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Remotely Operated Underwater Vehicle for Metal Detection

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Abstract: Underwater Remotely Operated Vehicles (ROVs) play an important role in a number of shallow and deepwater missions for marine science, oil and gas extraction, exploration and salvage. In these applications, the motions of the ROV are guided either by a human piloton a surface support vessel through an umbilical cord providing power and telemetry, or by an automatic pilot. In the case of automatic control, ROV state feedback is provided by acoustic and inertial sensors and this state information, along with a controller strategy, is used to perform several tasks such as station-keeping and auto immersion/heading, among others.

I. INTRODUCTION

A remotely operated underwater vehicle, commonly referred to as an ROV, is a tethered underwater vehicle. They are common in deep water industries such as offshore hydrocarbon extraction. An ROV may sometimes be called a remotely operated underwater vehicle to distinguish it from remote control vehicles operating on land or in the air. ROVs are unoccupied, highly manoeuvrable and operated by a person aboard a vessel.

They are linked to the ship by either a neutrally buoyant tether or often when working in rough conditions or in deeper water a load carrying umbilical cable) is used along with a tether management system (TMS). The TMS is either a garage like device which contains the ROV during lowering through the splash zone, or on larger work class ROVs a separate assembly which sits on top of the ROV.

The purpose of the TMS is to lengthen and shorten the tether so the effect of cable drag where there are underwater currents is minimized. The umbilical cable contains a group of cables that carry electrical power, video and data signals back and forth between the operator and the TMS. Where used the TMS then relays the signals and power for the ROV down the tether cable. Once at the ROV the electrical power is split and distributed between different components of the ROV.

However in high power applications most of the electrical power is used to drive a high powered electrical motor which in turn drives a hydraulic pump. The hydraulic pump is then used to power equipment such as torque tools and manipulator arms where electrical motors would be too difficult to implement subsea. Most ROVs are equipped with at least a video camera and lights.

These may include sonars, magnetometers, a still camera, a manipulator or cutting arm, water samplers, and instruments that measure water clarity, light penetration and temperature.

II. BLOCK DIAGRAM

The experimental set up for this system is shown in figure1.

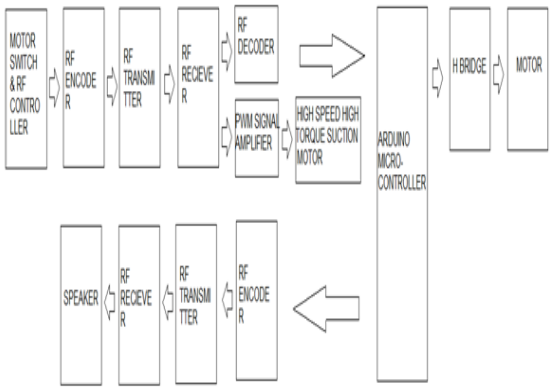

Figure. 1: Experimental setup

RF encoder (radio frequency encoder) is a device that takes a baseband input signal and outputs a radio frequency-modulated signal. An RF Module (Radio Frequency Module) is a (usually) small electronic circuit used to transmit and/or receive radio signals on one of a number of carrier frequencies. RF Modules are widely used in electronic design owing to the difficulty of designing radio circuitry. They are often used to replace older infra-red radio communication designs as they have the advantage of not requiring line-of-sight operation. Arduino is an open single descendant of the open-source Wiring platform designed to make the process of using electronics in multidisciplinary projects more accessible. The hardware consists of a simple open hardware design for the Arduino board with an Atmel AVR processor and on-board input/output support. The software consists of a standard programming language compiler and the boot loader that runs on the board.

An H-Bridge is an electronic power circuit that allows motor speed and direction to be controlled. Often motors are controlled from some kind of micro controller to accomplish a mechanical motion. The micro controller provides the instructions to the

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motors, but it cannot provide the power required to drive the motors. Dc geared motor is used for the movement of Robot in forward, Backward, left and right direction. This motor is having 60 rpm. It also has good torque to move the robot. Power supply required for this motor is 12V. The most common method of speed control is PWM or pulse width modulation. Pulse width modulation is the process of switching the power to a device on and off at a given frequency, with varying on and off times. These on and off times are referred to as "duty cycle". The end result of the PWM process is that the overall power sent to the motor can be adjusted from off to full on with good efficiency and stable control. While many robot builders use a microcontroller to generate the required PWM signals, the 555 PWM circuit explained here will give the novice robot builder an easy to construct circuit, and good understanding of pulse width modulation. It is also useful in a variety of other applications where the PWM setting need only be changed occasionally.

