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Design of Intelligent Water Buoy with Radio Frequency Control

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ABSTRACT: Statics shows that more than 1.2 million people around the world suffers due to abnormal weather conditions and die by drowning every year. Mainly these accidents occur in open water and due to flood. The challenge to save the life of victim in flood and open water without risking lives of lifesavers is a huge challenge. To reduce drowning accidents intelligent water buoy is launched. Intelligent water buoy is a smart and multipurpose device. It has an inbuilt navigation system and controlled by using a remote. It can be used for upper and lower water surface operations.

KEYWORDS: RF transmitter and receiver, top part and bottom part, back to back propeller design, mechanical hands.

I.INTRODUCTION

In our world millions of people are suffering due to many disasters. The main problems among them are flood and tsunami. Due to these disasters millions of peoples die by drowning. We have many disaster management facilities to save the victims but some situations which are not sufficient to save the life of victims and most of the available facilities can only be used in upper water surface and is difficult to use. Intelligent life buoy is a self propelled smart device which can be reached near the victim quickly and transport them safely by RF remote control. It is able to work under extreme conditions and also it can be used to save the victim from narrow regions. Intelligent water buoy is a life saving buoy that can move its self in water and reduce the risk of rescue workers. When the victims drown into the water an additional part was provided with the life saving buoy to save the victim who drowns into the water. Bottom part pick up the victim with the help of air bag [1]. This paper introduces a working model of dual purpose remote controlled smart life buoy. This device is an advanced device as compared to existing technologies which is provided with longer battery life and is solar powered.

II. MODEL DESIGN

The model which is designed for the rescue of the person who is drowning in the water. It is mainly designed for the areas which are mostly affected from flood. The model can also be used in remote areas which are not easily accessible. The model can be used from the shore itself so that the risk of the rescue person is less as compared to manual rescue operation. The working model consists of four main parts; top part bottom part transmitting and receiving part. Thermocol used for body of intelligent 5cm thickness thermocol sheets are used. Firstly a frame build up using plywood a U shape frame used to fit the equipment used for life buoy. Battery, receiver circuit, indicators are joined in the U shape frame and projecting propellers are connected to the frame. The frame is used for covering plywood sheets. The spacing required for the battery and related equipments are provided in the in the sheets is so easy to replace if any damage. The back to back arrangement of propellers makes stronger pulling force for the movement.

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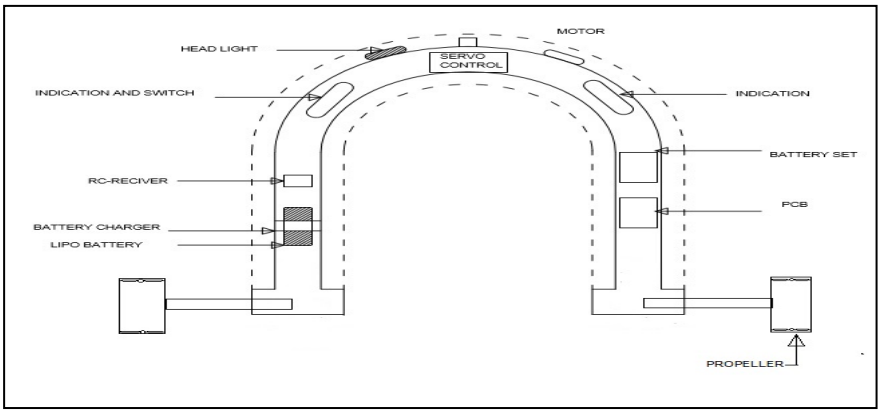

Fig 1: Model design diagram

III. WORKING

Working of intelligent water buoy divided into two part top part and bottom part operation. Top part floats at the upper water surface and bottom part which is used for under water operations. Over all bottom and upper part operation is done by using 6-channel RF transmitter and receiver.

