OCEARAY BOT, an Underwater Drone for Underwater Rescue Operations and under Water Surveillance

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ABSTRACT: Water accidents have become very common in this era. Most of the victims face death due to the delay in the appropriate rescue operations. An average adult cannot struggle for long at the surface before drowning. Every second counts when it comes to rescuing a panicking victim. In some cases, it may take one or two days. The rain may cause the work of the trained lifeguards to be in trouble. They have a limited amount of time to spend below the water before it becomes even more dangerous for them. The operation has a maximum depth they are able to dive. By using Ocearay BOT, we find a solution for this. The proposed system is equipped with compact flotation devices and cameras. The system is not to replace divers, but to work one step ahead of them. The main goal of the system is to reach the victim more quickly. The superior monitoring and control is provided from the base station. We are able to view a live video streamed to the base station, so that we can see from the drone's point of view, locate the victim more quickly, and drop the flotation device in the perfect location. Once the underwater drone successfully identifies the target, the divers are able to follow directly to the target. The diver's safety can also be closely monitored from the surface while the retrieval is being conducted**.**

I.INTRODUCTION

In this era of increasing road accidents, a large number of people meet with accidents. Many lives could have been saved if the emergency service could get the crash information in time. As such, efficient automatic accident detection with an automatic notification to the emergency service with the accident location is a prime need to save the precious human life. As a remedy for these problems, we are designing an intelligent system that ensures the safety of biker by making it necessary to wear helmet, as per government guidelines, prevents road accidents to a limit by detecting alcohol consumption and detect crash and can notify quickly the accident to a predefined number. By using this proposed system, it sends an automatic alert message to the authorized person or ambulance in case of an accident or any emergency situations. The alert message body contains the place and time of the consequences to speed up the first aid service to the victim.

II. PROPOSED SYSTEM

The proposed system is designed for under water operations like rescue operations, under water surveillance etc. The system is not to replace scuba driver but to work one step ahead of them. The superior monitoring and control is provided from the base station. We are able to view a live video stream from the base station, so that we can see from the rov point of view, locate the victim more quickly, and drop the flotation device in the perfect location.

III. BASIC BLOCK DIAGRAM

The basic block diagram of the system is shown in the above figure 3.1. Controlling of bot and arm according to the video signals is the major step of the system. The camera on the bot collects video and is send to the mobile phone by using Wi-Fi. Depending on the video the user controls the bot movement by using the joystick. Bot can

move in four directions according to the control signal. The mechanical arm is using to pick up and hold victim is controlling according to the video signals.
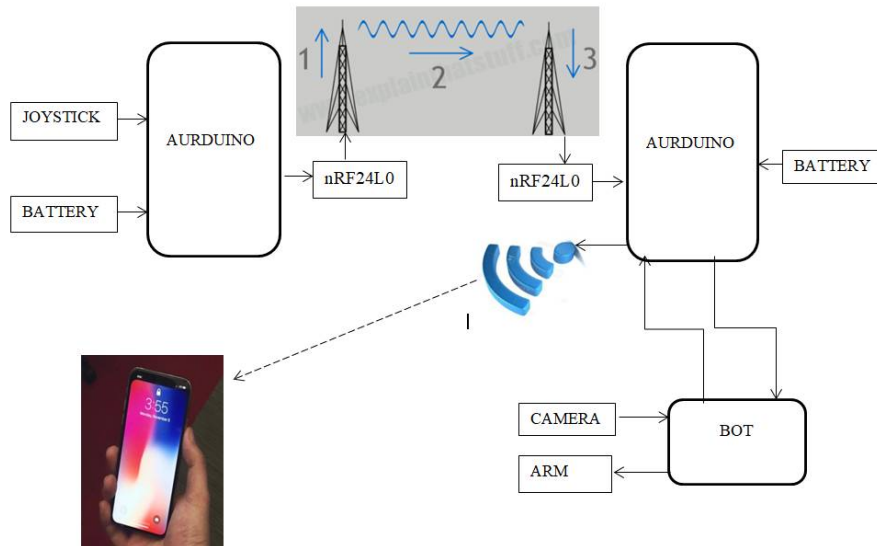

Fig 1 Block diagram of proposed system

IV. METHODOLOGY

The system consists of current, temperature and voltage sensing sections followed by its signal conditioning blocks as shown in figure. The necessary settings are made according to the requirement of the system temperature measurement parameters is very much important because temperature term decides internal resistance of the battery and rate of charging and discharging, and some required electrical quantities or parameters of the battery. The temperature of the battery is read through the sensor LM35 and corresponding output voltage is directly given to the Data Acquisition Server (DAS) with signal conditioning output of the sensor. Similarly the current and voltage part is also connected to the DAS system in order to make system ready for reading data continuously. Battery indications are also included in the software code like temperature of battery, lower/higher voltages, Total power of the battery, Remaining power of the battery and Charge holding time, Nominal Voltage and High temperature indications of the battery through emergency indicators. The different loads connected to the battery can be manipulated through software and corresponding load switching unit can be activated in order to use battery for optimum utilization.