III. CONTROL MECHANISM

Arduino is a popular open-source single-board microcontroller, descendant of the open-source Wiring platform, designed to make the process of using electronics in multidisciplinary projects more accessible. The hardware consists of a simple open hardware design for the Arduino board with an Atmel AVR processor and on-board input/output support. At a conceptual level, when using the Arduino software stack, all boards are programmed over an RS-232 serial connection, but the way this is implemented varies by hardware version. Serial Arduino boards contain a simple inverter circuit to convert between RS-232-level and TTL-level signals. Current Arduino boards are programmed via USB, implemented using USB-to-serial adapter chips such as the FTDI FT232. Some variants, such as the Arduino Mini and the unofficial Boarduino, use a detachable USB-to-serial adapter board or cable, Bluetooth or other methods. (When used with traditional microcontroller tools instead of the Arduino IDE, standard AVR ISP programming is used.) The Arduino board exposes most of the microcontroller's I/O pins for use by other circuits. The Diecimila, Duemilanove, and current Uno provide 14 digital I/O pins, six of which can produce pulse-width modulated signals, and six analog inputs. These pins are on the top of the board, via female 0.1 inch headers. Several plug-in application shields are also commercially available.

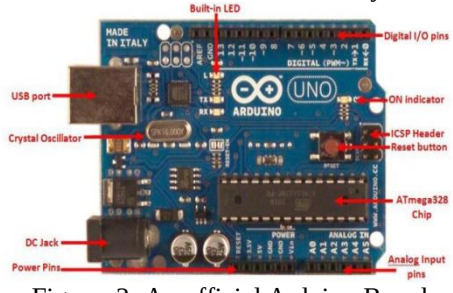

Figure. 2: An official Arduino Board

In this method we use a pneumatic cylinder, pneumatic control valve and an elastic membrane. The pneumatic valve is opened and closed using electric actuator. When the pneumatic actuator is powered then the pneumatic actuator will open the control valve A than the liquefied gas which is in pneumatic cylinder will pass to the elastic membranes.

When liquid gas from the cylinder moves out of the cylinder it will change its state to gaseous state and then gas is trapped inside the elastic membranes. Since gas is lighter than liquid inside which boat is placed then there will be an upward thrust for the boat. To move the boat down and the control valve B is opened , then the gas which is trapped inside the elastic membrane moves out of the elastic membrane and hence the upward thrust is reduced and then the boat moves downwards.

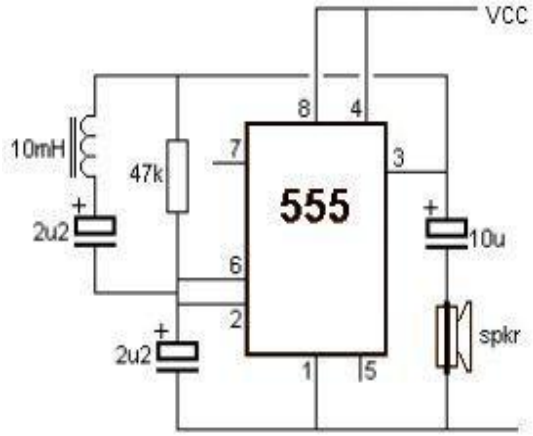

Figure 3: Metal Detector circuit using 555IC

A metal detector is a device which responds to metal that may not be readily apparent. The simplest form of a metal detector consists of an oscillator producing an alternating current that passes through a coil producing an alternating magnetic field. If a piece of electrically conductive metal is close to the coil, eddy currents will be induced in the metal, and this produces an alternating electric field of its own.

