International Journal of Electrical and Electronics Engineers
Vol. No.7 Issue 02, July-December 2015
www.arresearchpublication.com
IJEEE
ISSN 2321 - 2055

ROBOT CONTROL USING MOBILE PHONE

Aruna Devi[1] , Bharathi R[2]

[1,2]*Assistant Professor, Department of ECE, GSSSIETW, Mysuru*

ABSTRACT

Recently, robot technology has gained popularity because of labour shortage, ability to work for long hours, etc. Conventionally, wireless control robots use RF circuits, which have the drawbacks of limited working range, limited frequency range and limited control. Use of a mobile phone for robotic control can overcome these limitations. It provides the advantages of robust control, working range as large as the coverage area of the service provider. Although the appearance and capabilities of robots vary vastly, all robots share the features of mechanical, movable structure under some form of control. The control of robot using mobile phone involves three distinct phases: Reception, Processing and Action. Here the reception is done by DTMF decoder unit (HT9170), processing is done by on-board microcontroller (LPC2148) and the action is performed using motors (DC gear motors). The Camera is mounted on the robot to record and capture images of remote areas. The Robot is controlled according to the user's key press. The microcontroller is programmed in Embedded C language using Keil microvision4 compiler. Flash magic is used as a tool for user interface. The mobile control system has the ability to move in different directions such as left, right, forward, backward and stop according to user's keypress and to capture images of remote location. Mobile phone operated control is best because there is no limitation of range.

Keywords: DTMF Decoder Unit (HT9170), Microcontroller (LP2148), Motor Driver (L293D) and Flash Magic.

I. INTRODUCTION

A robot is a mechanical or virtual artificial agent, usually an electro-mechanical machine which performs a variety of tasks that is guided by a computer program or electronic circuitry.

Robotics inspires to make connections across several disciplines rather than learning topics in isolation as it combines mechanical, electronic, electrical and programming skills [1]. It gives visual grasp of math and science, builds logical thinking that brings out innovation and creativity and enhances problem solving skills.

Applications- Manufacturing industry, medical science, robots in space, national defense, transportation, agriculture etc.

II. PROBLEM STATEMENT

Conventionally, robots controlled by wireless communication employ radio frequency (RF) circuits, which have the drawbacks of limited working range, limited frequency range and the limited control. Use of a mobile phone for robotic control can overcome these limitations.

It provides the advantage of robust control, working range as large as the coverage area [2] of the service provider.

III. CONSTRUCTION

When constructing any robot, one major mechanical constraint is the number of motors being used. Either a two-wheel drive or a four-wheel drive can be used. Though four-wheel drive is more complex than two-wheel drive, it provides more torque and good control. Two-wheel drive, on the other hand, is very easy to construct [3]. The chassis used in this model is a plastic plate. Motors are fixed to the bottom of this sheet and the circuit is affixed firmly on top of the sheet. A cell phone is also mounted on the sheet. In the four-wheel drive system, the two motors on a side are controlled in parallel. So a single L293D driver IC can drive the rover.

IV. METHODOLOGY

The block diagram of the project is as shown in fig 1. It consists of DTMF decoder (HT9170), Arm7 microcontroller (LPC2148), Motor driver (L293D), Wireless camera module, two mobile phones (one mounted on the module and other with the user) and user PC.The method of project operation is explained below.

Here, the robot is controlled by a mobile phone attached to the robot. In the course of a call, if any button is pressed, a tone corresponding to the button is heard at the other end of the call [4]. This tone is called "dual-tone multiple frequency" (DTMF) tone. The robot perceives this DTMF tone with the help of the phone stacked in the robot

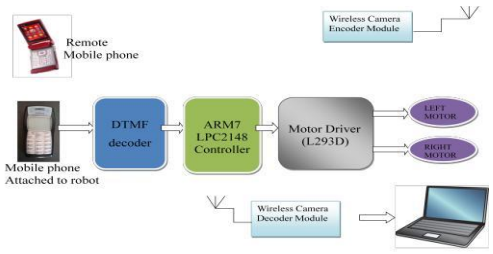

Fig.1. Block Diagram of Mobile Controlled Robot

The received tone is processed by the ARM7 microcontroller with the help of DTMF decoder HT9170. The decoder decodes the DTMF tone into equivalent binary digit and this binary number is sent to microcontroller. The microcontroller is preprogrammed to take a decision for any given input and outputs its decision to motor drivers in order to drive the motors for forward and backward direction or a turn. The mobile that makes a call to the mobile phone stacked in the robot act as a remote. So this robot system does not require the construction of receiver and transmitter units. DTMF signaling is used for telephone signaling over the line in the voice frequency band to call the switching centre. The version of DTMF used for telephone tone dialing is known as "Touch-Tone".

