# UNDERWATER WIRELESS ROVER

Ahammad Ali Asharaf[1], Blessy Elsa Varghese[2], Ebin George Jose[3], Mohammed Hisham[4], Anoop T R[5]

[1,2,3,4]*UG Students,* [5]*Associative Professor*
*Department of Electronics and Communication Engineering*
*Mar Baselios Christian College of Engineering and Technology, Kuttikkanam, Idukki, Kerala, India.*

**Abstract-An underwater remotely operated vehicle (ROV) is a mobile robot designed for aquatic work environments. Remote control is usually carried out through copper or fiber optic cables. A human operator sits in a shore-based station, boat or submarine bubble while watching a display that shows what the robot sees. This paper describes the design and implementation of Underwater Wireless Rover by substituting the cable with a wireless telemetry. It would help to avoid some mobility issues, such as movement limitations due to the cable length, and the risk of cable enlargement in rocks or man-made equipment. And there lies a great variety of its applications. it can be used for getting the live video or still pictures of the underwater life and all the underwater activities to learn about the underwater life. It makes the job for divers, rescuers and gem collectors easier as the rover gives the pictures, live video and all the other relevant details necessary for having a proper knowledge about the underwater elements.**

***Keywords*—Underwater Wireless Rover: ATmega32A, RFmodule, Transmitter, Receiver.**

## I. INTRODUCTION

The ocean occupies just about 71% of the earth surface and still has a lot of unidentified parts. Therefore various studies and growth about the ocean such as marine environment, submarine earthquake, ocean life, and marine resources research and so on are carried out. The collection of data by survey and observation in the actual sea is essential for the studies and the development. Hence there require a low cost, highly competent underwater vehicle which can serve multiple applications is required. Underwater vehicles are the vehicles which work for underwater surveillance and monitor aquatic ecosystem. They are influential and composite systems which are able to perform various underwater tasks. It is a device with a great variety of applications and scientists are trying to develop this device in a more advanced way.

In our proposed system, the major components of underwater wireless rover has ATmega32A microcontroller, RF module, wireless camera, LCD display, motors, PVC pipes.ATmega32A is a 40/44-pins device with 32 KB Flash, 2 KB SRAM and 1 KB EEPROM .The movement of rover is being controlled by using an RF module here HT12D and HT12E are the decoder and encoder IC that is used in RFmodule.

RF module consists of a transmitter and receiver. Transmitter consists of a encoder and receiver consist of a decoder.3 motors were used in the system. There is 1 dc motor each for forward and backward motion of the rover along with a high powered Johnson motor for upward and downward motion. Wireless camera is used for getting live video or still pictures of the underwater life.LCD display to show letters, numbers, and characters and so on.

These rovers significantly expand efficiency of all kinds of underwater operations by eliminating the necessity of human presence inside the submersible. Being remotely operated these vehicles can also be organized in missions who pose a great risk to human life. ROVs gained quick popularity because of their cost effectiveness and high mission applicability. When such underwater vehicles are made, it is essential to consider about the following things. 1) Seawater and Water Pressure Environment, 2) Sink, 3) There are no Gas or Battery Charge Stations, 4) Global Positioning System cannot use, 5) Radio waves cannot use.

## II. LITERATURE REVIEW

Amab Kumar Saha*et al.*have invented a low cost remote control underwater using Raspberry Pi. it provides promises by checking the deep altitudes whether it is comfortable or not. Apart from that it drives different areas like lakes, estuaries, ponds or seas to hope for finding any new species that can be topic of research.[1]

Ponlachart Chotikarn*et al*. have developed a low-cost submarine robot with volume change policy to vary robot's density (which is similar to a ballast) with Hydraulic seal and O-ring rubbers involved to limit water dripping. [2]

Christoph Waldmann*et al*. have proposed a Crawler by using many refined wheels which can drag up the soil sediments to pave a way for studying about them. They used wheels as they can hold the energy efficiency to a certain bound and a source is been linked for each arrangement.[3]

N.D. Jayasundere*et al*. have invented an ROV controlled robot that can work up to a specific depth of 10m; a Fuzzy logic motion has been introduced for a better version of the output signals being generated. The electronics portion is being mounted within properly and

besides LED lights and a Raspberry Pi microcomputer is been used form illuminations and obtaining videos respectively.[4]

Xiao Bo Tan *et al.* this paper presents an underwater vehicle which has a Robotic fish based on Robotic sensor networks for profiling the aquatic diffusion process where mobile sensors are used for profiling the characteristics of a diffusion process including source location, discharged substance amount, and its evolution over time.[5]

Lygouras.J.N, *et al.* this paper describes the unmanned underwater remotely operated vehicle (UROV) THETIS, an easy to operate vehicle suitable for exploiting water environments.[6]