V. COMPONENTS

The transmitter section consists of Joystick, Arduinouno, nrf transmitter. The receiver section consists of nrf receiver and Arduinouno. The bot consists of camera, light, dc motors and mechanical arm.

A. ARDUINO UNO

The Arduinouno is an open source microcontroller board based on microchip ATmega328 microcontroller and developed by Arduino.cc. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. The board has 14 Digital pins, 6 Analog pins, and programmable with the Arduino IDE (Integrated Development Environment) via a type B USB cable. It can be powered by a USB cable or by an external 9 volt battery, though it accepts voltages between 7 and 20 volts. The Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform. The ATmega328 on the Arduino Uno comes pre-programmed with a boot loader that allows uploading new code to it without the use of an external hardware programmer. It communicates using the original STK500 protocol.

B. DC MOTOR

A DC motor is any of a class of rotary electrical machines that converts direct current electrical energy into mechanical energy. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic, to periodically change the direction of current flow in part of the motor.

Type	Brushed
Voltage	12 V
RPM	3500
Torque	Low

Working principle of dc motor is electromagnetic induction. If a current carrying conductor is placed in a magnetic field perpendicularly, then the conductor experiences a force in the direction mutually perpendicular to both the direction of field and the current carrying conductor. Motor drives are circuits used to run a motor. In other words, they are commonly used for motor interfacing. These drive circuits can be easily interfaced with the motor and their selection depends upon the type of motor being used and their ratings (current, voltage).

Motor Driver circuits are current amplifiers. They act as a bridge between the controller and the motor in a motor drive. Motor drivers are made from discrete components which are integrated inside an IC. The input to the motor driver IC or motor driver circuit is a low current signal. The function of the circuit is to convert the low current signal to a high current signal. This high current signal is then given to the motor. The motor can be a brushless DC motor, brushed DC motor, stepper motor, other DC motors etc. In motor interfacing with controllers, primary requirement for the operation of the controller is low voltage and small amount of current. But the motors require a high voltage and current for its operation.

C. BATTERY

A rechargeable battery, storage battery, secondary cell, or accumulator is a type of electrical battery which can be charged, discharged into a load, and recharged many times, as opposed to a disposable or primary battery, which is supplied fully charged and discarded after use. It is composed of one or more electrochemical cells. The term "accumulator" is used as it accumulates and stores energy through a reversible electrochemicalreaction. Rechargeable batteries are produced in many different shapes and sizes, ranging from button cells to megawatt systems connected to stabilize an electrical distribution network.

Type	lead
Voltage	12 V
Ampere-hours	1.3Ah
Temperature range	10-27 degree Celsius

Several different combinations of electrodematerials and electrolytes are used, including lead–acid, nickel–cadmium (NiCd), nickel–metal hydride (NiMH), lithium-ion (Li-ion), and lithium-ion polymer (Li-ion polymer).

D. SERVO MOTOR

As the name recommends, a servomotor is a servomechanism. It is a servomechanism that uses position input to control its movement and last position. A servomotor is a rotary actuator or linear actuator that allows for precise control of angular or linear position, velocity and acceleration. It consists of a suitable motor coupled to a sensor for position feedback. It also requires a relatively sophisticated controller, often a dedicated module designed specifically for use with servomotors. Servomotors are not a specific class of motor although the term servomotor is often used to refer to a motor suitable for use in a closed-loop control system.

Servos are controlled by sending an electrical pulse of variable width PWM through the control wire. Servo Motor can generally just turn 90° in either heading for an aggregate of 180° developments. The Motors unbiased position is characterized as the position where the servo has the same measure of potential pivot in the both the clockwise or counter-clockwise course. The PWM sent to the Motor decides position of the pole and in light of the term of the pulse sent through the control wire the rotor will swing to the craved position. The servo Motor hopes to see a pulse each 20ms and the length of the pulse will decide how far the Motor turns. For instance, a 1.5ms pulse will make the Motor swing to the 90° position. Shorter than 1.5ms moves it to 0° and any more than 1.5ms will turn the servo to 180°, as charted beneath.

E. JOYSTICK

The Joystick Shield enableArduino with a joystick. The shield sits on top of Arduino and turns it into a simple controller. Five momentary push buttons (4+ joystick select button) and a two-axis thumb joystick givesArduino functionality on the level of old Nintendo controllers. This shield is a great piece of uer interface board, it is perfect for gaming and navigating through menu quickly. It has headers for LCDs and RF modules, to communicating and displays easily. Here joystick shield adds RF interface of nRF24L0.

F. MECHANICAL ARM

A mechanical arm is a machine that mimics the action of a human arm. Mechanical arms are composed of multiple beams connected by hinges powered by actuators. One end of the arm is attached to a firm base while the other has a tool. They can be controlled by humans either directly or over a distance. A computer-controlled mechanical arm is called a robotic arm. However, a robotic arm is just one of many types of different mechanical arms.