DTMF assigns a specific frequency to each key so that it can easily be identified by the electronic circuit.

V. HARDWARE REQUIREMENTS

The hardware requirements of the robot control system are given in below table 5.1.

Table 5.1: hardware Requirements of a Robot Control

SL NO.	Components Name	Qty
1	ARM7 IC LPC2148	1
2	DTMF decoder IC HT9170	1
3	Motor driver IC L293D	1
4	Motors	2
5	Crystal Oscillator(3.579 MHz)	1
6	Voltage regulators (7812,7805,1117)	3
7	Wireless camera	1
8	Resistor, LEDs	1, 6
9	Battery (12 V)	1
10	Mobiles	2

5.1 LPC2148 Micro Controller Board

The LPC2148 are based on a 32 bit ARM7 CPU with real-time emulation and embedded trace support, together with 512 kilobytes of embedded high speed flash memory ranging from 32 kb to 512 kb. A 128 bit wide memory interface and unique accelerator architecture enable 32 bit code execution at maximum clock rate [5]. These microcontrollers are particularly suitable for industrial control, medical systems and access control. With a wide range of serial communications interfaces, they are also very well suited for communication gateways, protocol converters and embedded soft modems as well as many other general-purpose applications.

5.2 DTMF Decoder

The decoder decodes DTMF audio signal to 4 bit binary TTL level output with LED indication. Suitable for use with microcontroller, remote and robotic applications[8].

5.3 Motor Driver

L293D Motor driver is simple and reliable DC motor driver. This motor driver can handle current up to 1 ampere.

5.4 Wireless Camera

It has two units, a Camera Capture Module & Wireless receiver Module. The function of this module is to take the snap of the remote location and perform the wireless transmission of the obtained snapshot.

At the Base station there is a wireless receiver module. The function of this unit is to receive the Snap of picture transmitted by the Capture module from remote location and process it and give the user the photographic view of location. The received pictures can be directly viewed on the T.V by using the video output jack on the module. The received pictures can also be viewed on the laptop by the use of additional Audio/Video card module integrated on the Laptop.

5.5 Motors

The motors are used for the movement of the robot, which are of DC gear motors operated at 12V DC power supply. Two motors have been used to rotate the two wheels clockwise or anticlockwise[9].

This provides motion to the robot. Motors are arranged in a fashion called H-Bridge. H-Bridge is an electronic circuit which enables a voltage to be applied across a load in either direction.

It allows a circuit full control over a standard electric DC motor. That is, with an H-bridge, a microcontroller, logic chip, or remote control can electronically command the motor to go forward, reverse, left, right and stop.

5.6 Power Source

To generate required power source to drive the vehicle 12V, 1.2A, rechargeable, lead acid heavy duty battery is used. Two different DC levels of +5V & +12V are used. The battery as it is delivering 12V is used to drive the DC motors & H-Bridge, where as for the remaining electronic circuitry consists of microcontroller & DTMF decoder chip requires +5V constant source[7].

To generate a stable supply of +5V, 7805 three terminal voltage regulator chip is used which provides constant supply, though the battery terminal voltage falls down to 8V.

The DC motors are designed to operate at 12V DC & each motor consumes a maximum current of 150 milli-amps, there by two motors together consumes 300 milli-amps, the remaining circuitry including microcontroller will consume another 150 milli-amps, hence the entire system consumes around 450 milli-amps approximately.

