



SIX LEGGED SOUND FOLLOWER ROBOT

A. SUBBIAH*, **N. SHANKAR GANESH**, **JABIN JAMES**
and S. RAJISH RAJA

Department of Electronics and Communication Engineering, Aarupadai Veedu Institute of Technology,
CHENNAI (T.N.) INDIA

ABSTRACT

An audio signal following control of a sound follower six legged robot with the estimation of the sound source location using a microphone array. The traveling time difference of the sound signal depending on the distance provides the three dimensional coordinates of the sound signal. To detect the sound signal, Four microphone array is used to locate the area in the three dimensional space. Our project involves implementing a signal processing system for audio sensing and manipulation for the control of an autonomous vehicle. Our system will have two modes, autonomous and control. In autonomous mode, the robot will detect and follow pulses of a predetermined set of frequencies and the robot will approach the source. In control mode, the robot will execute commands by an administrator on PC transmitted to the robot via an RS-232 serial connection.

Key words: Sound Follower robot, Microphone array.

INTRODUCTION

Legged robots are a type of mobile robot. They are somewhat a recent innovation in robotics. However, many or all bipedal models are not practical seeing as they are cumbersome and slow. Most successful legged robots have 4 or 6 legs for further stability. This legs over- wheels approach lends itself for use in all-terrain purposes seeing as legs are more effective in an uneven environment than wheels.

The PC is used to communicate with the PIC microcontroller in control mode for transmitting commands. During development, the PC communication was useful for testing, debugging and verification. A basic block diagram of the system. The four microphones were used to triangulate the angle of the source relative to the robot. The audio source plays a continuous stream of pulses. Pulses were chosen over continuous tone because, instead of

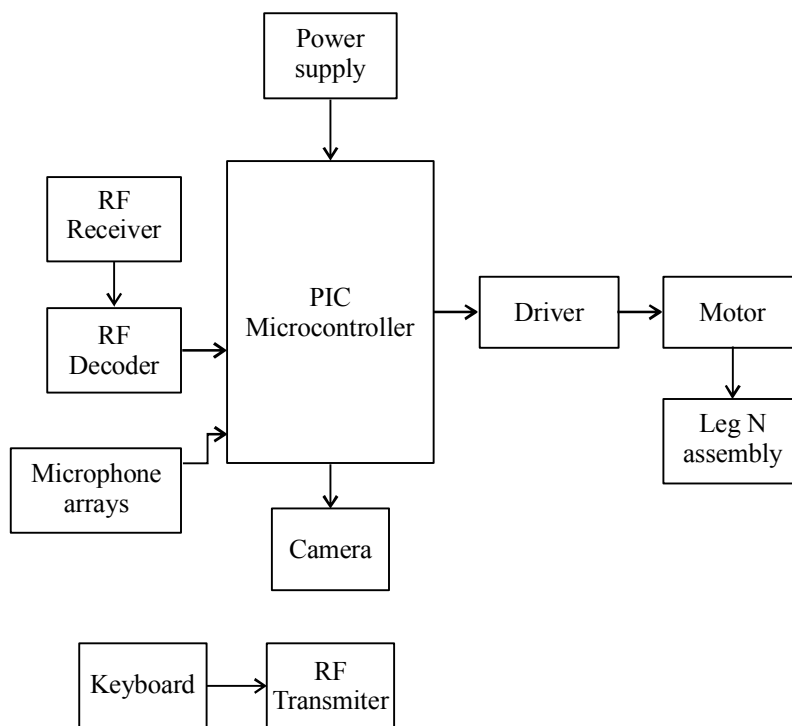
* Author for correspondence; E-mail: subbiah@avit.ac.in

detecting phase difference in the audio signal, our system detects the arrival time of the signal at certain amplitude at each microphone.

The robot is designed to be autonomous and is, therefore, not synchronized with the pulse generator. As a result, the time of flight of each impulse is not available and the robot is unable to quantify the distance to the source. Instead, the robot advances by a small predetermined distance and listens for the signal again. To find the sound source, the robot listens for the arrival of an impulse on any of the three microphones. Once an impulse has been detected at one of the microphones, the robot records the microphone data at 10 microsecond intervals for 10 milliseconds. Using this data, the arrival time of the impulse at each microphone is calculated and the direction of the source is obtained. Once the angle of the source has been identified, the robot rotates and pursues the source for a short period, and then promptly resumes triangulation of the signal to repeat the process.

