Wireless Communication Based Monitoring of Marine Environment and Data Transmissions In WSN

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Abstract- *The objective of this project which consists of high priority components of the Environmental Investment Program is to put in place the policy and institutional arrangements necessary to have physical planning, land use control, infrastructure investments and environmental protection managed in a coordinated and rational way. The project would also enable the government to take immediate remedial measures including selective investments to reverse the trend of environmental degradation and to develop a system of environmental monitoring and analysis for setting environmental standards and assessing the viability and cost-effectiveness of future investment. In this project the ship is monitored by using the controller and the sensors that we fixed in the ship. MEMS is used to find the tiltation of the ship when the tidal waves is in extreme range of cyclonic action. And the ultrasonic sensor is used to find the obstacle before the ship. Using LIFI we are transmitting the data to the control room at the other end at night time by receiving the light energy.GPS is used to track the position of the ship using the particular ID and it is useful to rescue the ship when it is in dangerous situation. And the alarm signals are intimated using voice play back and speaker. All these things will be monitored in PC.*

Keywords- Micro Electro Mechanical Sensor, Li-Fi, Voice Playback, Solar module, Global Positioning Syatem

I. INTRODUCTION

In this project the marine monitoring deals with high technology range and the technologies we used here are very initiative. In this project the ship is monitored by using the controller and the sensors that we fixed in the ship. MEMS are used to find the tiltation of the ship when the tidal waves are in extreme range of cyclonic action. And the ultrasonic sensor is used to find the obstacle before the ship. Using LIFI we are transmitting the data to the control room at the other end at night time by receiving the light energy.GPS is used to track the position of the ship using the particular ID and it is useful to rescue the ship when it is in dangerous situation. And the alarm signals are intimated using voice play back and speaker. All these things will be monitored in PC.

II. LITERATURE REVIEW

Guilin, China "Research on Inland Ship Navigation Status Monitoring System" IEEE, 2012.

The environment of inland navigation is complex which leads to many accidents, thus it is of great significance for inland traffic safety to develop the inland ship navigation status monitoring system. The system realized monitoring and alarming on the status data of ship navigation with high efficiency, so the ship failure and accident risk data can be provided to the ship crew timely, who can then clearly know about the navigation status. This has a positive effect in reducing and preventing inland traffic accidents and guaranteeing the safe ship operation.

Occans – St.John, Andrew Kuczora "TI Ship Performance Monitoring and Analysis to Improve Fuel Efficiency" IEEE, 2014.

A Pilot project was launched to monitor vessel performance and to explore ways to reduce fuel consumption. Two dominant rules were observed normal route for calm sea states and Irregular route probably for heavier sea states. The average fuel consumption per trip on a regular route was 11,927 litres. Autopilot was used normal routes. While the routes are similar, there are deviations. These deviations may cause the ferry to travel longer distances and use more fuel. Automatic fuel consumption measurement agreed well with manual tank sounding and was consistently about 0.5% below manual tank sounding. Four key performance indicators were explored "Fuel consumption per payload distance" and "Fuel consumption per displacement distance' were better explaining the influence of payload, displacement and distance travelled on fuel. Until an appropriate base line is established, it is impossible to determine the success of performance management strategies and corresponding savings.

Wuhan, P.R.China "Design of ship energy efficiency monitoring and Control System considering environmental factors" IEEE, June 25- 28, 2015.

The overall structure of ship energy efficiency monitoring and control system considering the environmental factors was designed. Through application of advanced communication technologies, the system has the advantage of good stability, high reliability and strong scalability. The key technologies of the system were also studied. All of them, the energy efficiency monitoring and control technology which is the core technology of the system is introduced. The system can calculate the ship's real time EEOI by collecting the related data, thereby achieving the monitoring of the ship energy efficiency levels.

III. EXPERIMENTAL SETUP

A. Hardware Working Procedure

Switch ON the KIT. LCD displays the title of the Project. Keep hand in front of ULTRASONIC SENSOR, Hand or any other object must be the obstacle. It displays the distance between the hands and sensor. MEMS sensor: Tilt the sensor to some angle. In LCD display, it displays the three variations. It shows the ship is in unbalanced condition. Show some heat in front of FIRE SENSOR, and then in LCD it displays some analog values. After the fire sensor detected then the WATER DISPENCER start dispense the water to off the fire. Then, LIFI module starts rotating up to 180 degree and start sending the data. LIFI receiver (photo detector/solar panel) receives the data and shown in PC connected. VOICE PLAY BACK and SPEAKER announce the emergency voice.

