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Control Of Poly-Wheeled Robot On A Mobile Phone

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Abstract: The Omni wheeled robot consists of three Omni-wheels which are mounted at 120 degrees apart. These three wheels mounted on DC motors which will be driven by relay motor drivers that are Omni-directional motion of the robot possible with utmost ease. This robot is controlled by using mobile phone which has DTMF (Dual Tone Multiple Frequency) decoder has been provided on the robot and also this robot can be controlled by using a remote controller with wired facility. A three wheel drive with Omni-directional wheel has been tried with success, and was implemented on fast moving autonomous mobile robots. This paper deals with the DTMF mobile controller of such mobile platform, it describes the advantages and also the type of control used. Vision AVR which is a C based compiler is used for coding. The robot chassis is manufactured out of acrylic and aluminum.

Keywords: Omni Wheel, DTMF (Dual tone multiplefrequency) decoder, ATmega128, Relay motor.

I. INTRODUCTION

The introduction of Omni wheeled robot is controlled by using Mobile phone with using DTMF decoder we will be learning the technologies used in the field of robotics and automation. Hands on experience of working on the DTMF.[1] along with their interfacing with a microcontroller will definitely help us in interfacing the real life systems. We are planning to implement the above project on an Atmega 128 microcontroller. Omni directional wheels have been used in robotics, in industry, and in logic-tics for many years. The main source of Omni directional wheels is companies which produce them for Omni directional conveyor systems, for example, for handling packages. Omni directional wheels are popular for Omni directional robots, especially in the Robocup setting. An Omni directional robot can drive along a straight line from point A to point B, while rotating along the line in order to arrive with the correct orientation. Omni directional wheels have also been used for wheelchairs, for service vehicles in airports, and many other applications.

II. OMNI WHEEL

Omni-directional wheels are unique as they are able to roll freely in two directions. It can either roll like a normal wheel or roll laterally using the wheels along its circumference. Omni-direction wheels allow a robot to convert from a non-holonomic to a holonomic robot.[2]

Wheel Specifications

- Diameter: 100mm
- Axial width: 16mm
- Number of plates: 2
- Number of roller: 18
- Body material: Nylon
- Roller material: Rubber
- Roller bearing material: Brass tube
- Roller diameter: 19mm
- Net weight: 290g
- Load capacity: 20kg

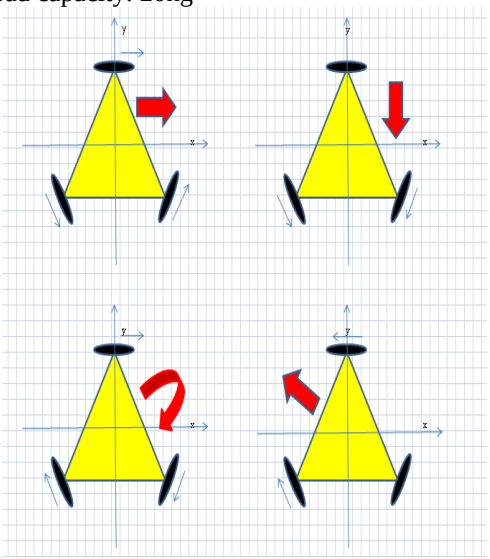

Figure1: Different Directions of Omni Wheeled Robot.

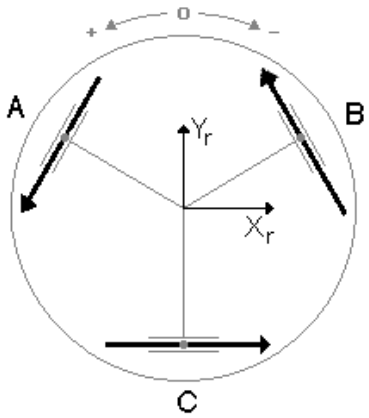

Figure2: Wheels driving axis

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II. DTMF DECODER

DTMF (dual tone multi frequency) is the signal to the phone company that we generate when we press an ordinary telephone's touch keys.

- Keypad tones can be different than DTMF tones (as in Samsung that use Sa Re Ga Ma … tone).
- It is just Nokia mobile manufacturer that uses DTMF tones for keypad tones also.
- The DTMF tone for each key is sum of two sinusoidal waves of frequencies as given in following table. Thus each key has unique frequency pair and thus unique DTMF tone. For example, DTMF tone for key6 is sum of two sinusoidal waves of frequency 1477Hz and 770Hz.
- The extra keys A, B, C and D are not present on cell phone. They are actually specially used for special purposes. For example, public payphones that accept credit cards use these additional codes to send the information from the magnetic strip.

Figure3: DTMF decoder.

	1209 Hz	1336 Hz	1477 Hz	1633 Hz
697 Hz	1	2	3	A
770 Hz	4	5	6	B
852 Hz	7	8	9	C
941 Hz	*	0	#	D

Table 1

The DTMF signals from source to destination follow the same path as that normal voice would have as you normally talk on mobile passing through may base stations and even satellites in case of large distances. [3]

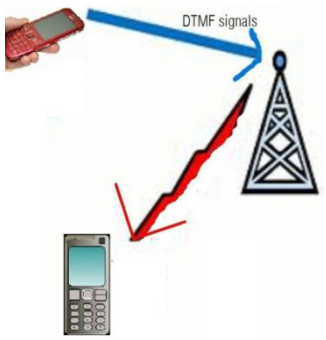

Figure4: DTMF Signals.