5.7 Mobile Phone

The mobile phone (also called a wireless phone or cellular phone) is a portable electronic device used for mobile voice or data communication over a network of specialized base stations known as cell sites. In addition to the standard voice function of a telephone, current mobile phones may support many additional services such as SMS for text messaging, email, packet switching for access to the Internet, gaming, Bluetooth, infrared, camera with video recorder and MMS for sending and receiving photos and videos. These days mobile phones connect to a cellular network of base stations (cell sites), which is in turn interconnected to the public switched telephone network (PSTN). When the mobile phone or data device is turned on, it registers with the mobile telephone exchange, or switch, with its unique identifiers, and can then be alerted by the mobile switch when there is an incoming telephone call. The handset constantly listens for the strongest signal being received from the surrounding base stations, and is able to switch seamlessly between sites. As the user moves around the network, the "handoffs" are performed to allow the device to switch sites without interrupting

the call.

5.8 Voltage Regulators

Voltage Regulators are used to regulate the output Voltage. Regulator IC is a three pin IC. It converts unregulated DC current into regulated DC current. Normally we get fixed output by connecting the voltage regulator at the output of the filtered DC. It can also be used in circuits to get a low DC voltage from a high DC voltage. There are two types of voltage regulators.

1. Fixed voltage regulators (78xx, 79xx)
2. Variable voltage regulators (LM317)

VI. SOFTWARE REQUIREMENTS

Here the programming language is embedded C, software used such as Keil, Flash Magic are explained.

6.1 Embedded C

C language has become a popular programming language because of its many user friendly features. It is both general purpose and specific purpose programming language. Programs written in C are efficient and fast. It is a robust language whose rich set of built-in functions and operators can be used to write any complex program. C compiler combines the capabilities of an assembly language with features of high level language and therefore it is well suited for writing both system software, including implementing operating systems and embedded system applications and business packages.

6.2 Keil Software

Keil development tools support every level for software developer from the professional application engineer to the student just learning about software development. Keil C compiler, micro assemblers, debuggers, real time kernels, single board computers and emulators support all processors[6]. The Keil development tools are designed to solve the complex problems faced by software developers.When starting a new project the processor from the device database is selected and the IDE sets all compilers, assemblers, linkers and memory options for the selected processors. Numerous example programmes are included to get started with the most popular processor devices. The Keil debugger accurately simulates on chip peripherals of processor device.Simulation helps in understanding the hardware configuration and avoids the time wasted on setup problems.

6.3 Flash Magic

Flash magic is a PC tool for programming flash microcontroller from NXP using in serial or Ethernet protocol in target hardware. Its features are straight forward and intuitive user interface programs Intel hex files. Automatic verification after programming is available. It controls RS232 signals to place the devices into boot ROM and execute modes automatically, displays information about the selected hex files including creation and modification dates, flash memory used, percentage of current device used. It displays the contents of flash in ASCII in hexadecimal formats. NXP semiconductors produce a range of microcontroller that features both on-chip flash memory and the ability to be the programmed using In-system programming technology. Flash magic is window software from Embedded systems Academy that allows easy access to all the ISP features provided by the devices.

VII. RESULTS

The Robot control system has the ability to move in different directions such as left, right, forward, backward and stop according to user's keypress and to capture images of remote location.

This is a robot with wireless visual system that the user can observe and control the movements via mobile.The primary purpose of the mobile phone operated land rover with DTMF decoder is to know the information in the places where we cannot move. The robot perceives the DTMF tone with the help of the phone stacked in the robot. It provides the advantage of robust control, working range as large as coverage area of service provider.

The final robot control system module is shown in fig.2.

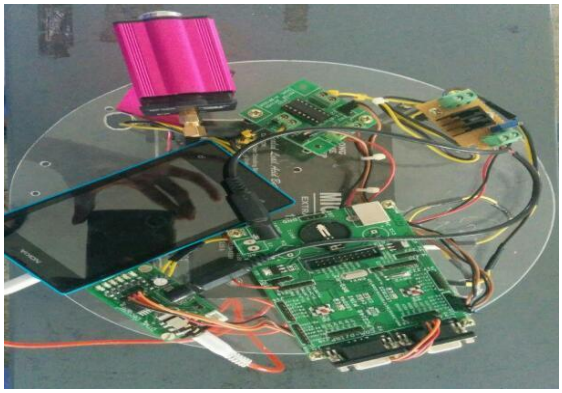

Fig.2. Final Module

VIII. ADVANTAGES AND APPLICATIONS

This gives the details of advantages and applications of the project.

