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Mobile Operated Water Robot Using Raspberry Pi

K.Shiva Prasada Raju
M.Tech,
Bheema Institute of Technologies and Sciences, Adoni.

B.Dhananjaya
M.Tech (Digital System) and Computer Electronics, (Ph.D), Professor,
Bheema Institute of Technologies and Sciences, Adoni.

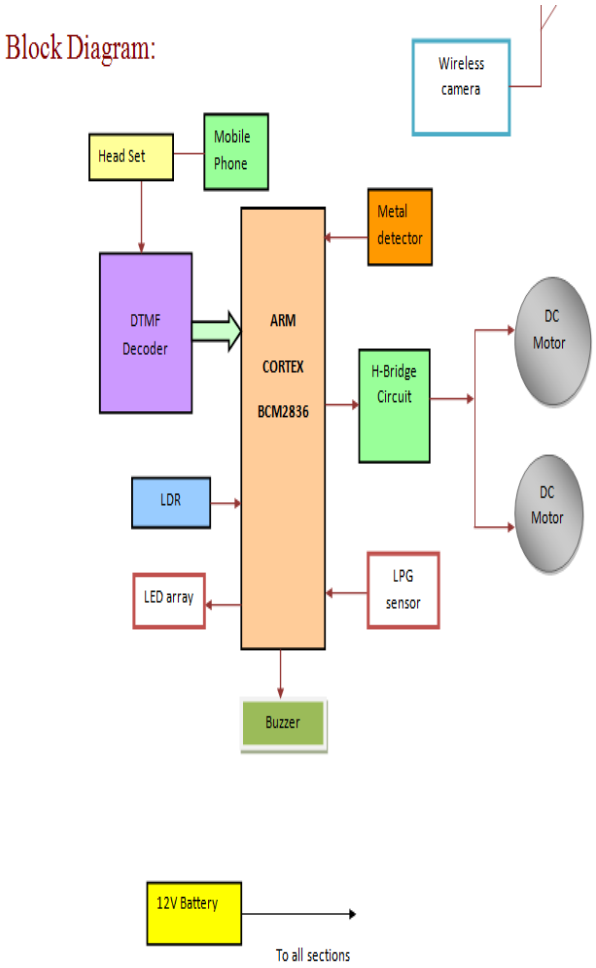
ABSTRACT:

This project is a prototype boat that can travel in water. The direction of the robot can be controlled by DTMF. This can be moved forward, backward direction. Also this robot can take sharp turnings towards left and right directions using DC Motors. This project uses DTMF technology for controlling Robot in a way such that near the controlling side we are provided with any type of communication device such as a mobile phone or a landline. Now coming to the other side we are provided with the mobile phone only because a landline cannot move accordingly with the movement of the boat.

In the mobile phone we allot the number keys as our direction movements for the Robot to move. This project uses BCM2836 MCU as its controller. Now when we dial the numbers in the mobile phone from the controlling side then it automatically recognizes which number has been recorded and it follows with the corresponding next step to be taken i.e., movement of the robot in water. A metal detector is fixed to detect the explosives and also a LPG sensor to find the dangerous gas to give a buzzer alert.

This Project uses DTMF Decoder which is controlled by a battery and in turn is connected to the mobile phone. This is controlled by the controller and is again connected to the driver circuit for driving the motor. This project uses Lead Acid (12V-1.3 Amps/hr) battery. This project is much useful for mines detection and Oceanic Research Applications.