Block diagram

Robot section



Keyboard section

PIC Microcontroller

PIC16F73/76 devices are available only in 28-pin packages, while PIC16F74/77 devices are available in 40-pin and 44-pin packages. All devices in the PIC16F7X family share common architecture, with the following differences:

- The PIC16F73 and PIC16F76 have one-half of the total on-chip memory of the PIC16F74
- The 28-pin devices have 3 I/O ports, while the 40/44-pin devices have 5
- The 28-pin devices have 11 interrupts, while the 40/44-pin devices have 12
- The 28-pin devices have 5 A/D input channels, while the 40/44-pin devices have 8
- The Parallel Slave Port is implemented only on the 40/44-pin devices

Six leg mechanism

The six legs attached to the robot are connected to a DC Motor, one Motor for each leg. Each leg is activated through a relay and a dc motor. The microcontroller gives the signal for the motion.

Infra-red object sensor

The basic idea is to send infra-red light through IR-LEDs, which is then reflected by any object in front of the sensor. Then all you have to do is to pick-up the reflected IR light. For detecting the reflected IR light, we are going to use a very original technique we are going to use another IR-LED, to detect the IR light that was emitted from another led of the exact same type! This is an electrical property of Light Emitting Diodes (LEDs) which is the fact that a led produce a voltage difference across its leads when it is subjected to light.

Wireless cameras

Wireless cameras are basically described as a wireless transmitter carrying a camera signal. The Camera is wired to a wireless transmitter and the signal travels between the camera and the receiver. This works much like radio. The sound you hear on a radio is transmitted wirelessly and you tune to a certain frequency and hear the sound. Wireless cameras have a channel also. The receiver has channels to tune in and then you get the picture. The wireless camera picture is sent by the transmitter the receiver collects this signal and outputs it to your Computer or TV Monitor depending on the receiver type.

Snap shots: Six legged sound follower robot



Fig. 1: Camera section

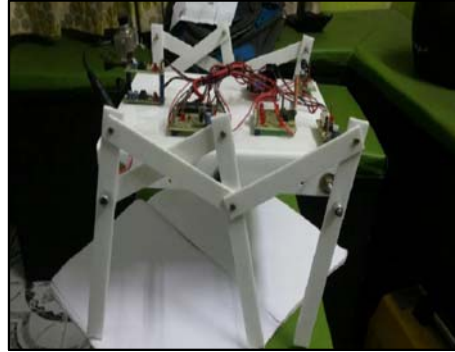


Fig. 2: Robot section

RESULTS AND DISCUSSION

Here we have designed a Six Legged Sound follower robot with PIC Microcontroller. With the help of Four Microphone array it is able to locate the place and move towards it. Infrared sensor is used to find out the obstacle in the pathway. Webcam is also fixed to find the pathway it is moving through and it can be transmitted to the television.

REFERENCES

1. H.-J. Böhme, T. Wilhelm, J. N. Key, C. Schauer, C. Schröter, H.-M. Groß and T. Hempel, An Approach to Multi-Modal Human-Machine Interaction for Intelligent Service Robots, *Robotics and Autonomous Systems*, **44**, 83-96 (2003).
2. Cynthia Breazeal, Towards Sociable Robots, *Robotics and Autonomous Systems*, **42(3-4)**, 167-175 (2003).
3. Cynthia Breazeal and Brian Scassellati, Robots that Imitate Humans, *Trends in Cognitive Sciences*, **6(11)**, 481-487 (2002).
4. T. Fong, I. Nourbakhsh and K. Dautenhahn, A Survey of Socially Interactive Robots, *Robotics and Autonomous Systems*, **42**, 143-166 (2003).
5. Y. Ota, Y. Inagaki, K. Yoneda and S. Hirose, Research on a six-legged walking robot with parallel mechanism" *Proceedings IEEE/RSJ International Conference on Intelligent Robots and Systems*, Victoria, BC (1998) pp. 241-248.

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