Charles C. Eriksen*et al.* presents underwater vehicle Sea gliders which are small, reusable autonomous underwater vehicles designed to glide from the ocean surface to a programmed depth and back while measuring temperature, salinity, depthaveraged current, and other quantities along a saw tooth trajectory through the water.[7]

## III.COMPONENTS USED

TABLE I. COMPONENT TABLE

| SN | NAME OF THE PART | USE |
|---|---|---|
| 1 | ATmega32A | ATmega32A is the main controller which will control the underwater rover. |
| 2 | Wireless camera | Camera module is used to get the live video and to get still pictures. |
| 3 | HT12D | It is the decoder IC that is used in the transmitter. |
| 4 | HT12E | It is the encoder IC that is used in the receiver. |
| 5 | 12 volt battery | To supply the power to ATmega32A and motors. |
| 6 | DC motors | For forward and backward movement. |
| 7 | Johnson motor | For upward and downward movement. |
| 8 | L293D Quadruple half-h driver | Quad AC high-current controllers |
| 9 | 3-Terminal 1A Positive Voltage Regulator | Provide internal current limitation, thermal closure and safe protection of the operation area. |
| 10 | LCD display | Flat panel display or electronically modified device |

### *A.ATmega32A*

The ATmega32A is a low power, CMOS 8-bit microcontrollers based on the AVR enhanced RISC architecture. The ATmega32A is a 40/44-pins device with 32 KB Flash, 2 KB SRAM and 1 KB EEPROM. By executing instructions in a single clock cycle, the devices achieve CPU throughput approaching one million instructions per second (MIPS) per megahertz, allowing the system designer to optimize power consumption versus processing speed.

The AVR core combines a rich instruction set with 32 general purpose working registers. All the 32 registers are directly connected to the Arithmetic Logic Unit (ALU), allowing two independent registers to be accessed in one single instruction executed in one clock cycle. The resulting architecture is more code efficient while achieving throughputs up to ten times faster than conventional CISC microcontrollers.

The ATmega32A provides the following features: 32Kbytes of In-System Programmable Flash Program memory with Read-While-Write capabilities, 1024bytes EEPROM, 2Kbyte SRAM, 32 general purpose I/O lines, 32 general

purpose working registers, a JTAG interface for Boundary-scan, On-chip Debugging support and programming, three flexible Timer/Counters with compare modes, Internal and External Interrupts, a serial programmable USART, a byte oriented Two-wire Serial Interface, an 8-channel, 10-bit ADC with optional differential input stage with programmable gain (TQFP package only), a programmable Watchdog Timer with Internal Oscillator, an SPI serial port, and six software selectable power saving modes. The Idle mode stops the CPU while allowing the USART, Two-wire interface, A/D Converter, SRAM, Timer/Counters, SPI port, and interrupt system to continue functioning. The Power-down mode saves the register contents but freezes the Oscillator, disabling all other chip functions until the next External Interrupt or Hardware Reset. In Power-save mode, the Asynchronous Timer continues to run,

allowing the user to maintain a timer base while the rest of the device is sleeping. The ADC Noise Reduction mode stops the CPU and all I/O modules except Asynchronous Timer and ADC, to minimize switching noise during ADC conversions. In Standby mode, the crystal/resonator Oscillator is running while the rest of the device is sleeping. This allows very fast start-up combined with low-power consumption. In Extended Standby mode, both the main Oscillator and the Asynchronous Timer continue to run.

The device is manufactured with Microchip's high density non-volatile memory technology. The on-chip Flash ISP allows program memory to be reprogrammed into the system through a SPI serial interface, a conventional non-volatile memory programmer or a chip-on-demand program running in the AVR core. The AVR ATmega32A

is compatible with a complete set of program and system development tools, including: C compiler macro-assemblers, debugger / program simulators, integrated emulators and evaluation kits. The AVR ATmega32A supports a complete set of program and system development tools. Includes: C compilers, macro-assemblers, debugger / program simulators, integrated

emulators in circuits and evaluation kits.