B. Transmitter

The hardware components involved in the working principle of transmitter are:

1. Ultrasonic Sensor
2. MEMS Sensor
3. GPS
4. Motor Driver
5. Motor
6. Arduino UNO
7. LCD Display
8. LIFI
9. Voice playback
10. Speaker
11. Power

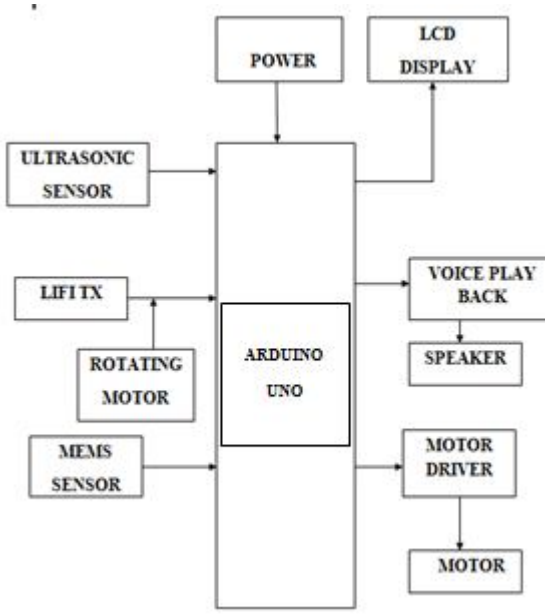

Fig.1 Block Diagram of Transmitter

1. Ultrasonic Sensor

Ultrasonic sensors work on a principle similar to radar or sonar, which evaluate attributes of a target by interpreting the echoes from radio or sound waves respectively.

Fig.2 Ultrasonic Sensor

It generates high frequency sound waves and evaluates the echo which is received back by the sensor. Sensors calculate the time interval between sending the signal and receiving the echo to determine the distance to an object.

2. MEMS Sensor

Micro Electro Mechanical Sensor is a low power, low profile capacitive micro machined Accelerometer that is used to measure proper acceleration of the devices such as process control systems, pumps, fans, rollers, compressors, etc. Apart from this, this product is known for its outstanding performance and accuracy. It can be used to measure vibration in vehicles.

3. GPS

The GPS device can retrieve data from the GPS system location and time information in all weather conditions, anywhere on or near the Earth. A GPS reception requires an unobstructed line of sight to four or more GPS satellites, and is subject to poor satellite signal conditions. Using the GPS information and subject to the sophistication of installed GPS software, a GPS device used as an automobile navigation system may be used in a number of contexts.

4. Motor Driver

A motor driver is a little current amplifier. The function of motor drivers is to take a low-current control signal and then turn it into a higher-current signal that can drive a motor.

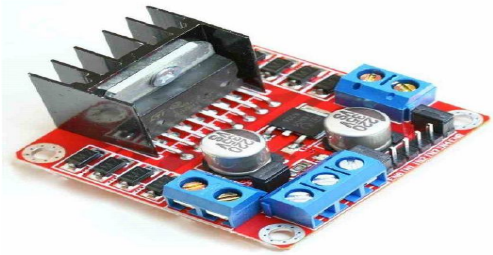

Fig.3 Motor Driver Circuit

Motor drivers can be found in a wide array of usage including: Relay and solenoid switching, Stepping motor, LED and incandescent displays, Automotive applications, Audio-visual equipment, PC Peripherals, Car audios and Car navigation systems.

5. Motor

A DC motor is a device that converts direct current, which is known as electrical energy, into mechanical energy. It's of vital importance for the industry today.

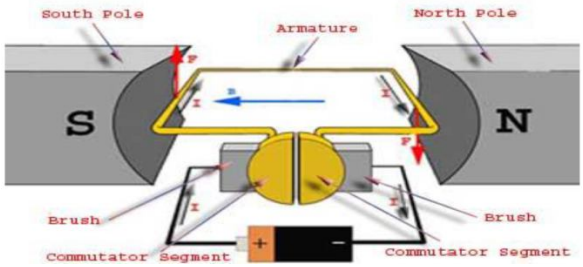

Fig.4 Construction of DC Motor

The very basic construction of a DC motor contains a current carrying armature which is connected to the supply end through commutator segments and brushes it is placed within the north south poles of a permanent or an electro-magnet as shown in the diagram above.

Fig.5 Fleming's Left Hand Rule

The working principle of DC motor is Fleming's left hand rule, which is used to determine the direction of force acting on the armature conductors of DC motor.

6. Arduino UNO

The Arduino Uno is a microcontroller board based on the ATmega328. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with AC-to-DC adapter or battery to get started.

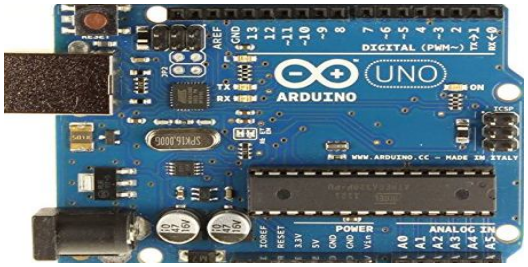

Fig.6 Arduino UNO

ATmega328, but an Atmega8 is shown in the schematic for reference. It can be powered via the USB connection or with an external power supply. It has a number of facilities for communicating with a computer, another Arduino, or other microcontrollers. The ATmega328 provides UART TTL (5V) serial communication, which is available on digital pins 0 (RX) and 1 (TX). An ATmega16U2 on the board channels this serial communication over USB and appears as a virtual com port to software on the computer. The RX and TX LEDs on the board will flash when data is being transmitted via the USB-to-serial chip and USB connection to the computerThe Arduino Uno can be programmed with the Arduino software.