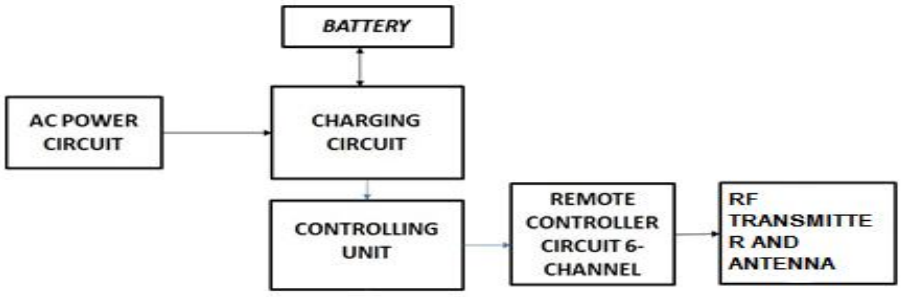

Fig 2: Transmitting part block diagram

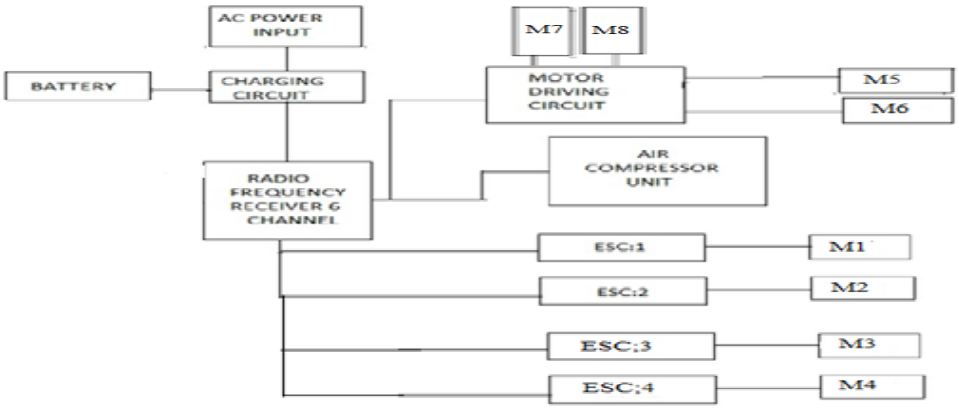

Fig 3: Receiving part block diagram

- The top part system composed of various sensors and various motors, interfaces, electronic speed controllers, battery, PCB, RF receiver, air compressor, as depicted in the system block diagram. All subsystems are connected to a common PCB. Two propellers are used to control the left and right movement of the intelligent water buoy. The movement of the water buoy achieved through air is pulled back using two propellers.

- The bottom part provided with an air bag, propeller to move the bottom part to front and back, lightning

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arrangement provided for visibility. The under water system kept in the housing provided in the bottom of floating part of intelligent water buoy. The overall operation of under water system is controlled through the remote from shore.

i. Top part operation

For right position control, here we are using a 12V lithium battery, which is connected to ESC1 and ESC2. A supply is needed for ESC1 and ESC2 and for that; we are using +ve and –ve, which are red and black in color respectively. The output of ESC is a three-wire system, which is blue in color and is directly connected to BLDC motor 1 and 2. Each ESC are used because there are two propellers. Control circuit is taken from each ESC and the positive and negative terminals are shorted in a common point. Two terminals brown and red are taken from the shorted circuit and is connected to the receiver channel 1. There are 3 terminals in the receiver channel and the two terminals from the shorted circuit are connected to the brown and red terminal of the receiver channel. The remaining terminal, which is yellow in color, is used for the power ON and OFF of the propeller and is connected to 5V relay. The relay has two terminals which are NO and NC respectively. Normally contact is connected with NC. When we power ON ESC, get supply through NC and the right propellers rotate. The power goes OFF the coil energizes and the terminal on NC will change to NO. The right and left side movements are determined by receiver channel 2. The terminals in the receiver channel 2 are directly connected to servomotor. Additional DC supply is not needed for the receiver channel 2. The servomotor is connected to limit switch. A 9V battery is connected to the centre of the limit switch. When the throttle is moved upward, the relay coil energizes and the contact from NC changes to NO and as a result the supply to the right side propeller stops. Now the left side propeller is only working. As a result the buoy moves to the right side. For left position control, same as the right side two BLDC motor are provided in the left side. The supply from the 9v battery is connected to ESC 3 and ESC 4 and is then connected to two BLDC motor. The common points of two ESC are connected to receiver channel 1. The control terminal of the receiver channel 1 is connected to relay 1 for right side control as we explained above and is also connected to relay two. Normally the terminal of relay two connected to NC same as relay 1 and when the supply is on the left side BLDC motor 1 and 2 start rotating also with the right side BLDC motors. Receiver channel 2 throttle changes to downward coil of relay two energize and the contact changes from NC to NO supply to the left side motor breaks and due to the pull from the right side then buoy move to left side.