DTMF signal doesn't means it is electrical signal or audible voice signal (as intuition may guess). It is combination of two sinusoidal waves and sinusoidal waves may be present in any form. In fact the DTMF signal starts with electrical form on transmitter mobile, then encoded on electromagnetic wave, then again converted to electrical wave by receiver mobile and then to sound signal which is audible.

DTMF Applications

- Central office.
- Mobile radio.
- Remote control.
- Remote data entry.
- Call limiting.
- Telephone answering systems.

IV. RELAY MOTOR DRIVE

Normal DC gear-head motors require current greater than 250mA. ICs like 555 timers, ATmega16 Microcontroller, 74 series ICs cannot supply this amount of current. If we directly connect motors to the output of any of the above IC's, they might get damaged. There is a need of a circuitry that can act as a bridge between the above mentioned ICs and the motors. There are several ways of making it, some of them are mentioned below. Relays are electromechanical switches.[4]They have very high current rating and both AC and DC motors can be controlled through them because motor will be completely isolated from the remaining circuit. Relays consist of an electromagnet, armature, spring and electrical contacts. The spring holds the armature at one electrical contact and as soon as a voltage is applied across the electromagnet, it coils the armature, changes its contact and moves to another electrical contact.

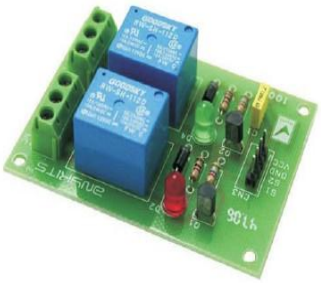

Figure5: Relay module.

RELAY MOTOR DRIVER	1 motor	I max=10A	
		OUTPUT	OUTPUT
GND	VCC	A	EN
TRUTH TABLE			
EN	A	B	DIRECTION
1	X	X	STOP
0	0	0	STOP
0	0	1	CLOCKWISE
0	1	0	ANTICLOCKWISE
0	1	1	BRAKE

Table 2

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V. DC MOTOR

A DC motor is any of a class of electrical machines that converts direct current electrical power into mechanical power. In this project we use simple DC motor for the rotation of the wheel which is responsible for the movement of the robot.[5] 100RPM 12V DC geared motors for robotics applications. Very easy to use and available in standard size nut and threads on shaft to easily connect and internal threaded shaft for easily connecting it to wheel. In this project 12v, 4W DC Motor is used. The Motor input power supply is taken into a nippo battery. The Motor shaft is connected across an Omni wheel.

Figure6: A Simple DC Motor.

Features

- 100RPM 12V DC motors with Gearbox
- 3000RPM base motor
- 6mm shaft diameter with internal hole.
- 1.2kgcm torque
- No-load current = 60 mA (Max), Load current = 300 mA (Max).

VI. ATMEGA128 MICROCONTROLLER

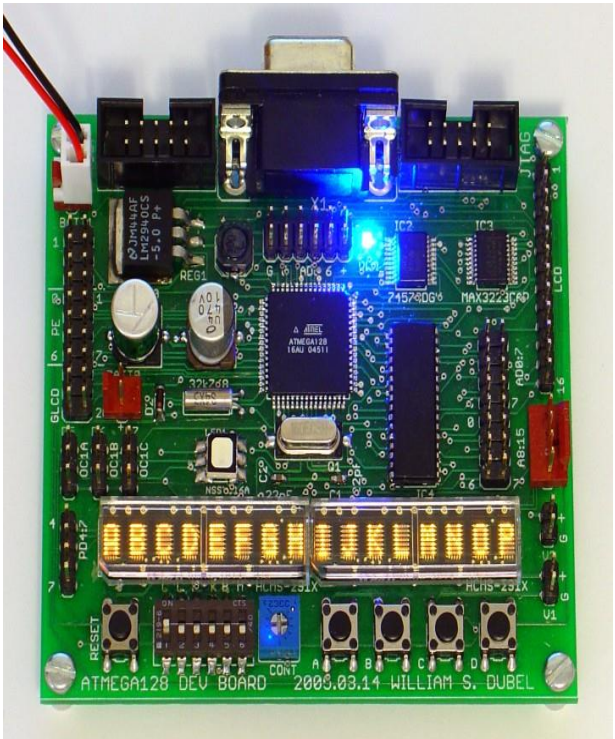

Figure7: ATMEGA 128 Microcontroller Board.

- High-performance, Low-power AVR 8-bit Microcontroller.
- Advanced RISC Architecture.
  - 133 Powerful Instructions – Most Single Clock Cycle Execution
  - 32 x 8 General Purpose Working Registers + Peripheral Control Registers
  - Fully Static Operation
  - Up to 16 MIPS Throughput at 16 MHz
  - On-chip 2-cycle Multiplier
- Nonvolatile Program and Data Memories
  - 128K Bytes of In-System Reprogrammable Flash
- True Read-While-Write Operation
  - 4K Bytes EEPROM
- I/O and Packages
  - 53 Programmable I/O Lines
  - 64-lead TQFP and 64-pad QFN/MLF
- Operating Voltages
  - 2.7 - 5.5V for ATmega128L
  - 4.5 - 5.5V for ATmega128
- Speed Grades
  - 0 - 8 MHz for ATmega128L0 - 8 MHz for ATmega128L
  - 0 - 16 MHz for ATmega128