the robot will sense the obstacles and it will make decisions according to the obstacles it encounters.
4. It warns the person against the intruders.
5. Useful in controlling fire at extreme places where human being cannot reach.
6. Live images of the incident can be seen through wireless camera.

IV.FUTURE SCOPE

Some of interfacing applications which can be made are controlling home appliances, robotics movements, Speech Assisted technologies etc.

By making it GPS enabled, robot can be controlled from remote station also.

A CO2 booster can be attached to make it powerful extinguisher.

V. LIMITATIONS

Speech has difficulties to be recognized by an application. Because speech is different for every speaker, May be fast, slow, or varying in speed. May have high pitch, low pitch, or be whispered. Have widely-varying types of environmental noise. Can occur over any number of channels .Changes depending on sequence of phonemes, May not have distinct boundaries between units (phonemes), Boundaries may be more or less distinct depending on speaker style and types of phonemes,. Changes depending on the semantics of the utterance, has an unlimited number of words, has phonemes that can be modified, inserted, or deleted.

VI. CONCLUSION

Based on the design principles and requirement, a prototype of the system for Voice Operated Fire Extinguisher Robot has been developed.

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