Single Chip Solution for Multimode Robotic Control

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Abstract: **Today's world is communicating with cutting edge equipments which are using 3G/5G communication standards. With this it is possible to do multiple operation simultaneously with equipments are handheld mobile phone. The mobile systems are also using multiple communication standards like GSM, Bluetooth, Wi-Fi for interrupt free communication. Same technology can be used for operation of wireless control robots. To establish fail proof communication channel between wireless robot and hand held terminal. Single chip solution for multimode robotic control can be provided. The chip can communicate with communication standards like DTMF, RF, IR. As the Robots are widely used in education, industrial, scientific, military, medical areas this can be helpful for development of fail proof robotic systems.**

Keywords – Communication, Mobile, Multimode, Robot, Single chip, Wireless.

INTRODUCTION

The increasing demand for wireless based services continues to grow with a multiplicity of standards developing. This is driving a need to develop integrated mobile terminals which have multi-mode capabilities, i.e. multiple communication systems which can coexist. The attention of this is focused on the coexistence of multiple communication systems via a simple hardware based structure. The term multi-mode[6] in this is limited to a set of standards and to a receiver that is expected to handle different systems with a low hardware complexity. Mobile robots are used in several teaching and research areas such as modeling, control, automation, power systems, sensors, data transmission, embedded electronics and much more used in educational systems. Hence it is necessary to develop robust communication system for controlling robots. This single chip solution provides embedded system prototype design. The objective of multimode robotic control is to allow easy and quick adaptation of prototype structure. Dedicated

hardware is shared and reused by different systems[6]. Such devices need to be designed for the best performance even when multiple standards are operating simultaneously.

I. MULTIMODE COMMUNICATION CHANNELES

There are few of communication channels for robotic control which is listed for multimode communication purpose.

1. Cellular DTMF over voice
2. Radio Frequency (RF)
3. Infra Red (IR)

1. *Cellular DTMF over voice*: The robot is controlled by a mobile phone that makes a call to the mobile phone attached to the robot. In the course of a call, if any button is pressed, a tone corresponding to the button pressed is heard at the other end of the call. This tone is called DTMF (dual-tone-multiple-frequency). The robot perceives this DTMF[2] tone with the help of the phone stacked in the robot. The received tone is processed by the microcontroller with then help of DTMF decoder. The decoder decodes the DTMF tone into its equivalent binary digit and this binary number is sent to the microcontroller. The microcontroller is programmed to take a decision for any given input and outputs its decision to motor drivers in order to drive the motors.

2. *Radio Frequency(RF)* :- RF communication[3] consists of a transmitter and a receiver module. A transmitter creates electromagnetic waves in a particular frequency (i.e.433MHz) and a receiver captures this signal. A controller can decode this signal and use it to control other peripherals i.e. robot.

3. *Infra Red(IR)* :- A transmitter in your controller transmits IR light and an IR receiver on your robot receives the signal, which is decoded with the help of a controller. IR transmitter can made with the help of photo diode or with timer IC for generating 38kHz frequency for which is received by TSOP[5] and appropriate control signals or codes is given to robotic control.

II. METHODOLOGY AND SYSTEM ARCHITECTURE

a. *Control Module*: It consists of receiver module which features wireless interfaces and robot control system. Control modules comprise of Infrared (IR), Radio Frequency (RF) and Cellular based Dual-Tone Multi-frequency (DTMF) over voice call connection. Using these communication channels we can control the robot or it can be automatic.
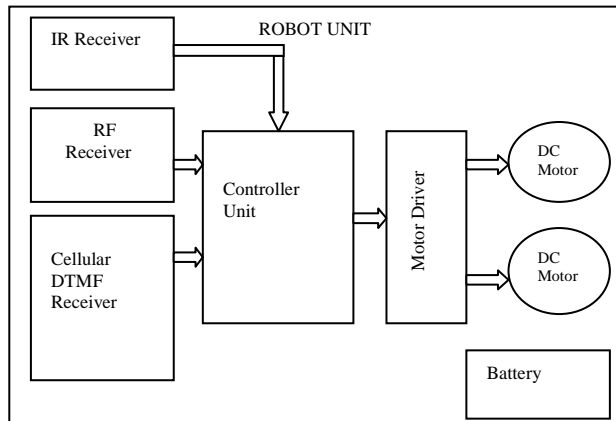

FIG . 1 RECEIVER SECTION ROBOT

b. *Receiver System (Robot):*
At the receiver module uses IR, RF, Cellular (DTMF over voice) communication channels for receiving controlling signal from control module which control the robot with five operations.