Block Diagram:



RASPBERRY-PI

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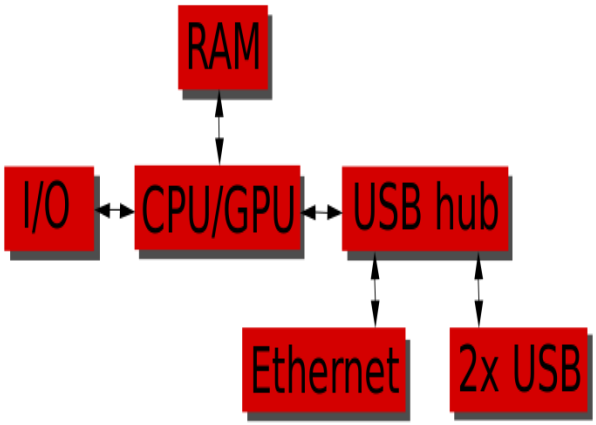
The Raspberry Pi has a Broadcom BCM2836 system on a chip (SoC), which includes an a quad-core Cortex-A7 cluster. The Cortex-A7 MP Core processor is a high-performance, low-power processor that implements the ARMv7-A architecture. The Cortex-A7 MPCore processor has one to four processors in a single multiprocessor device with a L1 cache subsystem, an optional integrated GIC, and an optional L2 cache controller. The Raspberry Pi foundation has finally released an upgraded version of the Raspberry Pi. Raspberry Pi 2 model B features much of the same ports and form factor as Raspberry Pi Model B+, by replaces Broadcom BCM2835 ARM11 processor @ 700 MHz with a much faster Broadcom BCM2836 quad core ARMv7 processor @ 900 MHz, and with an upgrade to 1GB RAM.



Basic Hardware of Raspberry-PI

Raspberry Pi 2 Model B specifications:

- SoC – Broadcom BCM2836 quad core Cortex A7 processor @ 900MHz with VideoCore IV GPU
- System Memory – 1GB LPDDR2
  Storage – micro SD card slot (push release type)
- Video & Audio Output – HDMI and AV via 3.5mm jack.
- Connectivity – 10/100M Ethernet

USB – 4x USB 2.0 ports, 1x micro USB for power

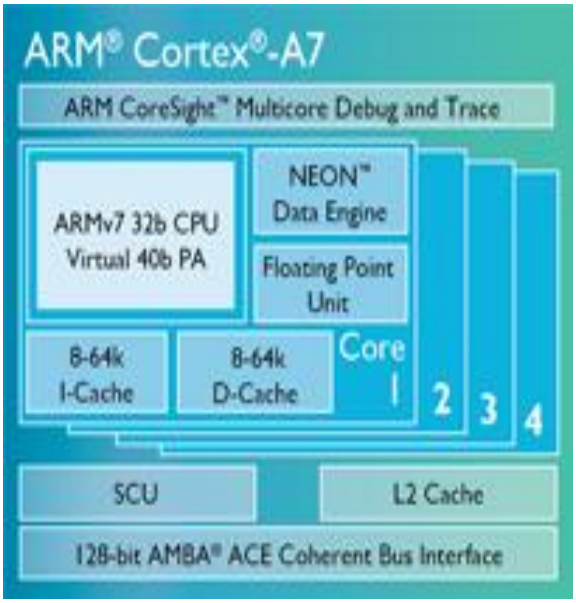
Expansion

a. 2×20 pin header for GPIOs
b. Camera header
c. Display header

- Power – 5V via micro USB port.
- Dimensions – 85 x 56 mm

Image of the board showing SD card

Cortex-A7 Processor



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OS used in Raspberry pi is Linux

Wireless camera:

Wireless cameras are proving very popular among modern security consumers due to their low installation costs (there is no need to run expensive video extension cables) and flexible mounting options; wireless cameras can be mounted/installed in locations previously unavailable to standard wired cameras. In addition to the ease of use and convenience of access, wireless security camera allows users to leverage broadband wireless internet to provide seamless video streaming over-internet.
(Model: SP-007AS)

Fig Wireless A/V camera

Fig Wireless camera

Technical parameters of receiving unit:

- Wireless Video Receiver
- Receiving Method: CPU Phase-Locked Loop Locking Frequency Points
- 4-Band Automatic Reception Switch
- Reception Sensitivity: +18dB
- Receiving Frequency: 1.2Ghz
- Receiving Signal: Audio, Video
- Voltage: DC+12V
- Current: 500mA

