Speech Controlled Robotic Vehicle

Vijay Kumar[1] Akash Srivastava[2] Amit Maurya[3] Md. Afsar[4] Dinesh kr Verma[5]
[1]Assistant Professor [2,3,4,5]Student
[1,2,3,4,5]IMSEC-Ghaziabad (INDIA)

Abstract— This paper presents a voice controlled robotic vehicle that operates on voice recognition aided with Google voice search. In here, we use voice as the input & and execute voice commands as functions. The speech recognition system use an I.C called HM2007, which can store and recognize up to 20 voice commands. The radio frequency transmitter and receiver are used for wireless transmission purpose. We have used AT89S52 micro control for giving the instructions to the robotic vehicle for its operations. This robotic vehicle can be able to prevent collision of vehicle, obstacle collision and it is secure and accurate. Physically challenged people can use these robotic vehicles .They can also be used in various industries and also can be used for carrying contagious material from one place to another.

Key words: Speech Recognition System, Micro Controller AT89S52, R. F. Transmitter and Receiver

I. INTRODUCTION

The field of robotics includes a wide and broad spectrum of technologies in which computational intelligence is embedded in physical machines, creating systems with capabilities far exceeding the main and core elements alone. Such robotic systems are then able to carry out tasks that are not achievable by conventional machines, or even by humans working with conventional tools [1-4].

Robotic technology is indispensable in many manufacturing industries. The reason behind this is that the cost per hour to function a robot is a very minute of the cost of the human labour needed to perform the same operation. More ever, once programmed, robots continuously perform operations with a high accuracy that surpasses that of the most experienced human professionals. Robots are programmed to be job specific & are in the infancy stage of their evolution. As they evolve, they will become more versatile, emulating the human capacity and ability to switch work easily. Robots require a combination of elements to be effective: sophistication of intelligence, movement, mobility, navigation, and purpose.

Problems caused in the existed vehicles are - Not useful to the disabled persons, no temperature detector, metal detector, Obstacle collision, No security to the vehicles, and complexity in controlling. The solution for all the above problems can be solved by the voice controlled robotic vehicle. By this we can reduce complexity in controlling and provide usage to physically disabled people, avoid obstacle collision Provide security to the vehicles. (VCR) is a robot whose motions can be controlled by user's specific voice commands. The speech recognition is capable of identifying the 5 voice commands, (forward, backward, right, left, stop). It can also be helpful in industries to carry goods from one place to the other. Also this can be used to repair process in tunnels as it can detect temperature, humidity, light, metal and carbon monoxide and carbon dioxide, using temperature detector humidity detector, light, metal detector and gas detector simultaneously[3-6]

II. SPEECH RECOGNITION

Voice recognized devices operate on the principal of speech recognition. This process of converting an acoustic signal, captured by micro phone of android device, to a set of words. There are two important parts in Speech Recognition

Firstly recognizing series of sound and secondly identify the word from the sound.

This technique depends also on various parameters like Speaking mode, Style, enrolment, Size of the Vocabulary, Language Model, and Transducer etc. Converting a speech waveform to a sequence of words involves several essential steps:

1) A microphone picks up the signal of speech to be recognized and converts it into an electrical signal.

The electrical signal represented digitally by means of an Ana log-to-digital (A/D) conversion process, so that it can be processed with digital computer or a microprocessor[5-8]

2) This speech signal is then analysed, producing representation consisting of salient features of the voice. The most important feature of speech is derived from its short-time spectrum, measured successively over short-time windows of length 20–28 milliseconds over at intervals of 10–20ms. Each short-time spectrum is transformed in a featured vector and the temporal sequence of such featured vectors hence forth forms a speech pattern.

The speech pattern is now compared to a store of phoneme patterns through a dynamic programming process in order to generate a hypothesis of the phonemic unit sequence. A phoneme is a basic unit of speech and the model is a succinct representation of the signal that reflects to a phoneme, usually accompanied in an utterance. A speech signal inherently has substantial variations along many dimensions.

III. STRUCTURE OF THE VEHICLE

1) Transmitter
2) Receiver

Both parts communicate with each other wire free. Transmitter contains two sections namely

1) Speech recognition system.
2) Radio Frequency Transmission circuit. Speech recognition system are self contained recognition circuit, up to 20 word vocabulary of duration two seconds each in number. It recognition data in memory even after power off and also easily interfaced to control external circuits & appliances desired. The heart of the device is the HM2007IC. This IC can recognize 20 words, each word a length of 1.92 seconds. The keypad and digital display are used to program the HM2007 chip. The keypad contains 12 normally open momentary contact switches. When circuit is turned on, “00”is digitally

displayed, the red LED (READY) is lit and the circuit awaits the command. Press "1" and 01 is displayed and led will turn off, then press the TRAIN key and the led will turn on as now circuit is in training mode for word one. Say the target word into the microphone (near LED) clearly. The circuit accepts the signal of the voice input by blinking the LED off then on.