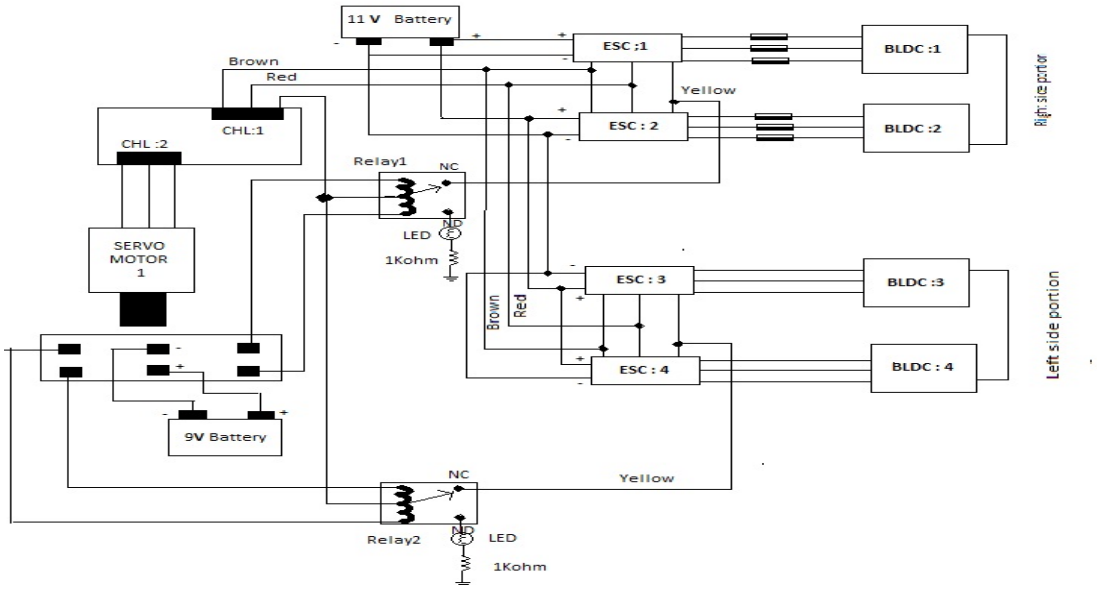

Fig 4: Top level operation diagram

ii. Bottom part operation

Bellow the detailed circuit diagram of the bottom part is given. Channel 4 select for the upward and downward movement of the bottom part. The upward and downward motion of the bottom part is obtained with the help of a 100-rpm gear motor. Channel 4 is connected to a servomotor, which is used for the operation of the slide switch 4. A 9v battery connected to the slide switch. The bottom part can move downward by operating channel 4. The servomotor 4

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operate and slide switch move to the upper polarity then 100- rpm gear motor rotate in anti-clockwise direction. The bottom part moves downward. The positive polarity of the battery is connected to the upper terminal of the slide switch. Centre terminal and bottom terminals of the slide switch are connected to the motor. For moving the bottom part upward direction the slide switch moves to negative polarity and motor rotate in clockwise direction and bottom part moves upward. Channel 5 is used for dual controlling purpose one is controlling the operation of gear motor and after inter locking of mechanical hands automatically turn on compressor and filling air inside the air bag. This dual controlling operation is obtained by channel 5 connected to the slide switch through the servomotor 5. The mechanical hands are operated by using two 100-rpm gear motor. We selecting a condition for closing the slide switch moves to positive polarity of the slide switch and the positive polarity enters to the common point of the limit switch which is normally closed position and the purpose of this limit switch is close feedback so slide switch moves to positive polarity limit switch changes to normally open position and it is connected to the normally open feedback limit switch. It changes to closed position. Now system is in open position slide switch changes to positive polarity and the positive supply enters to close feedback limit switch common point. Now the limit switch is in open position then the supply enters to open feedback limit switch. It checks the system is open if it is open position the limit switch changes to normally open position and positive supply forward bias the diode. Then rotate the two-gear motor then mechanical hands are interlock and the positive supply returns. Once the mechanical hand are closed the first limit switch changes to normally closed position then positive supply reverse bias the diode and the supply is brake. If opening the locking the slide switch changes to negative position. It conduct the diode and motor rotate in reverse direction and the mechanical hands are open the limit switch changes to normally open position. Now the second limit switch breaks the supply because the diode is not conduct under negative supply. In inter locked condition the first limit switch changes to open position now the supply enters to the 5v relay. The negative terminal of the relay is connected to the negative terminal of the supply now the relay coil is energized. The common point of the relay is connected to the negative of 12v battery supply then relay point changes to open position and negative supply enters to the negative point of compressor. Positive of 12v supply already connected to the compressor. The compressor is turned on and air filled to air bag and it pick up the bottom part to upper level of water. There two led provided for indicate interlocking and turn on of compressor. Channel 6 is used for the forward and backward movement of the bottom part. The movement achieved by using a propeller and 200-rpm gear motor. Channel 6 connected to the servomotor then it connected to a slide switch a 5v supply provided to the slide switch. Slide switch changes to positive polarity bottom part moves forward and changes to negative polarity bottom part moves backward. Led indication provided for understanding the rotation of propeller.

