IJREAT International Journal of Research in Engineering & Advanced Technology, Volume 2, Issue 2, Apr-May, 2014
ISSN: 2320 – 8791 (Impact Factor: 1.479)
www.ijreat.org

Under Water Surveillance Hydrobot

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Abstract

Under water surveillance hydrobot is a moving surveillance device whose motion can be controlled using a joystick.It can be used to monitor far distances and wide areas for under water objects. It has an acoustic video system which develops an underwater surveillance system. Ultra high frequency wireless camera is used to capture the underwater images. This proposed system resists the overflow of water and it automatically changes its position against to the overflow of water. A tilt sensor is used to control the tilt manually.

Keywords: *Unmanned Underwater Vehicles (UUV), Signal transmission, underwater surveillance, hydrobort*

1. Introduction

Underwater surveillance requires a significant amount onboard power for Unmanned Underwater Vehicles (UUV).Small UUVs relax the power requirements onboard and increase the machine time. Underwater are great applications for robotics to replace humans. Working underwater is both dangerous and difficult for humans.

Since more than 90% of global trade carried by sea, securing operations in the maritime environment poses greater challenges than ever. Underwater security is an important part of total homeland security. Many reasons events around the world starting with 9/11 attacks have had tremendous effect on security use and concepts around world. Ongoing treat of terror attacks has produced an awareness of the need to protect critical marine and coastal infrastructure. So the underwater surveillance should be seriously treated.

The proposed system consist of two parts an underwater part and monitoring part. The underwater part will move into the water to locate the objects. This underwater part contains a camera and the recorded pictures can be viewed in the monitoring device. Computer is used as the monitoring device. It has an automatic control system which will align the device properly in case there is any obstruction to motion. The electronic circuit is placed in a water sealed mechanical body. It is possible to detect the materials in underwater.

2. Related works

Autonomous Modular Optical Underwater Robot (AMOUR) Design [1] deals with self reconfigure by stacking and unstacking modules of novel modular underwater robot. Application of this robot includes underwater monitoring exploration and surveillance. This robot functions as a testbed for the subsystems which are needed in the modular implementation. Experiment results demonstrate depth control, linear motion, target module detection and docking capabilities.

The IEEE paper on Advanced Surveillance technology for underwater security sonar systems [2] describes an acoustic video system modifying a dual frequency acoustic camera, Didson and developing an optimum underwater surveillance method and software. Security sonar system transmitting beam is variable in width can steered up and down depending on the installation environments making it possible to easily detect targets. The sonar monitors far and wide area. With embedded software developed for overlaying aerial photomaps on sonar images. The sonar system is expensive.

Development of an underwater vision sensor for 3D reef mapping [3] explains the underwater vision based sensor to reef monitoring. It have multicamera stereo reconstruction algorithm geared towards coral reef monitoring. Preliminary field trials indicate the utility of the sensor for 3D reef monitoring and results of plan based evaluation of the sensor to evaluate the accurate of the system.

The IEEE paper on an improved 3D modeling of water-jet propellers for a spherical underwater robot [4] presents a newly improved 3D modeling of multiple water-jet propellers which is used inside a spherical underwater robot to overcome undesirable properties of the 2D modeling a more accurate modeling is designed instead previous one. It adopts one six axis load cell sensor to detect propulsive forces in the x, y, z axis directions and torque simultaneously.

Dynamic modeling of variable ballast tank for spherical underwater robot [5] proposed to develop a spherical

underwater robot that can be employed docking and soft ground behavior. To obtain this mechanism, the spherical underwater robot has the capability of self ballast. Dynamic model is developed by simulation implemented in MATLAB.

3. Motivation

3.1 Real time motivation

Now a days it is a usual incident that the ship accidents. Underwater security is as important as homeland security. Ongoing treat of terror attacks has produced an awareness of the need to protect critical marine and coastal infrastructure. So the underwater security is crucial matter and to be see seriously. This made us to do project on underwater surveillance.

3.2 Technical motivation

In earlier works, underwater devices are balanced by pumping water according to the tilt. So it provides less efficient and it takes a lot of time to balance the device. Now a day's technologies are developing. So this proposed system can be controlled as like the devices worked in the land by using propellers and also the underwater device is wireless. The signal can be transmitted and received by using zigbee module.

4. Problem domain

It is possible to view the underwater objects and also to check water conditions like water flow rate, presence of obstacles. This project is mainly used in the communication and robotic fields. There will be communication between the underwater device and the computer.

The wireless camera can be controlled by the user through joystick and also it provides the images in return. It is the underwater section acts as the robot and the zigbee is used for communication between underwater device and monitoring part. The control signals can be exchanged between them.

Power circuits are used for the motor driving sections and for the power supply. Embedded systems are used in underwater devices.180°C rotating camera is used for mapping and capturing images. So it is possible view the entire surroundings in the underwater.