The word is identified as the "01" word. If LED did not flash, start over by pressing "1" then "TRAIN" key. We may continue training new words in the circuit. Press "2" then TRAIN to train the second word and so on. The circuit will accept and also recognize upto 20 words that is numbers from 1 to 20. It is not necessary to train all word spaces Performing attest recognition: Repeat a trained word in the microphone. The number of the word should be displayed on the digital display. For example, if the word "forward" was trained as word number 20, saying the word "forward" in the microphone will cause the number 20 to be displayed.

Checking Error codes:

The chip provides the following error codes. 55 corresponds to a word to long

- 66 corresponds to a word to short
- 77 corresponds to no match

Clearing memory:

To erase all words in memory press "99" and then "CLR". All numbers will quickly scroll by on the digital display as the memory erase begins.

Changing and erasing words:

Trained words can easily be changed by overwriting with the original word. For example word six was the word "Country" and you want to change it to the word "State". Now retrain the word space by pressing "6" after words the TRAIN key and saying the word "State" in the microphone. If we have to erase the word without replacing it with another word, press the word number (in this case six) then press the CLR key, the word six is erased completely. Radio Frequency

Transmission circuit:

R.F Transmission circuit contains a micro controller namely AT89S52, along with an encoder namely HT12E and a R.F. transmitter[6-10]

The AT89S8252 is a low-power 8 bit micro controller with a high-performance CMOS with 8K bytes of downloadable Flash programmable and erasable read-only memory. It also has 2K bytes of EEPROM.

Sample codes are as follows:

1) Forward Routine:

```
Back:Mov A,P1
     Cjne A.#01h.Next1
     Setb Rp
     Setb Lp
     Clr Rn
     Clr Ln
     Sjmp Bac
```

2) Backward Routine:

```
Next1:Cjne A,#02h,Next2
          Setb Rn
          Clr Rp
          Clr Lp
          Sjmp Back
```

3) Stop Routine:

```
Next4:Cjne A,#05h,Back
      Clr Rp
      Clr Lp
      Clr Rn
      Clr Ln
      Sjmp Back
```

4) Left Routine:

```
Next2:Cjne A,#03h,Next3
      Setb Rp
      Setb Ln
      Clr Rn
      Clr Lp
       Lcall One
      Clr Rp
      Clr Ln
       Lcall One
       Lcall One
       L Call One
       L Call  One
       Sjmp Back
```

5) Right Routine

```
Next3:Cjne A,#04h,Next4
      Set Rm
      Set Lp
      Clr Rp
      Clr Ln
      Lcall One
      Clr Rm
      Clr Lp
      Lcall One
      Lcall One
      Lcall One
      Lcall One
      Sjmp Back
```

The encoder used is,"HT12E" for the purpose of encoding the data coming from the micro controller, and then to send the data to R.F. Transmitter. In here, we use 432 MHz RF Transmitter STT-433 for transmission purpose.

Receiver part components:

The Receiver part is the combination of R.F. Receiver along with a Decoder (HT12D) and Motor control circuit. Here, we use 432 MHz RF Receiver STT-433 for reception purpose. The decoder used is,"HT12D" for decoding the data coming and then send the data to motor control unit. A variety of electric motors provide power to robots, hence making them move with various programmed motions in various directions. The motor driver IC used in vehicle is, L293D.

Interfacing the robot:

The transmitter as well as the receiver part of the robot is communicated wirelessly. Typically, communication in modular robots is on infrared or in some cases wired communication. The main problem of infrared and wired communication is that they need to be accurately aligned and orient to perform communication, which is very difficult ideally. The environment also represents a problem for infrared and wired communication because dust and dirt can abrade and obstruct the infrared optics.. These limitations have motivated the use of wireless communication technologies.

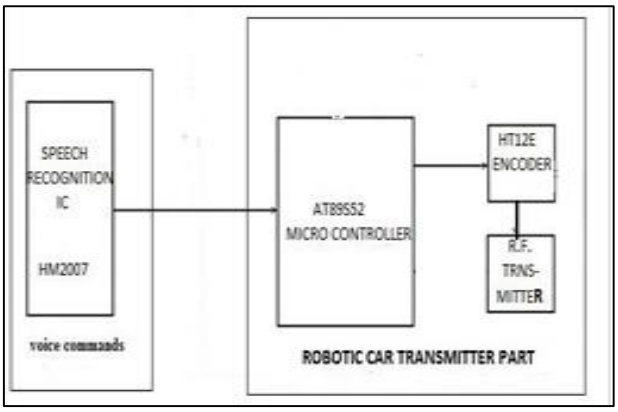

Fig. 1:

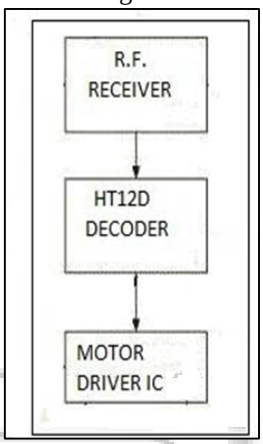

Fig. 2: Robotic Car Receiver

We use a metal Detector for detecting of metal near by the vehicles wheel we use metal detector: LJ18A3-8-Z-BX for sensing.