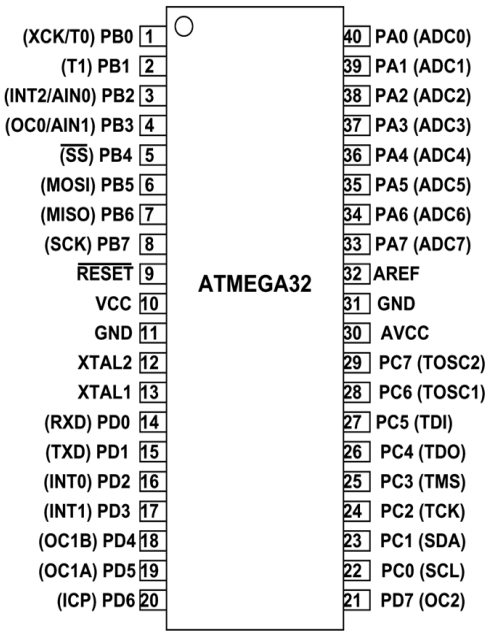


Fig 1. Pinout ATmega32A

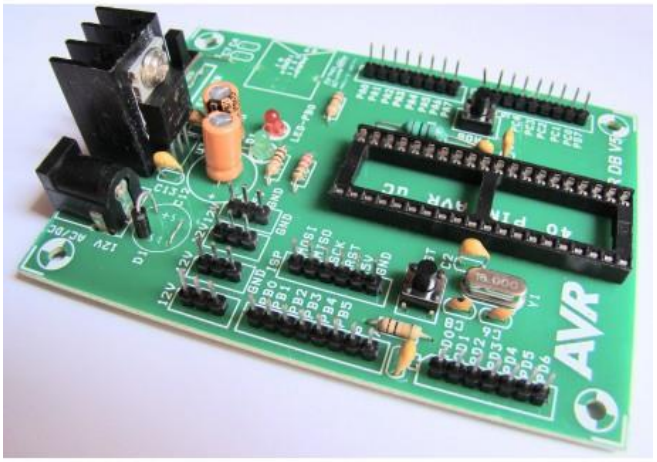


Fig 2. ATmega32A

*B.Wireless endoscopic camera*

Wireless camera module is use to get live video and still pictures Wireless Video Endo-Camera is a special purpose digital video camera combined with a universal coupler, designed for various endoscopic applications. ...
The DE1250 Wireless Endoscope Camera is being routinely used in otolaryngology (ENT), Gynecology, Urology, and Cosmetic practices worldwide.

*C.HT12D/HT12F*$2^{12}$*Series of Decoder*

The decoders $2^{12}$ are a series of CMOS LSIs for applications of remote control systems. They are associated with the$2^{12}$ series of Holtek encoders. For correct operation, a pair of encoders / decoders must be selected with the same number of addresses and the same data format. The decoders receive serial and data addresses from a series of programmed encoders $2^{12}$ that are transmitted by an operator using an RF or IR transmission medium. They compare the serial input data three times continuously with their local addresses. If no error code or no match is found, the input data codes are decoded and then transferred to the output pins. The VT pin also goes high to indicate a valid transmission. The set of decoders $2^{12}$ is capable of decoding information consisting of N address bits and 12 N data bits. From this series, the HT12D is arranged to provide 8 address bits and 4 data bits, and the HT12F is used to decode 12 bits of address information.

*D. HT12E/HT12A* $2^{12}$*Series of Encoder*

The $2^{12}$ encoders are a series of CMOS LSIs for remote control system applications. They are capable of encoding information composed of N address bits and 12-N data. Each address / data entry can be set to one of two logical states. Programmed addresses / data are transmitted with the header bits through an RF or infrared transmission medium when an activation signal is received. The ability to select a TE trigger on the HT12E or a DATA trigger on the HT12A further enhances the application flexibility of the $2^{12}$ series encoders. The HT12A also provides a 38 KHz carrier for infrared systems.

*E. Motor*

There are 3 motors used in the system. There is 1 dc motor each for forward and backward motion of the rover along with a high powered Johnson motor for upward and downward motion. Switch is set to a high voltage of 5V by default. When the button is being pressed, the voltage of the switch drifts back to low voltage. The transmitter has got an encoder which encodes the input and transmits to the receiver, which decodes it. Receiver, then it to the Corresponding low voltage pin of the motor. Thus the motor starts its motion in the direction of prescribed input.

*F. Power supply*

The processor uses a 12V, 7A battery. ATmega32A controller used here has got 4 ports named A, B, C,D with 8 pins each. The receiver's 4 pins are connected to the first 4 pins of the respective port. If we have assigned 0 for forward motion and when 0 is being connected, voltage shifts to low state and control occurs.

*G. L293D Quadruple half-h driver*

The L293 and the L293D are Quad AC high-current controllers. The L293 is designed to provide bidirectional drive currents up to 1A at voltages between 4.5 V and 36 V. The L293D is designed to provide bidirectional drive currents up to 600 mA at voltages from 4.5 V to 36 V. Designed to drive inductive loads such as relays, solenoids, bipolar stepper motors and DC motors, as well as other high current / high voltage loads in positive offer applications.

*H. KA78XX/KA78XXA 3-Terminal 1A Positive Voltage Regulator*

The positive regulators of three terminals of the KA78XX / KA78XXA series are available in the TO-220 / D-PAK package and with several fixed output

voltages, which makes them useful in many applications. Each type uses an internal current limitation, thermal closure and safe protection of the operation area, which makes it essentially indestructible. If the heat dissipation is sufficient, they can provide an output current greater than 1A. Although they are designed primarily as fixed voltage regulators, these devices can be used with external components to provide adjustable voltages and currents.