5. Problem definition and statement

Underwater hydrobot can be used for underwater surveillance in which it uses a wireless camera and monitoring device. The motion of the underwater equipment can be controlled by the signals given by the joystick and the captured images can view in the computer. According to that underwater surveillance can be done.

6. Problem issues

Inputs for the underwater device are given through zigbee module. Thus the motor in the underwater device can be drive. The underwater device capture the images in the underwater and it send to the computer. According to the images captured the motion of camera can be decided. The underwater device will automatically tilt by sensing the water overflow. Rectangular body shape will also resist the tilt.

7. Problem capture

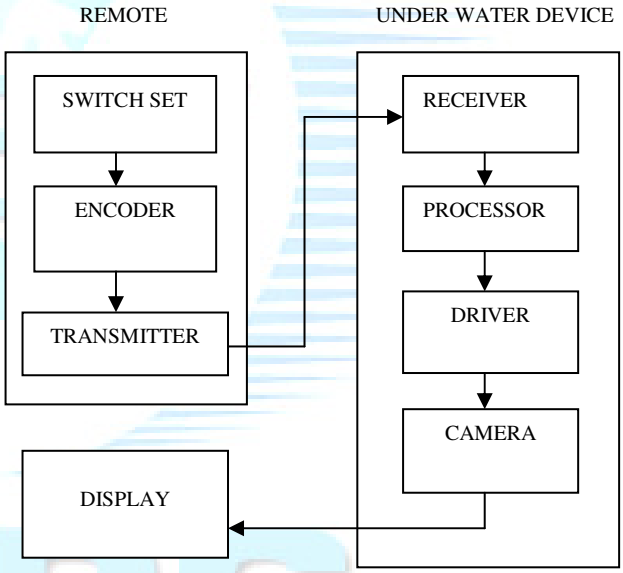

Fig. 1 Block diagram of underwater surveillance hydrobot

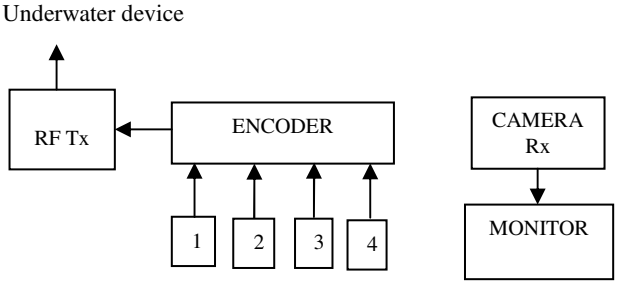

Fig. 2 Remote

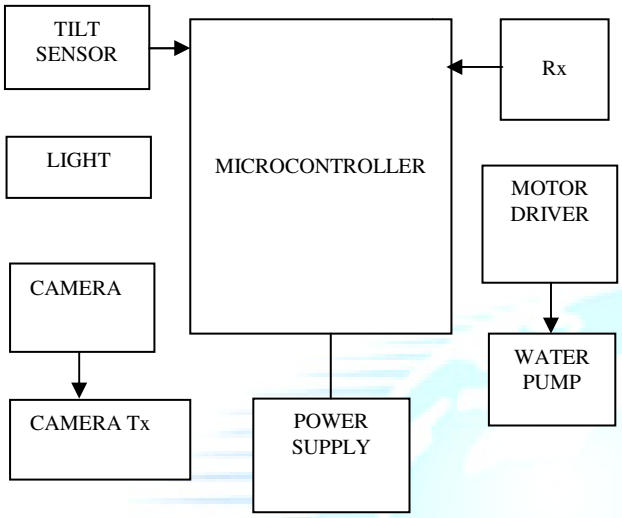

Fig. 3 Underwater device

The system has two parts namely remote and underwater device. The underwater device can be controlled using remote. Each key are assigned with each movement of the underwater device like up, down, left, right, forward, backward. When the keys are pressed corresponding signals are transmitted to the receiver.

The received signal at underwater device is given to the microcontroller which is driven by a power supply. Microcontroller will give signals to pump driver corresponding to the decoded signal. Tilt sensor is used to control the tilt automatically. The captured image can be transmitted using camera transmitter. At the remote section the transmitted images are received and displayed in the computer.

8. Algorithm

STEP1 : Start

STEP 2 : Check port for inputs

STEP 3 : If any input, decode the input

STEP 4 : If decoded instruction is to go forward or backward then it drive forward or backward

STEP 5 : If instruction is go up or down, check for speed ratio code

STEP 6 : Decode speed ratio bit and drive the up or down motor

STEP 7 : If the received instruction is tilt, drive tilt motor

STEP 8 : Check for tilt sensor output

STEP 9 : If tilt is not correct, drive tilt motor to get correct position

STEP 10 : Repeat STEP 8 and 9 until tilt instruction is removed

STEP 11 : Go to STEP 2 and repeat all steps

STEP 12 : Stop

9. Circuit diagram

While pressing the key, the parallel data at underwater device is decoded to serial data. HT12E encoder is used. So the corresponding data is transmitted using RF transmitter, TLP434A. Coding can do by using diodes.12V power supply is used to drive the encoder IC.