DTMF Decoder

Dual-tone multi-frequency signaling (DTMF) is used for telecommunication signaling over analog telephone lines in the voice-frequency band between telephone handsets and other communications devices and the switching center. The version of DTMF that is used in push-button telephones for tone dialing is known as Touch-Tone. It was first used by AT&T in commerce as a registered trademark, and is standardized by ITU-T Recommendation Q.23. It is

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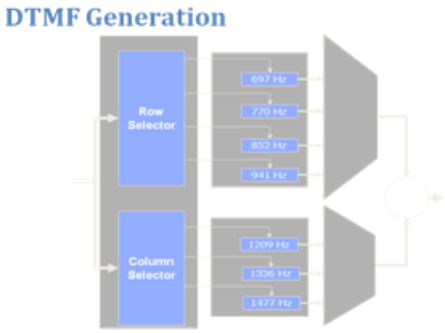
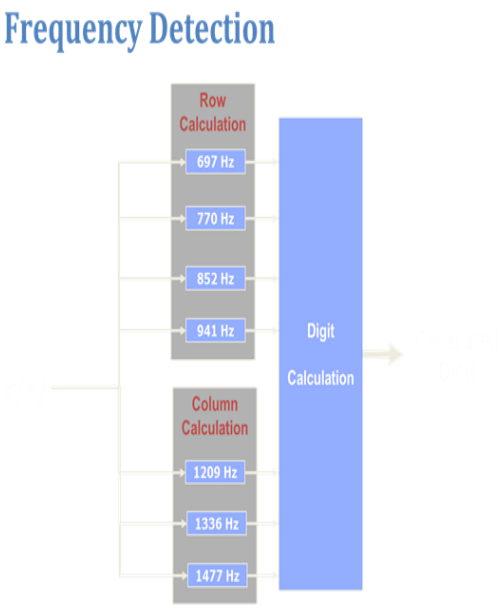
also known in the UK as *MF4*. Other multi-frequency systems are used for internal signaling within the telephone network. The Touch-Tone system, using the telephone keypad, gradually replaced the use of rotary dial starting in 1963, and since then DTMF or Touch-Tone became the industry standard for both cell phones and landline service. The DTMF keypad is laid out in a 4×4 matrix, with each row representing a *low* frequency, and each column representing a *high* frequency. Pressing a single key (such as '1') will send a sinusoidal tone for each of the two frequencies (697 and 1209 hertz (Hz)). The original keypads had levers inside, so each button activated two contacts. The multiple tones are the reason for calling the system multi frequency. These tones are then decoded by the switching center to determine which key was pressed.

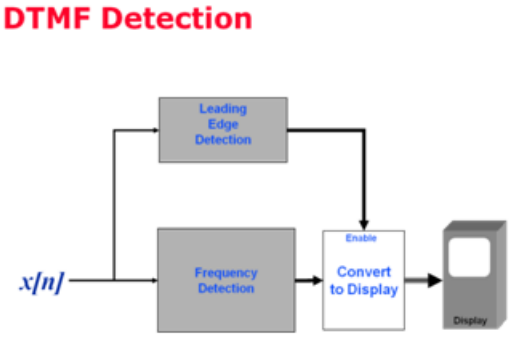
DTMF keypad frequencies (with sound clips)

	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

- The DTMF is a popular signaling method between telephones and switching centers
- DTMF is also used for signaling between the Telephone network and computer networks
- The DTMF signals are Transmitted over a telephone line
- Uses speech frequency signals
- DTMF signals are the superposition of 2 sine waves with different frequencies







