Mobile Operated Pelican Robot

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ABSTRACT
A pelican is a large water bird with a distinctive pouch under the beak, belonging to the bird family Pelecanidae.Modern pelicans, of which there are eight species, are found on all continents except Antarctica. This system of 'Pelican Robot' is designed in such a way that it can perform task of moving on land, water & underwater. This robot will perform all basic operations i.e. forward, backward, left and right movements on land as well as under water. It will also float on water. As it works wirelessly we can control robot anywhere within the mobile range. It can be used in war conditions to monitor the actual condition there on cameras where there is danger for human beings. Importantly by using less hardware we can use this technology at low cost. The first part of this paper includes introduction of the complete system designed. Second part covers the design aspects of Pelican Robot system such as block diagram and its description. Different mechanisms used here are Sinking mechanism for under water applications, Deo mechanism for uplifting the robot on the surface of water from underwater. Furthermore Floating mechanism is used to drive the robot on the water surface. This mechanism has been covered in third part of the paper. Remaining paper covers the controlling aspects of the robot and the system specifications. Experimental results show that the system worked successfully on the land, on the surface of water as well as underwater and thus can be used for researches in marine life, remote and hazardous land areas and many other fields.

Keywords
Pelican, DTMF, Floating, Sinking and Deo-Mechanism.

1. INTRODUCTION
Automation and Robotics are closely related technologies. In an Industrial context we can define automation as a technology i.e. concerned with use of electronic mechanical and computer based system in the operation and control of production. Accordingly Robotics is a form of industrial automation.Pelican is a large water bird with a distinctive pouch under the beak, belonging to the bird family Pelecanidae. This system of 'Wireless Pelican Robot' is designed in such a way that it can perform task of moving on land, water & underwater as well [1,8]. In this system we used motors with geared mechanism for motion. We used silicon sealant to provide insulation when the Pelican moves in water. The compressed gas cylinder is used to lift this system to come out from water to land or on water surface. This system can move in forward, backward, right, left, up & down.The objective of the Water project is to produce a fully-autonomous amphibious robot which can explore underwater environments and gather data with minimum disturbance of the indigenous marine life. The water project explores the science and technologies for the interpretation of underwater video footage, the identification of underwater features, human-robot interaction.

2. PELICAN ROBOT SYSTEM

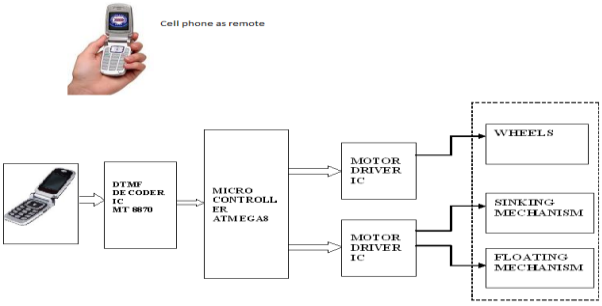

Fig1: Block diagram of system

Wireless pelican robot is controlled through mobile phones. So we kept cell phone connected to system through headset and kept it on auto answer mode. When we make call, cell phone will automatically receive call. Cell phone of user will act as remote of the system. The key pressed on cell phone will be detected by DTMF decoder which is connected to headset. After detecting key pressed decoder generates respective four bit binary code. Generated code is given to controller. Controller will control motor driver IC accordingly. Wheel motors will perform robots movements such as forward, backward and turn. Another motor driver IC will control motors of sinking mechanism. . For example if we press key 2 on our phone, that key will be detected on robot and desired function will be carried out. When we press any key on cell phone keypad, key is transmitted as high and low frequency. In this system we used DTMF decoder MT8870. The MT8870 is a complete DTMF receiver integrating both the band split filter and digital decoder functions. The filter section uses switched capacitor techniques for high and low group filters; the decoder uses digital counting techniques to detect and decode all 16 DTMF tone pairs into a 4-bit codeDTMF is the signal to be transmitted to the counterpart whenthe keypad buttons of the mobile phone are pushed.Each button pushed creates two tones of differing frequency.One tone belongs to the high frequency range and the othertone low frequency. Voice tones generally range from 0Hz to4000Hz. A DTMF tone includes two frequencies in this range[5].

Table1: DTMF frequency pair

	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

One tone belongs to the high frequency range and the othertone low frequency. Voice tones generally range from 0Hz to4000Hz. A DTMF tone includes two frequencies in this

range(Table1). The DTMF tones corresponding to five buttonsconsist of mixed frequencies of 770Hz and 1336Hzcorresponding to row 1 and column 1 in Table 1. The A, B, C,
D buttons are not used in general mobile phone. These buttonsare reserved for special use. The DTMF tones of mobilephones are generated by the same process as with generaltelephone.