Fig. 3:

Also we use temperature detector and humidity detector to detect these two different parameters if they are required for usage.

Robokart Lm 35 Temperature Sensor:

We also add a light sensor for sensing of the light , for example if a tunnel repair has to be done and information required that weather light is present or not we use this sensor to check weather the light is present in tunnel or not. We use NaPiCa light sensor

IV. Discussion and Results

The Project mainly consists of Voice recognition system and Communication system performing five basic operations along with the sensors that could sense temperature, humidity, light, and metal near by the vehicle.The speech recognition circuit is shown below.

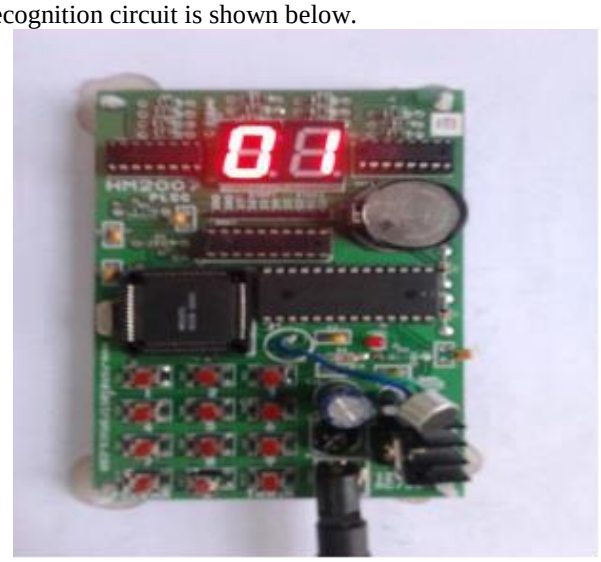

Fig. 4:

Speech Recognition System possesses a higher recognition rate in low noise environment. This circuit has accuracy around 78% in correctly identifying a voice command. It is highly sensitive so it also may affect due to the noise which surround the microphone .There is a possibility of misinterpreting some noises as one of the voice commands given to the vehicle. Also the accuracy of word recognition is reduced when noise is present in near surrounding. The sound coming from motors has a significant effect on accuracy. The voice-controlled smart car designed can be regarded as a model of Auto control. It could be widely used in various automated control systems if continuing to improve its function.

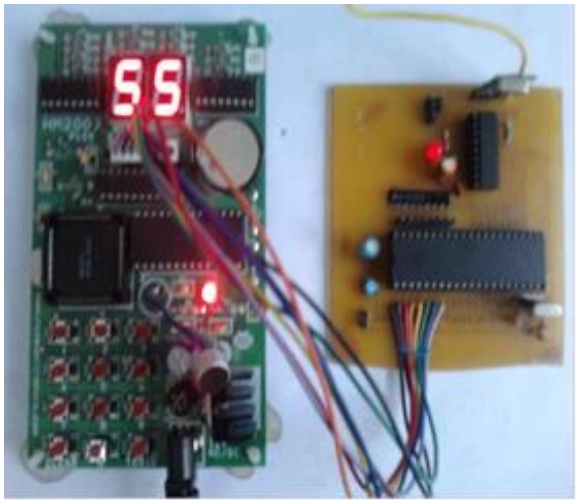

Fig. 5:

References

[1] H. Dudley, The Vocoder, Bell Labs Record, Vol. 17, pp.122-126, 1939.
[2] C. G. Kratzenstein, Sur la raissance de la formation desvoyelles, J. Phys., Vol 21, pp. 358- 380, 1782

[3] Sir Charles Wheatstone, The Scientific Papers of charles Wheatstone, London: Taylor and Francis, 1879.
[4] 4J. G. Wilpon and D. B. Roe, AT&T Telephone Network
[5] H. Dudley and T. H. Tarnoczy, The Speaking Machine of Wolfgang von Kempelen, J. Acoust. Soc. Am., Vol. 22, pp. 151-166, 1950.
[6] B. Lowerre, The HARPY Speech Understanding System, Trends in Speech Recognition, W. Lea, Editor, Speech
[7] T. B. Martin, A. L. Nelson, and H. J. Zadell, Speech Recognition by Feature Abstraction Techniques, Tech.
[8] J. Viterbi, Error Bounds for Convolutional Codes and an Asymptotically Optimal Decoding Algorithm, IEEE
[9] M. Mohri, Finite-State Transducers in Language and Speech Processing, Computational Linguistics, Vol. 23, No. 2, pp. 269-312, 1997.
[10] Shannon, A mathematical theory on communication, Bell System Technical Journal, vol.27, pp. 379-421 and 623-656, July and October, 1948

