Design and implementation of GSM Controlled Versatile Robotic Vehicle Using a PIC Microcontroller

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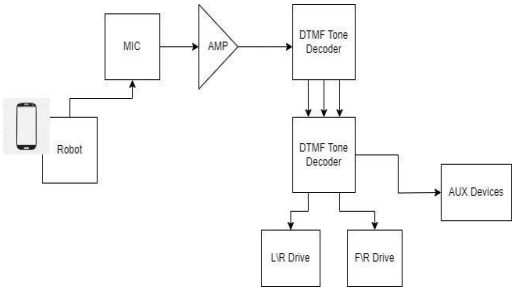
Abstract

This paper presents a wireless-controlled robot that utilizes GSM communication for remote operation. The robot is controlled through a standard mobile handset, which sends commands to control its movements. The system consists of two mobile devices, one acting as the transmitter and the other as the receiver. The transmitter sends commands via GSM communication, and the receiver decodes these commands to control the robot's motion. This project establishes a one-way communication link between the transmitter and the receiver, enabling remote control of the robot. The communication operates over regular mobile networks, incurring standard call charges. The robot's movements can be directed in various directions based on the commands received by the receiver. The setup involves the use of a DTMF decoder circuit, microcontroller, and DC motor drive circuit to execute the commands effectively.

Introduction:

The term "Robot" has evolved over time, encompassing a range of autonomous devices. This paper focuses on a wireless robot that is remotely controlled using GSM communication. Originally, robots were human-like entities capable of independent action, but the definition has expanded to include various autonomous vehicles. This concept extends to remote-controlled robots, such as those used in emergency services and entertainment contests.

Block Diagram:



Basic Parts of a Robot Vehicle:

The robot vehicle consists of mechanical components capable of interacting with the environment. Sensors provide environmental feedback, guiding the robot's actions based on situational input.

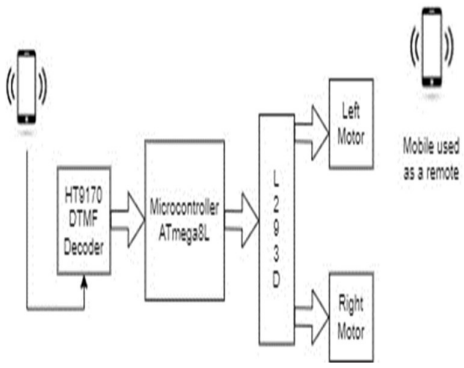
- Wireless Control Mechanism:

The robot's wireless control is achieved through GSM communication. Specific key presses on a mobile handset trigger actions in the robot. For instance, pressing key 2 initiates forward motion. The DTMF circuitry interprets these key presses and communicates with the microcontroller to command the motor to move accordingly.

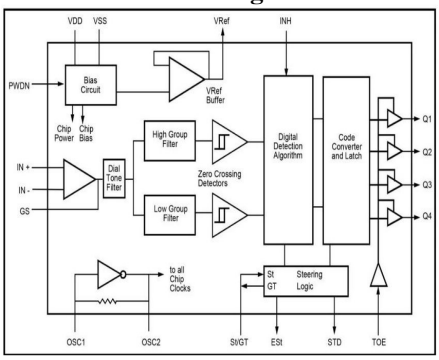
- DTMF Receiver and Decoder (8870):

The 8870D/8870D-1 DTMF receiver integrates band split filtering and digital decoding functions. It utilizes switched capacitor techniques for filtering and digital

counting methods to decode DTMF tone pairs into a code. This compact component reduces the need for external elements.



Functional Block Diagram:



A block diagram illustrates the functional elements of the system, showing how various components interact.

Functional Description:

The DTMF receiver section comprises bandpass filters that separate tones into high and low groups. The digital counting section validates tone frequencies and durations, producing corresponding output codes. The decoder section determines incoming tone frequencies and employs an averaging algorithm for tolerance to frequency variations.

DC Motor Drive Circuit:

The circuit for driving the DC motor includes a stabilized 5V DC supply, logic inputs for motor control, and indicators for power status.

DC Motor's Steering Circuit:

The steering circuit operates on a 5V DC supply, controls a built-in DC motor, and enables directional movement of the robot's wheels.

Microcontrollers (MCU):

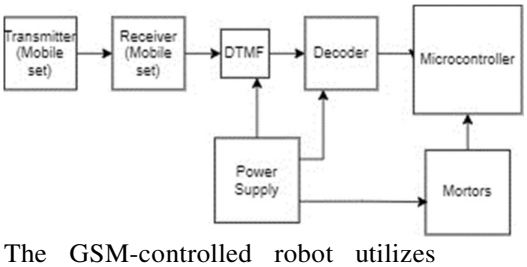
The PIC16F8X microcontroller series is used in the project, offering RISC architecture, deep stacks, and internal/external interrupt capabilities. These microcontrollers provide efficient performance and support various applications.

Decoder Section:

It is fixed at the end of the filter section., its main function is to determine the frequencies of incoming tones decoder section uses digital counting techniques and it is verified that weather the frequency belongs to standard DTMF frequencies. To enhance the tolerance and small frequency deviations complex averaging algorithm is used.

It also enables tone simulation by external voice signals etc., This algorithm has been developed to ensure an optimum combination of immunity to talk-off and tolerance to the presence of interfering frequencies (third tones) and noise. If the detector output contains two valid tones the “Early Steering” (ESt) output will go to an active state. ESt is in an inactive state if the signal is lost.

Working of GSM Robot:



The GSM-controlled robot utilizes radio signals for remote control, and its setup includes a mobile phone, DTMF decoder, and microcontroller. The transmitter phone sends commands, while the receiver decodes andexecutes them, directing the robot's movements.

FUTURE SCOPE: IR Sensors IR sensors can be used to automatically detect & avoid obstacles if the robot goes beyond the line of sight. This prevents the vehicle from being damaged if we are manoeuvring it from a distant place.

Password Protection

Project can be modified to password-protect the robot so that it can be operated only if the correct password is entered. Either cell phones should be password protected or necessary modifications should be made in the assembly language code. This introduces conditioned access and increases security to a great extent**.**

Alarm Phone Dialler

By replacing DTMF Decoder IC CM8870 with a '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, the opening of the back window, garage door, etc. When the system is activated it will call several 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 the user is at work.

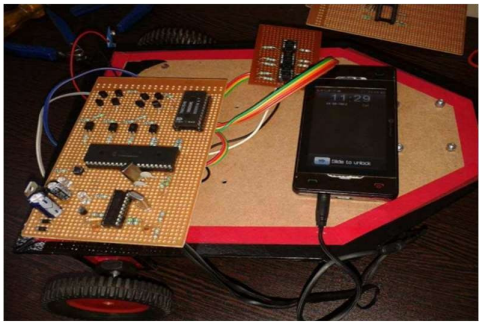


Fig: GSM Controlled Versatile Robotic Vehicle Using PIC Microcontroller

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