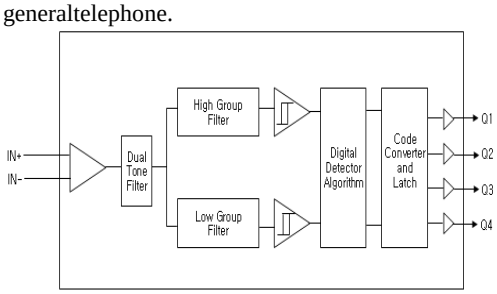

Fig.2:The diagram of DTMF receiver.

The DTMF tones generated from mobile phones aretransmitted over mobile communication networks to cell phone that is incorporated in the mobile robot. The cell phone sends the voice signals with theDTMF tone to the DTMF receiver through a stereo ear phonejack. As the Figure 2 shows, the DTMF receiver passes theDTMF tone through a zero crossing detector[5]and dividesthe width frequency and the height frequency into a high groupfilter and a low group filters. The DTMF receiver calculates apoint of intersection between the two frequencies and generates four bit code for respective key. Digital output for different keys is shown in following table.

Table2: Digital output of DTMF receiver

No	Low Frequency	High Frequency	Q4	Q3	Q2	Q1
1	697	1209	0	0	0	1
2	697	1336	0	0	1	0
3	697	1477	0	0	1	1
4	770	1209	0	1	0	0
5	770	1336	0	1	0	1
6	770	1477	0	1	1	0
7	852	1209	0	1	1	1
8	852	1336	1	0	0	0
9	852	1477	1	0	0	1
0	941	1336	1	0	1	0
*	941	1209	1	0	1	1
#	941	1477	1	1	0	0
A	697	1633	1	1	0	1
B	770	1633	1	1	1	0
C	852	1633	1	1	1	1
D	941	1633	0	0	0	0

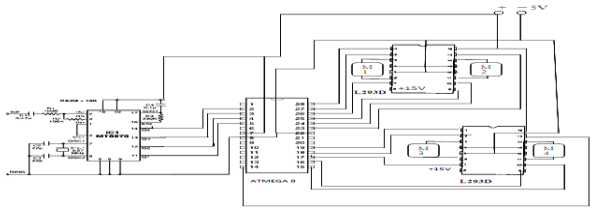

Fig.3: Circuit for pelican robot

We used AVR microprocessor ATMEGA 8in pelican robot system to send thecontrol signal to L293D to control DC motors. This board controls the right, leftmotors and motors for sinking and floating mechanismof the mobile robot. Control of pelican robot is dependent on the key pressed by user. ATMEGA 8 receives 4-bit code fromthe DTMF receiver. Atmega 8 microcontroller is used in this system as it is high performance and low power with 130 powerful instructions and most of single clock execution. Controller identifies output at pins of DTMF decoder, and generates respective motor driver IC code for running motors. Motor driver L293D is used to drive internal geared motors of robot.TheL293Disaquad,highcurrent,designedtoprovidebidirectional.
drivecurrentsofupto600mAatvoltagesfrom4.5Vto36V.Itmake siteasiertodrive thedcmotors. We used internal geared motors for robot wheels and different mechanisms. According to power and speed we used different r.p.m. motors. For making the system water proof and water resistant we used silicon sealant. All components were sealed by silicon sealant. Wire joints are made water resistant by using submersible rubber joints.

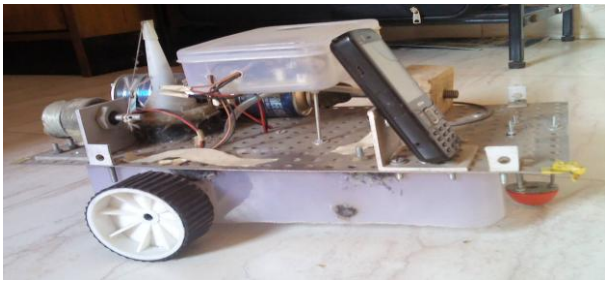

Fig.4: Pelican robot

3. MECHANISMS

For performing robot operation in water robot it has air cavity. So to fill air and release it i.e. floating and sinking we used different mechanisms. So robot can swim in water, sink in water and can also perform tasks under water.

3.1 Sinking mechanism

When system enters into water, it should sink automatically. By basic weight of robot it will sink in water. To sink properly in water air should escape from air cavity made for floating mechanism, so we are using motor and a funnel arrangement to make air escape. Control of the funnel motor is given to motor driver IC. Whole sinking mechanism is controlled wirelessly.