Mechanical arms can be as simple as tweezers or as complex as prosthetic arms. In other words, if a mechanism can grab an object, hold an object, and transfer an object just like a human arm, it can be classified as a mechanical arm.

G. RADIO TRANSCEIVER

nRF24L01 is a single chip radio transceiver for the worldwide 2.4 - 2.5 GHz ISM band. The transceiver consists of a fully integrated frequency synthesizer, a power amplifier, a crystal oscillator, a demodulator, modulator and Enhanced Shock Burst protocol engine. Output power, frequency channels, and protocol setup are easily programmable through a SPI interface. Current consumption is very low, only 9.0mA at an output power of -6dBm and 12.3mA in RX mode. Built-in Power Down and Standby modes makes power saving easily realizable.

VI. FUTURE SCOPE

Underwater drones operate at great depths. They aren't a particularly new development and up until recently they haven't been widely used, besides for commercial purposes such as research in the gas and oil industry. The past couple of years they have however started to become a more familiar sight. Ocean exploration organizations and universities have started using them for various purposes such as mapping the ocean floor. With their technology becoming increasingly advanced, drones are more efficient than ever before. They can be employed for surveillance, gathering data and intelligence. They check for roadside bombs or devices on landing areas. They listen to mobile phone conversations, follow or attack suspected insurgents and are widely used in warfare. They are also used for recreational purposes, aerial photography and a host of other things. Well, those are the flying drones. Deep Trekker underwater drones are widely used in military & first responder search and rescue missions, aquaculture,

and shipping industries. With its compact and portable design, marine biologists and commercial diving companies are able to transport the underwater drone to some of the most remote locations.

VII. RESULT

The project is mainly divided into three parts, transmitter, receiver and bot. Transmitter consists of an Arduino, joystick shield and a transceiver module. Transmitter part generates the control signals and controls the movement of Bot and arm. Receiver comprises a battery, Arduino and transceiver module. Receiver receives the signals and sends it to the Bot. The bot consist of a camera, mechanical arm and DC motor. The bot moves according to the control signals and captured video is send to the transmitter side. The system was designed with a wireless camera which sends the video signals to the mobile phone with the help of Wi-Fi. If that was possible the transmitter and receiver would be wireless. But due to lack of component availability the camera used is wired. The system works with 75 % efficiency and visibility under water is of good quality..

VIII. CONCLUSION

This project have a wide range of application in surveillance, underwater videography, fisheries department etc. The range of operation of bot can be extended by using wireless communication between receiver and bot. The system is designed for underwater rescue purposes. The main advantage is that it works one step ahead of scuba divers. It is less time consuming and it reduces the diver struggles. The system can cover more distance than the conventional underwater rovs. The system is easy to operate and it can be easily placed anywhere. The system ensures the safety of scuba divers.

REFERENCES

[1] Barbieri, Loris; Bruno, Fabio; Gallo, Alessandro; Muzzupappa, Maurizio; Russo, Maria Laura (2018). "Design, prototyping and testing of a modular small-sized underwater robotic arm controlled through a Master-Slave approach". *Ocean Engineering*. Issue 4, pp:(253–262).

[2] Bellingham (1997), "New Oceanographic Uses of Autonomous Underwater Vehicles", *Marine Technology Society Journal* Issue 3, pp: (34–47).

[3] Y.M. Ahmed, O. Yaakob (2014), "Design of a new low cost ROV vehicle", *JurnalTeknologi*.

[4] Bruno, Fabio; Lagudi, Antonio; Barbieri, Loris; Rizzo, Domenico; Muzzupappa, Maurizio; De Napoli, Luigi (2018). "Augmented reality visualization of scene depth for aiding ROV pilots in underwater manipulation". *Ocean Engineering*, pp:(140–154).

[5] NOAA. Ocean. National Oceanic and Atmospheric Administration.gov. [Online] United States Department of Commerce, April 18, 2013.

[6] M. Dumiak (2017), ''Lice-hunting underwater drone protects salmon,'' *IEEE Spectr,* Volume 54, Issue 4, pp : (9–10).

[7] I. Anwar, M. Mohsin, S. Iqbal, Z. Abideen, A. Rehman, N. Ahmed (2016), "Design and fabrication of an underwater remotely operated vehicle (Single thruster configuration)", *13th International Bhurban Conference on Applied Sciences and Technology (IBCAST)*.

[8] L. Whitcomb, "Underwater robotics: out of the research laboratory and into the field", *IEEE International Conference on Robotics and Automation*, Volume 1, pp :(709-716).

[9] T. Hyakudome (2011), "Design of Autonomous Underwater Vehicle", *International Journal of Advanced Robotic Systems*, Volume 8, Issue 1, pp : (131-139)