*I. 16 x 2 Character LCD*

LCD is a flat-panel display or other electronically modulated optical device that **uses** the light-modulating properties of liquid crystals.

16 × 2 LCD is so called because; It has 16 columns and 2 lines. There are many combinations available such as, 8 × 1, 8 × 2, 10 × 2, 16 × 1, etc. But the most used is the LCD 16 * 2, so we use it here.

## IV.METHODOLOGY

The proposed system is controlled by an RF module. The RF module includes a transmitter, which has an encoder and a receiver which has a decoder. The ICs HT12E and HT12D are used for encoding and decoding at the transmitting and receiving end respectively. Using this RF module, we can provide 4 control pins, which are usually high. When any switch is being pressed, corresponding pin shifts to low. The code is written based on this condition. Each pins are assigned for a specific motion, which can be forward, backward, upward as well as downward. The visuals are captured using an endoscopic wireless camera having Wi-Fi connectivity. It has got a transmitter that provides hotspot onto which user's mobile phone can be connected and the visuals can hence be viewed.

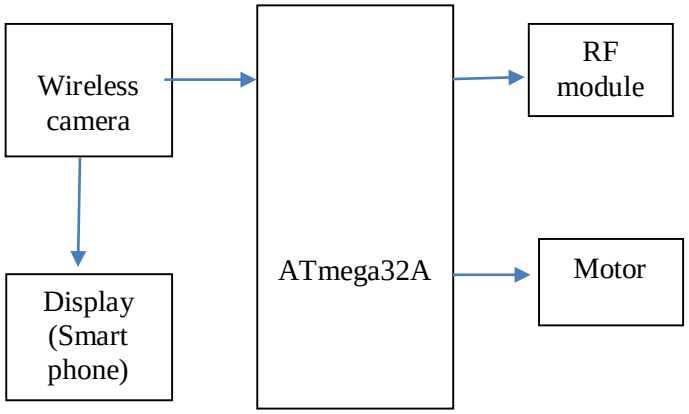


Fig 3. Block diagram of proposed system

The motor works with motor driver IC called l293d. Using l293d, we can control 2 motors at a time. The next motor is being controlled by using a H bridge. H Bridge is an electronic circuit that switches the polarity of the voltage applied to the load. H bridge arrangement is generally used to reverse the polarity or direction of the motor, but can also be used to "brake" the motor.

## V. CONCLUSION

In this article, we have proposed a remote operation underwater wireless rover that not only provides an overview of aquatic habitats, but also contributes to the protection and monitoring of the aquatic ecosystem. Our objective is apparently to provide a great platform for fishing or diving; fulfill promises when verifying deep

altitudes, whether comfortable or not. Apart from that, we try to immerse ourselves in different areas, such as lakes, ponds or seas, with the hope of finding a new species that can be investigated. As research in this area increases and other innovations are introduced in rover operations, rovers will become increasingly common and highly profitable.

## REFERENCES

[1]ArnabKumarSaha,SubhronilRoy,AranyaBhattacharya,PrabhatShankar,Anindya Kumar Sarkar, HimadriNathSaha,"A Low cost Remote controlled underawater rover using Raspberry Pi"institute of engineering and management IEEE(2018)

[2]PonlachartChotikarn,WerapongKoedsin,BoonluaPhongdara and PattaraAiyarak,Low cost submarine robot, Songklanakarin Journal of Science and Technology 17th Feb 2010, Accepted 21 October 10

[3]ChristophWaldmann, Lutz Richter (2007),"Traction properties of the wheels of an underwater crawler on different soils", OCEANS 2007

[4]N.D. Jayasundere, S.H.K.K. Gunawickrama, (2016), "Under-water ROV with Fuzzy Logic Motion Control", Information and Automation for sustainability(ICIAfS),2016

[5]Yu Wang, Ruy Tan, Guoliang Xing, Jianuxun Wang, and Xiaobo Tan, (2014) "Profiling Aquatic Diffusion Process Using Robotic Sensor Networks", IEEE Transactions on Mobile Computing, vol 13, No.4

[6]Xuri Yu, Tommy Dickey, James, Bellingham, Derek Manov, and Knut Streitlien, (2012) " The Application of Autonomous Under Water Vehicles for Inter Disciplinary Measurements in Massachusetts and Cape Cod Bays, Continental Shelf Research 22

[7] Charles Eriksen.C, James Osse. T, and Andrew chiodi. M, (2009) "Sea glider: A Long –Range Autonoums Underwater Vehicle for Oceanographic Research", IEEE Journal of Oceanic Engineering, Vol 26, No.4