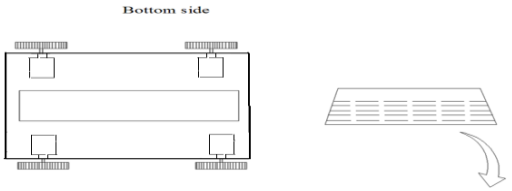

Fig.5: Sinking mechanism

3.2 Floating Mechanism

After the robot is completely sunk, the main issue is to bring it back on the land or above the water level. For that purpose we have to fill the cavity again by air. To fill cavity with air we use a deodorant. As deodorant has more air which filled in can by pressure. For making the deodorant to escape from lid, the nozzle has to be pressed. To press the nozzle, stud motor mechanism is used in the following arrangement. The deodorant mechanism is used to spray deodorant, so that the internal air will escape through deodorant. Escaped air is collected at the bottom side of robot which has air cavity. We create pressure by using shaft and motor. Shaft moves in accordance with rotation of motor. The shaft moves forward when motor moves clockwise whereas it moves backward when motor moves anti-clockwise. The clockwise and anti-clockwise movement of motor is carried out by reversing the connection of the motor. Before starting deodorant mechanism we have to close funnel so air will not escape through it.

3.3 Deo mechanism

The deodorant-mechanism is the mechanism used to spray the deodorant so that the internal gas comes out & this will help to move robot body towards up when it is under water. To press the nozzle of spray, pressure is required and we are creating the required pressure with the help of motor & shaft. The shaft moves in accordance with the movement of motor. The shaft moves forward when motor moves clockwise whereas it moves backward when motor moves anti-clockwise. The clockwise and anti-clockwise movement of

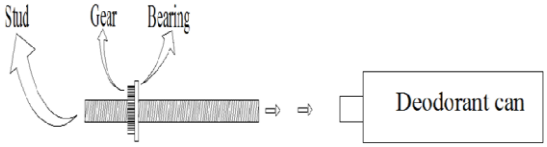

Fig.6: Deodorant- mechanism

motor is carries out by reversing the connection of the motor. These operations are carried out through cell phone remotely.

4. CONTROLLING OF ROBOT

We control robot by mobile phone,the mobile phoneused in this system is a general phone that is registered on amobile communication network of a mobile network provider. The pelican robot in this system consists of a cell phone, DTMF receiver, microprocessor-based robot control,DC motors and the motor drivers.We implemented hardware to convert the DTMF tonetransmitted to the cell phone. We connected pinsof the DTMF receiver to the pin ofthe AVR microprocessor. For controlling robot we used different keys of mobile for different functions,the software code that we implementthe functions in the AVR control board is shown in Table 3.

Table3: controlling keys

ACTION	KEY
Forward	2
Reverse	8
Turn right	6
Turn left	4
Deo clockwise	1
Deo anticlockwise	3
Funnel air tight	6
Escape air	9
Stop all actions	5

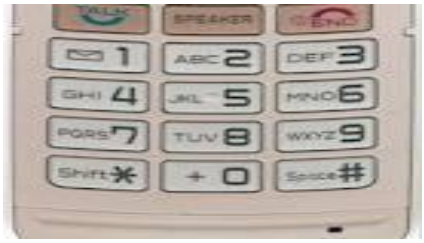

Fig.7: Cell phone keypad

Thecontemporarykeypadislaidout ina3x4 grid,although the originalDTMF keypad had an additional column forfournow-defunctmenu selectork e y s .Whenused todialatelephonenumber,pressingasinglekeywillproduce apitchconsistingoftwosimultaneous puretonesinusoidal frequencies. Therowinwhichthekeyappearsdeterminesthe lowfrequency,andthecolumndeterminesthehighfrequency. Forexample,pressing the 1 key will result in asound composed ofboth a 697 and a 1209 hertz (Hz) tone[3].

5. SYSTEMSPECIFICATIONS

Mechanical dimensions of robot
Length- 24 inch
Width – 12 inch
Height- 5 inch
Weight- approx. 2kg
Turning radius – 360 degree
Wheel diameter- 2.5 inch
Electronic specifications
Rated voltage for IC -4.5V to 5.5V
Voltage to drive motor- 12V to 15V
RPM of DC motor - 100 rpm and 60 rpm

6. CONCLUSION

The objective of the Water project is to produce a fully-autonomous amphibian robot which can explore underwater environments and gather data with minimum disturbance of the indigenous marine life. The water project explores the science and technologies for the interpretation of underwater video footage, the identification of underwater features and human-robot interaction. By using this robot, several important classes of measurement can be made much more reliable. The system of wireless pelican robot is designed in such a way that it can perform tasks of moving on the surface of water as well as on land. The task of the movement of robot under water, movement of robot on the surface of water and its movement on land has been designed successfully. This system can be successfully used for marine life exploration by the researchers. It will be helpful to save marine animals under water. Many more application areas are research in remote and hazardous region, under water research, saving up of species in water etc. The system can be used during war conditions. With some modifications in currently designed structure, the pelican robot can perform the complete task similar to a 'pelican bird' i.e. it will work on land, in water as well as in air. Further in remote places where cell phones do not have network, then we can control the system through advanced communication technology.

7. REFERENCES

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