8.1 Advantages

The Robot has ability to survey the environment or situation at certain place using wireless camera. The visual gathering from the robot can be recorded and viewed by human directly. The mobile controlled robot that has ability to move in different directions according to user's keypress and to capture images of remote location. This is a robot with wireless visual system that the user can observe and control the movements via mobile.

The advantages are as follows

- Wireless control.
- Noise free operation.
- Unlimited control options.
- Vehicle Navigation with use of 3G technology.
- The operation is quite simple.
- Takes in use of the mobile technology which is almost available everywhere.
- This wireless device has no boundary of range and can be controlled as far as network of cell phone.
- From a performance standpoint, the perceived benefits of a robotic security or surveillance capability are numerous and well documented.
- Humans are removed from direct exposure to potentially dangerous situation.
- Robotic systems can perform many security and surveillance functions more effectively than humans,

giving us information that humans cannot get.

- They can perform tasks faster than humans and much more consistently and accurately.
- They can capture moments just too fast for the human eye to get.
- They can entertain us and help us in certain tasks.

8.2 Applications

There are wide range of applications which are as listed below.

- Cell phone controlled robot can be used in the borders for displaying hidden Land mines.
- The robot can be used for reconnaissance or surveillance.
- The robot can be used anywhere there is the service provider tower of the connection provided that is mounted on robot.
- It can be adequately implemented in national defense through military-industrial partnership.
- It can be vastly applied in Resorts, borders of noted buildings.
- Installation of combat robots in the stadiums, sacred places, government and non government organizations assures top security.

IX. CONCLUSION

Conventionally, wireless control robots use RF circuits, which have the drawbacks of limited working range, limited frequency range and limited control. Use of a mobile phone for robotic control can overcome these limitations. It provides the advantages of robust control, working range as large as the coverage area of the service provider. Although the appearance and capabilities of robots vary vastly, all robots share the features of mechanical, movable structure under some form of control. This system has the ability to move in different directions such as left, right, forward, backward and stop according to user’ s keypress and to capture images of remote location.

X. FUTURE SCOPE

So far the present system is designed mainly for the supervision applications. In the area of suspectance, the robot can be directed and if any smoke or gas is identified the robot can produce alarm and also informs the operator. The comments from the operator can also be transmitted to the area where the robot moves. Further the key board can be interfaced with the TV receiver to increase the number of comments given to the robot. Amplifier is needed to be connected to the speaker of the mobile interfaced with the robot to pass the comments directly through mobile from the remote mobile. The above system can also used for military purpose as bomb detection and as spy robot. Integrated factory automation systems, to which robot technology is key, affect nearly all types of manufacturing. In the near future, productivity and competitiveness in these industries will depend in large part on flexible automation through robotics. And further enhancement are:-Compact design, Quick movement, Improved reliability, Night vision camera, Replacement of transmitter with low power transmitter & receiver which is highly sensitive to reduce the power consumpion.

REFERENCES

[1]. Pete Miles & Tom Carroll, Build Your Own Combat Robot, (2002).

[2]. K.S.Fu , R.C.Gonzalez , C.S.G..Lee, Tutorials Robotics.

[3]. Asaro,P. How just could a robot war be?, Frontiers in Artificial Intelligence and Applications, 75, 50-64.

[4]. S. Y. Harmon & D. W. Gage, "Current Technical Research Issues of Autonomous Robots Employed In Combat", 17th Annual Electronics and Aerospace Conference.

[5]. www.Atmel.com

[6]. http://www.keil.com/dd/docs/datashts/atmel/at8 9s52_ds.pdf

[7]. Robert L.Boylestad and Louis Nashelsky, "Electronic Devices and Circuit Theory", 8th Edition, 2006

[8]. Decoder HT-12D, Encoder HT-12E http://robokits.co.in/shop/index.php?main_page=product_info&cPath=14_15&products_id=76>

[9]. A. Khamis, M. Pérez Vernet, K. Schilling, "A Remote Experiment On Motor Control Of Mobile Robots", 10th Mediterranean Conference on Control and Automation – MED2002.

[10]. www.alldatasheet.com/datasheet-pdf/pdf/169605/.../RLP434A.htm