Multioperating Autonomous Robot

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ABSTRACT- Conventionally, wireless controlled robots user circuits, which have a drawback of limited working range, limited frequency range and limited control. Use of mobile phones for robotic control can overcome these limitations. Although, the appearance and capabilities of robot vary vastly, all robots share the feature of a mechanical, movable structure under some form of control. The control of robot involves three distinct phases: perception, processing, action. Generally, the preceptors are sensors mounted on the robot, processing is done by the on board microcontroller and the task is performed using motors or with some other actuators. In this project the robot is controlled by a mobile phone that makes a call to the mobile phone attached to the robot and the movement of the robot is controlled by pressing key of the mobile phone. And this robot is also controlled by speech recognition system using voice processor. This robot performs multiple functions like follow black line or white line using IR sensors and IR sensors can be automatically detect & avoid obstacles if the robot goes beyond line of sight. This avoids damage to the vehicle if we are maneuvering it from a distant place.

KEYWORDS—Autonomous Robot; Speech recognition; Wireless controlled robots; HM2007; DTMF decoder; Microcontroller; IR sensor.

1. INTRODUCTION

Radio control is the use of radio signals to remotely control a device. The term is used frequently to refer to the control of model vehicles from a hand-held radio transmitter. Industrial, military and scientific research organizations make [traffic] use of radio controlled vehicles as well. A remote control vehicle is defined as any mobile device that is controlled by a means that does not restrict its motion with an origin external to the device. This is often a radio control and vehicle, or an infrared controller. A remote control vehicle (Also called as RCV) differs from a robot in that the RCV is always controlled by a human and takes no positive action autonomously. One of the key technologies which underpin this field is that of remote vehicle control. It is vital that a vehicle should be capable of proceeding accurately to a target area; maneuvering within that area to fulfill its mission and returning equally accurately and safely to base. Recently, Sony Ericson released a remote control car that could be controlled by any Bluetooth cell phone.

In this section we will emphasize on detailed overview of each of the block shown in above block diagram. In every description of the block respective schematics and working is explained. This robot consists of following blocks, as shown in the block diagram.

- **Microcontroller AT89S52**
  The AT89S52 is a low-power, high-performance CMOS 8-Bit microcontroller with 8k bytes of in-system

Radio is the most popular because it does not require the vehicle to be limited by the length of the cable or in a direct line of sight with the controller. Bluetooth is still too expensive and short range to be commercially viable. One of the most natural forms of communication tool used by human-being is their voice or speech. Hence it is natural that a lot of research has been devoted to analyzing and understanding human speech for various applications. This paper describes hardware based speech recognition system. For speech recognition systems, speech is an important form of man-machine interface. The proposed system design is used to control robotics movement through speech. The system is designed using voice IC HM2007. It has 8 bit data out which can be interfaced with any microcontroller for further development. This speech recognition system will increase the security of the robot.

2. METHODOLOGY

A. Block Diagram

![Figure 1. Block Diagram.](image-url)
programmable Flash memory. The device is manufactured using Atmel’s high-density non volatile 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 non volatile 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.

- **Motor Driver (L293D)**

The Device is a monolithic integrated high voltage, high current four channel driver designed to accept standard DTL or TTL logic levels and drive inductive loads (such as relays, solenoid, DC and stepping motors) and switching power transistors. To simplify use as two bridges each pair of channels is equipped with an enable input. A separate supply input is provided for the logic, allowing operation at a lower voltage and internal clamp diodes are included. This device is suitable for use in switching applications at frequencies up to 5 kHz. The L293D is assembled in a 16 lead plastic package which has 4 center pins connected together and used for heat sinking.

- **DTMF Decoder (CM8870)**

The MT8870D/MT8870D-1 is a complete DTMF receiver integrating both the band split filter and digital decoder functions. The filter section uses switched capacitor for high and low group filters, the decoder uses digital counting technique to detect and decode all 16 DTMF tone pairs into a 4-bit code. External components count are minimized by chip provision of a differential input amplifier, clock oscillator and latched three status bus interfaces.

- **DC Power Supply**

A fixed voltage power supply producing constant +5V consists of step down transformer, a bridge rectifier, filter capacitors C1 and 3 terminal regulator IC LM7805. A step down transformer is selected in such a way that it produces 9V at the input of IC. This power supply is capable of supplying +5v and load current up to 500mA. The capacitor C2 connected between output terminal and ground cancels out any inductive effect due to long distribution leads. Input capacitor C1 is used to improve transient response of the regulator IC, i.e. response of regulator to sudden changes in load. It is also helpful in reducing the noise present in the output. Dropout voltage (Vin-Vout) needs to be at least 2V under all operating conditions for proper operation of regulator.

![Figure 2. Motor Driver L293D](image)

![Figure 3. DTMF CM8870](image)

![Figure 4. Circuit Diagram of DC power supply.](image)
utilize speech control.