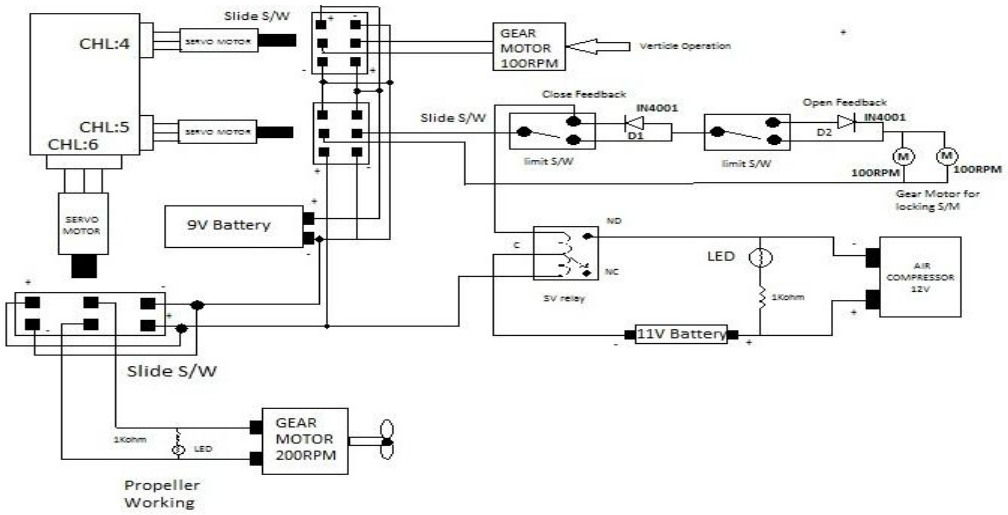

Fig 5: Bottom level operation

IV. RESULT

The working model is efficiently working at all conditions. The machine was tested for number of times and it was found that each time the machine works efficiently and the person can be rescued.

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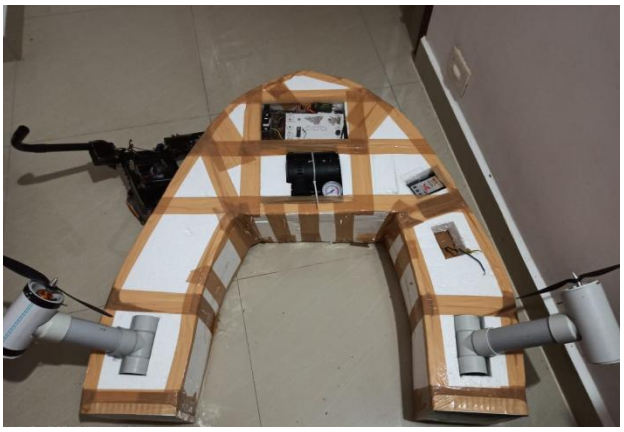

Fig 6: Intelligent water buoy

V. CONCLUSION

The idea of the project described in this report dealt with the design and fabrication of intelligent water buoy by incorporating modern technologies and this innovation is created by considering the requirement of disaster management and many other applications, mainly saving the life of a person who suffers in the water. All existing technologies can only use in surface of water. Intelligent water buoy is an innovation, which can be used to save the life of a person who drowns in water. The water buoy fabricated successfully as per the design considerations. All the units and parts accompanied in the intelligent water buoy perform the related task without any kind of malfunctioning. The buoy is costless, easy to control and is an advanced multipurpose model as compared to existing technologies.

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