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Mobile Control Robot

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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.

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.

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

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II. LITURATURE SURVEY

The first remote control vehicle was a propeller-driven radio controlled boat, built by Nikola Tesla in 1898. It is the original prototype of all modern day uninhabited aerial vehicles and precision guided weapons, in fact, all remotely operated vehicles in air, land and sea. Powered by lead-acid batteries and an electric drive motor, the vessel was designed to be manoeuvred alongside a target using instructions received from a wireless remote-control transmitter. Once in position, a command would be sent to donate an explosive charge contained within the boat's forward compartment. The weapon's guidance system incorporated a secure communications link between the pilot's controller and the surface running torpedo in an effort to assure that control could be maintained even in the presence of electronic countermeasures. During World War II in the European theatre the U.S Air force experimented with three basic forms of radio control guided weapons. In each case, the weapon would be directed to its target by a crew member on a control plane. The first weapon was essentially a standard bomb fitted into steering controls. The next evolution involved the fitting of a bomb to a glider airframe, one version, the GB-4 having a TV camera to assist the controller with targeting. The third class of guided weapon was the remote controlled B-17. It's known that Germany deployed a number of more advanced guided strike weapons that saw combat before either the V-1 or V-2. Currently, the primary mode for robot communication uses RF (radio frequency). RF is an obvious choice for communication since it allows more information to be transferred over small distances. However range is a huge limitation in robots designed using RF circuits. Conventionally, wireless-controlled robots using RF circuits have various drawbacks such as the working range, limited frequency and 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 of the service provider, no interference with other controllers and up to twelve controllers.

III. TECHNOLOGY USED

Dual Tone Multi-Frequency (DTMF) signalling is used for telecommunication signalling over analog telephone lines in the voice frequency band between telephone handsets and other communications devices and the switching centre. The version of DTMF used for telephone tone dialling is known by the trademark term Touch-tone and is standardized by ITU-T recommendation Q.23. It is also known in the UK as MF4. Other multi frequency systems are used for signaling internal to telephone network. As a method of in-band signaling, DTMF tones were also used by cable television broadcasters to indicate the start and stop times of local commercial insertion points during station breaks for the benefit of cable companies.

Telephone Keypad is laid out in a 3x4 grid, although the original DTMF keypad had an additional column for four now-defunct menu selector keys. When used to dial a telephone number, pressing a single key will produce a pitch consisting of two simultaneous pure tone sinusoidal frequencies. The row in which the key appears determines the low frequency and the column determines the high frequency. The keypad has levers inside, so each button activates two contacts. The multiple tones are the reason for calling the system multi frequency. These tones are then decoded by the switching centre to determine which key was pressed.

Hardware Design • AT89C51 Microcontroller: It is a low power high performance CMOS 8-bit microcontroller with 4k bytes of In-System 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 program memory to be reprogrammed in-system or by a conventional non-volatile memory programmer. The AT89C51 provides us with 4K bytes of Flash, 128 bytes of RAM, 32 I/O lines, watchdog timer, two data pointers, two 16-bit timers/counters, a five vector two level interrupt architecture, a full duplex serial port, on-chip oscillator and clock circuitry. In addition the AT89C51 is designed with static logic for operation down to zero frequency and supports two

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software selectable power saving modes, „Idle mode“ and „Power down mode“.

MT8870 DTMF Decoder: It is basically a low power complete DTMF Decoder along with internal gain setting amplifier. The filter section of MT8870 uses switched capacitor technology for both the high and low filters and for dial tone rejection. The filter section is used for separation of the low-group and high group tones and it is achieved by applying the DTMF signal to the inputs of two sixth order switched capacitor band pass filters, the bandwidths of which corresponds to the low and high group frequencies. The filter section also incorporates notches at 350 and 440HZ for exceptional dial tone rejection. Each filter section is followed by a single order switched capacitor filter section which smoothes the signals prior to limiting. Limiting is performed by high gain comparators which are provided with hysteresis to prevent detection of unwanted low level signals. The outputs of the comparators provide full rail logic swings at the frequencies of the incoming DTMF signals. The decoder section uses a digital counting technique to determine the frequencies of the limited tones and to verify that those tones correspond to standard DTMF frequencies. A complex averaging algorithm is used to protect against tone simulation by extraneous signals while providing tolerance to small frequency variations.

IV. ADVANTAGE

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.

V. APPLICATION

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.

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VI. PROPOSED 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

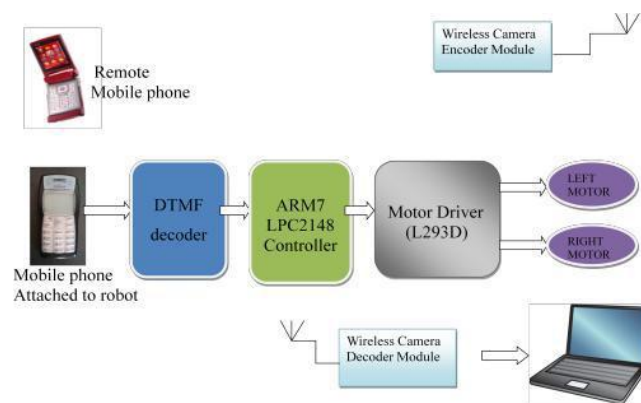


Fig.1. Block Diagram of Mobile Controlled Robot

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.

VII. RESULT

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.

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The final robot control system module is shown in fig.

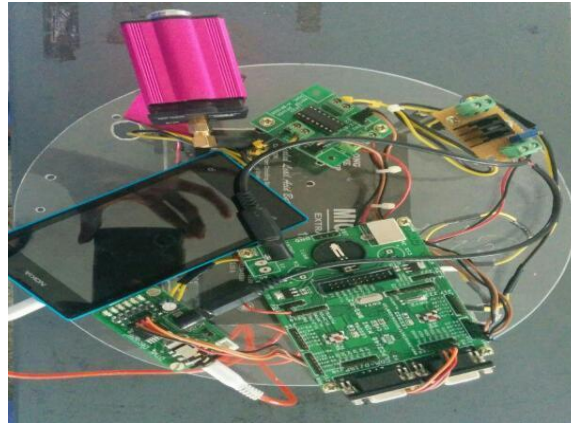


Fig.2. Final Module

VIII. 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.

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 use 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 consumption..

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