Figure 1. Voice Processor HM2007

B. Circuit Description.

A CM8870 series DTMF decoder is used here. All types of the CM8870 series use digital counting techniques to detect and decode all the 16 DTMF tone pairs into a 4-bit code output. The built-in dial tone rejection circuit eliminates the need of pre-filtering. When the input signals are given at pins 1(IN+) & 2(IN-), a differential input configuration is recognized to be effective, the correct 4-bit decode signal of the DTMF tone is transferred to (pin11) through (pin14) outputs. The pin11 to pin14 of DTMF decoder are connected to the pins of microcontroller (P1.0 to P1.3). The AT89C52 is an 8-bit microcontroller has 256 byte RAM and 8k ROM. Four 8-bit I/O ports. Three 8-bit timers/counter. Outputs from port pins P2.0 through P2.3. Switch S1 is used for manual reset. The microcontroller output is not sufficient to drive the dc motors, so current drivers are required for motor rotation. The L293D is a quad, high-current, half-h driver designed to provide bidirectional drive currents of up to 600mA at voltages from 4.5V to 36V. It makes it easier to drive the dc motors. The L293D consists of four drivers. Pins IN1 through IN4 and OUT1 through OUT4 are the input and output pins, respectively of driver 1 through driver 4. Drivers 1 and 2, and driver 3 and 4 are enabled by enable pin 1(EN1) and pin 9 (EN2), respectively. When enable input EN1 (pin1) is high, drivers 1 and 2 are enabled and the outputs corresponding to their inputs are active. Similarly, enable input EN2 (pin9).

Figure 5. Circuit Diagram of DTMF CM8870 interfacing with Microcontroller AT89S52.

- Using the System

The keypad and digital display are used to communicate with and program the HM2007 chip. The keypad is made up of 12 normally open momentary contact switches. When the circuit is turned on, “00” is on the digital display, the red LED (READY) is lit and the circuit waits for a command.

- Training Words for Recognition

Press “1” (display will show “01” and the LED will turn off) on the keypad, then press the TRAIN key (the LED will turn on) to place circuit in training mode, for word one. Say the target word into the onboard microphone (near LED) clearly. The circuit signals acceptance of the voice input by blinking the LED off then on. The word (or utterance) is now identified as the “01” word. If the LED did not flash, start over by pressing “1” and then “TRAIN” key. You may continue training new words in the circuit. Press “2” then TRN to train the second word and so on. The circuit will accept and recognize up to 20 words (numbers 1 through 20). It is not necessary to train all word spaces. If you only require 10 target words that are all you need to train.
C. Flow chart.

![Flow chart image]

3. RESULT

Table 1. Motion of Wheel According To Key Pressed.

<table>
<thead>
<tr>
<th>Number pressed by user</th>
<th>Output of HT9170 DTMF decoder</th>
<th>Output from microcontroller</th>
<th>Action performed</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>0x02</td>
<td>0x02</td>
<td>Forward motion</td>
</tr>
<tr>
<td></td>
<td>00000010</td>
<td>0301001</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>0x04</td>
<td>0x04</td>
<td>Left turn</td>
</tr>
<tr>
<td></td>
<td>00000100</td>
<td>00000101</td>
<td>Right motor forwarded, Left motor backwarded</td>
</tr>
<tr>
<td>6</td>
<td>0x06</td>
<td>0x06</td>
<td>Right turn</td>
</tr>
<tr>
<td></td>
<td>00000110</td>
<td>00000101</td>
<td>Left motor backwarded</td>
</tr>
<tr>
<td>8</td>
<td>0x08</td>
<td>0x08</td>
<td>Backward motion</td>
</tr>
<tr>
<td></td>
<td>00001000</td>
<td>00000110</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>0x05</td>
<td>0x05</td>
<td>Stop</td>
</tr>
<tr>
<td></td>
<td>00001010</td>
<td>00000000</td>
<td></td>
</tr>
</tbody>
</table>

- **Testing Recognition.**
Repeat a trained word into the microphone. The number of the word should be displayed on the digital display. For instance, if the word “directory” was trained as word number 20, saying the word “directory” into the microphone will cause the number 20 to be displayed.

- **Error Codes.**
The chip provides the following error codes.
55 = word too long
66 = word too short
77 = no match

- **Clearing Memory.**
To erase all words in memory press “99” and then “CLR”. The numbers will quickly scroll by on the digital display as the memory is erased.

- **Changing & Erasing Words.**
Trained words can easily be changed by overwriting the original word. For instance, suppose word six was the word “Capital” and you want to change it to the word “State”. Simply retrain the word space by pressing “6” then the TRAIN key and saying the word “State” into the microphone. If one wishes to erase the word without replacing it with another word press the word number (in this case six) then press the CLR key. Word six is now erased.

4. FUTURE SCOPE.

- **Password Protection**
Project can be modified in order to password protect the robot so that it can be operated only if correct password is entered. Either cell phone should be password protected or necessary modification should be made in the assembly language code. This introduces conditioned access & increase security to a great extent.

- **Alarm Phone Dialer**
By replacing DTMF Decoder ‘IC CM8870’ to The DTMF Transceiver ‘IC CM8880’ DTMF tones can be generated from the robot. So, a project called Alarm Phone Dialer! Can be built which will generate necessary alarms for something that is desired to be monitored (usually by triggering a relay). For example, a high water alarm, low temperature alarm, opening of back window, garage door etc. The system is activated; it will call a number of programmed numbers to let the user know the alarm has been activated. This would be great to get alerts of alarm conditions from home when user at work.

- **Adding Camera**
If the current project is interfaced with a camera (e.g. a webcam) robot can be driven beyond line-of-sight & range becomes practically as GSM networks has very large range.

REFERENCES


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