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Features

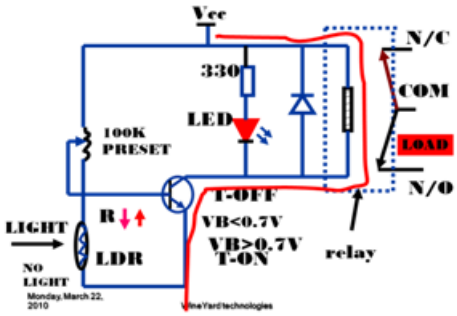
- Complete DTMF Receiver
- Low power consumption
- Internal gain setting amplifier
- Adjustable guard time
- Central office quality
- Power-down mode
- Inhibit mode
- Backward compatible with MT8870C/MT8870C-1

LPG Gas Sensor - MQ-6

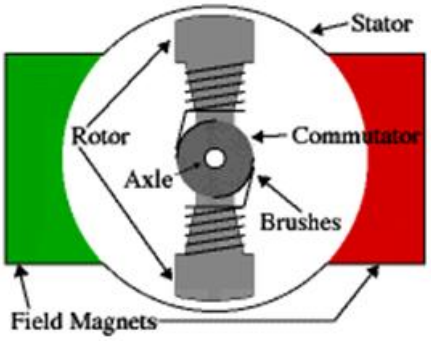
Description: This is a simple-to-use liquefied petroleum gas (LPG) sensor, suitable for sensing LPG (composed of mostly propane and butane) concentrations in the air. The MQ-6 can detect gas concentrations anywhere from 200 to 10000ppm.This sensor has a high sensitivity and fast response time. The sensor's output is an analog resistance. The drive circuit is very simple; all you need to do is power the heater coil with 5V, add a load resistance, and connect the output to an ADC.This sensor comes in a package similar to our MQ-3 alcohol sensor, and can be used with the breakout board below.

LDR:

An LDR is an input transducer (sensor) which converts brightness (light) to resistance. It is made from cadmium sulphide (CdS) and the resistance decreases as the brightness of light falling on the LDR increases.



DC MOTOR



An electric motor is a machine which converts electrical energy into mechanical energy.

Principles of operation:

In any electric motor, operation is based on simple electromagnetism. A current-carrying conductor generates a magnetic field; when this is then placed in an external magnetic field, it will experience a force proportional to the current in the conductor, and to the strength of the external magnetic field. As you are well aware of from playing with magnets as a kid, opposite (North and South) polarities attract, while like polarities (North and North, South and South) repel. The internal configuration of a DC motor is designed to harness the magnetic interaction between a current-carrying conductor and an external magnetic field to generate rotational motion.

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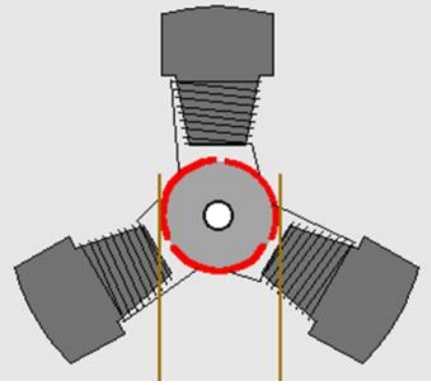

H-BRIDGE

An H-bridge is an electronic circuit which enables DC electric motors to be run forwards or backwards. These circuits are often used in robotics. H-bridges are available as integrated circuits, or can be built from discrete components.

Advantages:

1. Not line of sight
2. Not blocked by common materials: can penetrate most solids and pass through walls
3. Longer range
4. Not light sensitive
5. Not as sensitive to weather/environmental conditions

Applications

1. Can travel in Water
2. Can be used in oceanic research centers
3. Security purpose
4. Remote monitoring
5. Transportation and logistics

CONCLUSION:

This project presents a DTMF based human less boat control for ocean research applications and it is designed and implemented with MCU in embedded system domain. The robot is moved in particular direction using DTMF Signals. Experimental work has been carried out carefully. The result shows that higher efficiency is indeed achieved using the embedded system. The proposed method is verified to be highly beneficial for the security purpose and industrial purpose.

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