a. *DTMF channel:*
The dual-tone multi frequency (DTMF) signal was originally developed just over 25 years ago. This was before the U.S. government forced Bell Telephone to break up, allowing the company to expand into other markets. DTMF is commonly known as touch-tone dialing. The standard DTMF signal is composed of two audio tones generated from a group of eight possible tone frequencies. The eight frequencies are divided into two equal groups, a low-frequency group and a high frequency group. The DTMF[1] signal is an algebraic sum of two tone frequencies, one tone from each frequency group.
For DTMF channels control module which is a mobile phone on that pressing a key or button generates tone depending upon key pressed at transmitter module DTMF[2] decoder decodes the received tone & gives binary equivalent of it to the microcontroller. The controller is programmed such that appropriate output is given to motor driver IC which will drive the DC motor i.e. robot motion with five keys which is used for controlling the robot. Bellow operation shows controlling Robot using DTMF channel.

key- 2.Forword
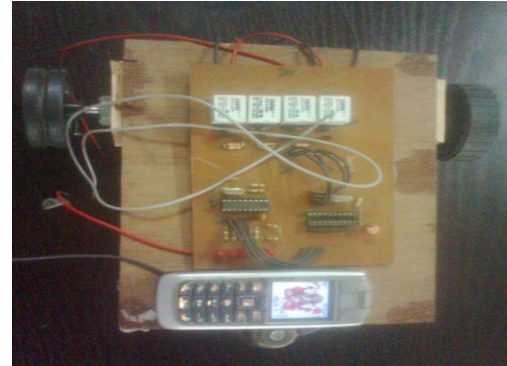key- 8. Reversed
key- 4. Left
key- 6. Right
key- 5. Stop.

FIG.2 DTMF CHANNEL CONTROL ROBOT

b. *Radio Frequency channel:*
Transmitter Circuit
Five keys are connected to the microcontroller AT2051. Key data is transmitted through the 433 MHz transmitter module through its of the microcontroller which is TX pin of the inbuilt UART of the microcontroller and works on 1200bits/sec.. Key pressed value is transmitted through antenna.
Receiver Circuit Operation:
RF433-RX is 433 MHz radio[3] receiver which receives the transmitted codes from the remote place transmitted by the transmitter these codes are converted to digital format and output is available at micro-controller, this is the Rx pin of inbuilt UART of the microcontroller. We are using UART to receive our codes at 1200 baud rate. Based on the transmitted key microcontroller operate and DC motor will drive. Robot will behave as follows:
KEY-up – Forward Direction
KEY-Down – Reverse Direction
KEY-Right – Right Direction
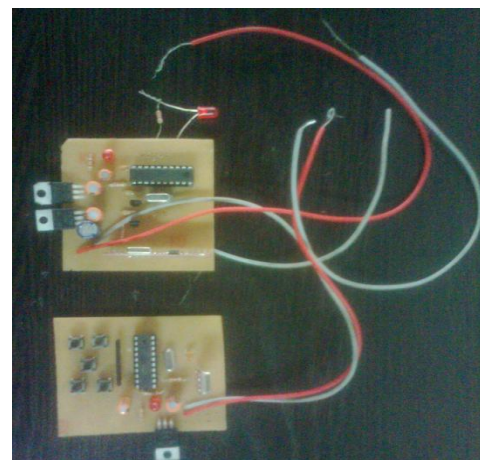KEY-Left – Left Direction
KEY-Center – STOP.

FIG.3 RF CHANNEL CONTROL ROBOT

III. RESULTS AND DISCUSSION

Bellow hardware module which presents the DTMF and RF, IR communication channel working on same hardware. These modules works independently i.e. fail safe.

Sr. No	Control Channel Name	Working range	Modulation	Hardware
1	DTMF channels	As per service provider	OOK	Yes
2	RF channel	0-80Meter	ASK	Yes
3	IR channel	5-10M	PWM	Yes

TABLE NO. 1 COMPARISON TABLE

IV. CONCLUSION AND FUTURE WORK

With the help of multimode robotic communication it can be possible to overcome drawbacks in single channel communication control for robot. It will give single chip solution for multimode robotic control. It can also make the system fail-safe using this system we can operated robot by three modes.

Future work:
1. Interface of GSM communication (SMS) to the robot for more operation.
2. Video call and acknowledgement from receiver to the sender station.
3. Verification of fail - safe condition at unmanned area.

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