The transmitted signals are received at underwater device using the receiver RLP434A. The signals can be decoded i.e. converting serial data to parallel data using HT12D decoder. This parallel data is given to the microcontroller. Here PIC18F22K23 is used. Then the motor is driven with the processed data. Primary transistors and MOSFETs are used to drive the pumps. Tilt can be controlled by tilt sensor .Its output is analog which is given to the microcontroller.

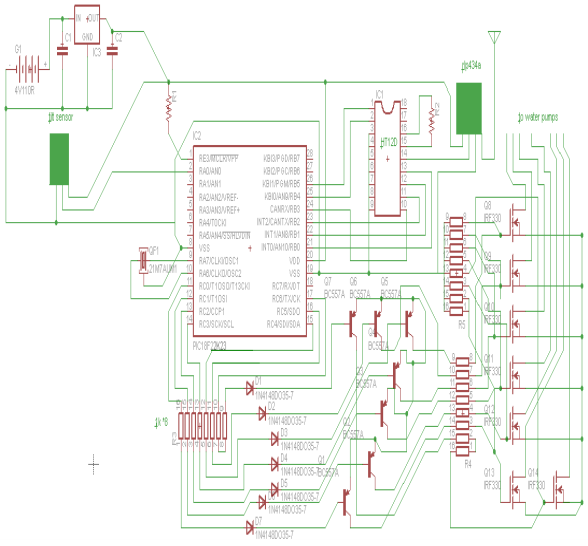

Fig. 5 Underwater device

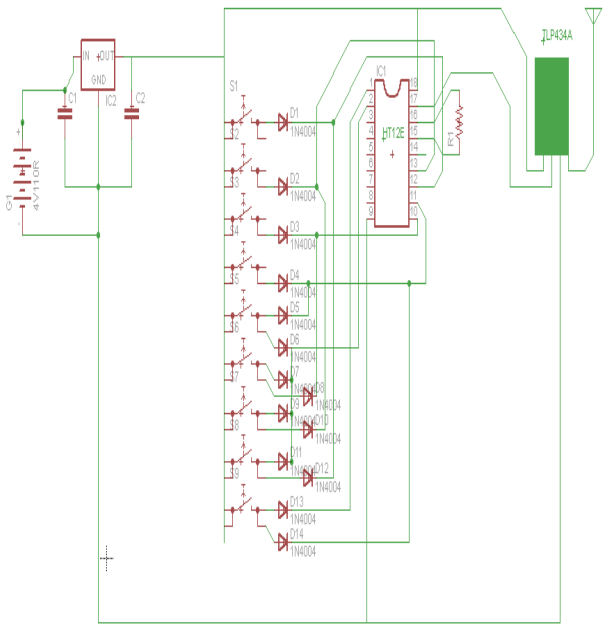

Fig. 4 Remote

10. Input-output model

10.1 Tilt sensor

Input: Angular motion
Process: Sense the tilting of underwater system in the range 0 to 5V
Output: Analog variation

10.2 RF Module

Input: RF wave
Process: Frequency shift keying modulation and demodulation of signals. Its minimum sensitivity is -25 db.
Output: Receiving and transmitting of high frequency serial data

10.3 HT12D

Input: Serial data
Process: Decoding the serial data to parallel data
Output: Parallel data

10.4 HT12E

Input: Parallel
Process: Encoding the parallel data to serial data.
Output: Serial.

11. Result

The camera movement is controlled by the joystick and the images are displayed in the computer. Thus the aim is achieved. It provides the captured images in the computer faster and it is easier to transmit and receive the signals using the wireless connection. The entire underwater system can be moved in various directions such as left, right, up, down, forward, backward. The tilt of the underwater device is automatically corrected by the use of tilt sensor so it is highly efficient.

12. Comparison of results

In AMOUR design [1] 180º rotation is not possible and also it will tilt or change the position of the underwater device due to the higher rate of water flow. Sonar system [2] is highly expensive but it is possible to measure far and wide areas. In the proposed system the underwater device can be rotated 180º. So it is possible to capture the images in the entire surroundings. The position of the motor can be adjusted by using a tilt sensor.

13. Conclusion

The proposed system is highly efficient for underwater surveillance. It can be used in the deep ocean where human intervention is not possible by increasing the efficiency of the wireless system. By changing the physical structure it can be used for the deep ocean mining. By using the thermal imaging camera instead of normal camera the temperature difference under the ocean can be determined.

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