If another coil is used to measure the electric field (acting as a magnetometer), the change in the magnetic field due to the metallic object can be detected. The metal detector circuit using 555IC is shown in figure 3. The first industrial metal detectors were developed in the 1960s and were used extensively for mining and other industrial applications.

Uses include de-mining (the detection of land mines), the detection of weapons such as knives and guns (especially in airport security), geophysical prospecting, archaeology and treasure hunting.

Metal detectors are also used to detect foreign bodies in food, and in the construction industry to detect steel reinforcing bars in concrete and pipes and wires buried in walls and floors.

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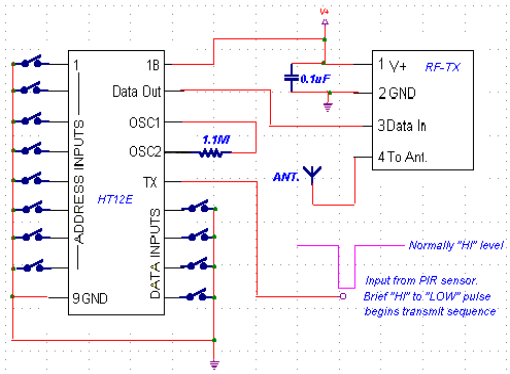

Figure 4: Transmitter circuit

An RF Module is a (usually) small electronic circuit used to transmit, receive, or transceiver radio waves on one of a number of carrier frequencies. RF Modules are widely used in consumer application such as garage door openers, wireless alarm systems, industrial remote controls, smart sensor applications, and wireless home automation systems. As with any other radio-frequency device, the performance of an RF Module will depend on a number of factors. For example, by increasing the transmitter power, a larger communication distance will be achieved. However, this will also result in a higher electrical power drain on the transmitter device, which will cause shorter operating life for battery powered devices. Also, using a higher transmit power will make the system more prone to interference with other RF devices, and may in fact possibly cause the device to become illegal depending on the jurisdiction.

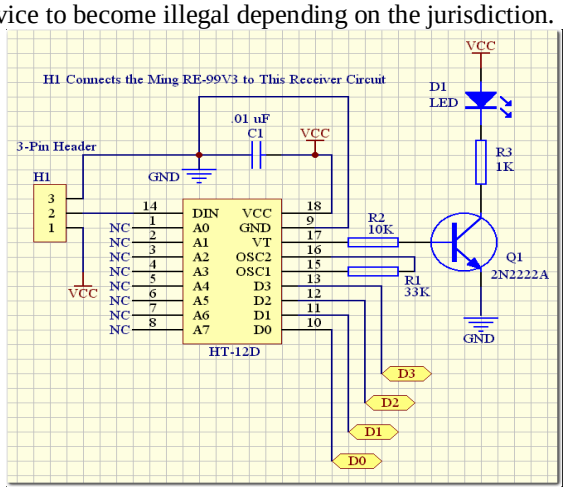

Figure 5: RF Receiver

Correspondingly, increasing the receiver sensitivity will also increase the effective communication range, but will also potentially cause malfunction due to interference with other RF devices. The performance of the overall system may be improved by using matched antennas at each end of the communication link. Finally, the labelled remote distance of any particular system is normally measured in an open-air line of sight configuration without any interference, but often there will be obstacles such as walls, floors to absorb the radio wave signals, so the effective operational distance will in most practical instances be less than specified.

VI. CONCLUSION

A lot of under-water secrets remain still unexplored. More than 60% of earth is occupied by water. Under-water ROV can be used for exploring the different historical secrets of the vast oceans. These robot senses the valuable metals which are lost under water using metal detector and can pick those metal and bring those metal above the water surface. It can be also employed for under-water rescue operations which are impossible for humans. It can detect any human trapped under water with the help of the PIR (Passive Infrared) Sensor. It can be also employed for military purpose for tracking enemy operations and submarines. With this robot it is possible to keep a constant check on our borders for any enemy movements. Thus this robot can be of high advantageous purposes. It could be a great support for the modern world in knowing the unknowns about the wide spread oceans. In future it could be of made into the category of Artificial Intelligence Robot category to reduce the manual control and to operate it with maximum accuracy.

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