7. LCD Display

Liquid Crystal Display is combination of two states of matter, the solid and the liquid. It uses a liquid crystal to produce a visible image. It's technologies allow displays to be much thinner when compared to cathode ray tube (CRT)

technology. The combination of colored light with the grayscale image of the crystal forms colored image. This image is then displayed on the screen like shown below.

Fig.7 LCD Output

Most of the electronic devices depends on LCD for their display. The liquid has a unique advantage of having low power consumption than the LED or cathode ray tube.

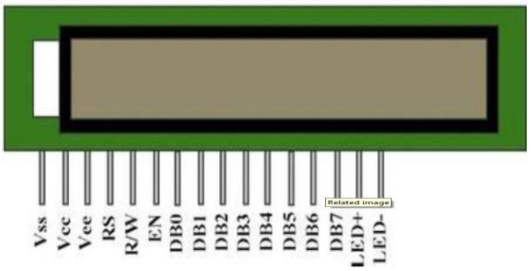

Fig.8 LCD Pin Configuration

The principle behind the LCD's is that when an electrical current is applied to the liquid crystal molecule causes the angle of light which is passing through the molecule of the polarized glass and also cause a change in the angle of the top polarizing filter. As a result a little light is allowed to pass the polarized glass through a particular area of the LCD. Thus that particular area will become dark compared to other.

8. LI-FI

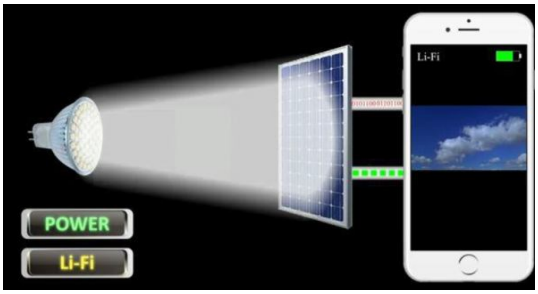

Fig.9 LIFI Technology

The affordable, speed change in the optical form of Wi-Fi is the Li-Fi and it is based on VLC i.e. Visible Light Communication where VLC is a medium of information communication which avails quick pulses of light to send the data wirelessly. The main constituents of a Li-Fi system is excel brightening white LED which plays the role of a transmitter. A silicon photodiode with a good response to visible light acts as a receiver. In LEDs, switching on and off can be done through 1's and 0's.

Fig.10 LIFI Model

It provides the speed up to 1 Gbps with the exceptional bandwidth. It provides high security because the light cannot travel or enter the walls and due to this the factor of misuse cannot occur.

9. Voice playback

Here APR33a3 processor is used for voice playback, which provides high quality recording and playback They are powerful audio processor along with high performance audio ADCs and DACs. It incorporates all the functionality required to perform demanding audio/voice applications.

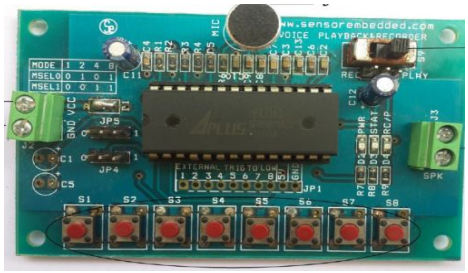

Fig.11 APR33a3 Voice Playback Processor

10. Speaker

A speaker consist of an electromagnet (an electromagnet is simply a metal coil which produces a magnetic field when an electric current flows through it), and a fixed permanent magnet.

Fig.12 Speaker

The polarity of permanent magnet and the electromagnet feel attractive and repulsive forces, this keeps the electromagnet to vibrate back and forth. These fluctuating vibrations are then amplified by first removing ripples or small disturbances in the signal and then produced as output audible signal through a 'cone'. The vibrations produces certain frequency, which decides the pitch of the output sound produced, whereas its amplitude governs the volume of the sound produced. Different frequencies of sound are produced by using cones of different sizes.

11. Power

` All basic electronic circuits need constant DC voltage. The low power system can be run with a battery. But, for long time operating devices, batteries could prove to be costly and complicated. The best method used is in the form of a regulated power supply a combination of a transformer, rectifier and a filter.

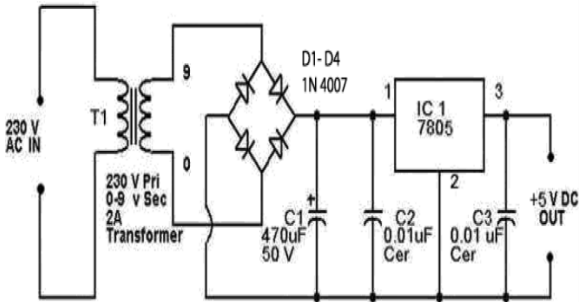

Fig.13 Regulated Power Supply

In above figure, a small step down transformer is used to reduce the voltage level to the devices needs. The output of the transformer is a pulsating sinusoidal AC voltage, which is converted to pulsating DC with the help of a rectifier. Then, it is given to a filter circuit which reduces the AC ripples, and passes the DC components to get the regulated 5v power supply as output.

(a)Transformer

Transformer is a static device which transforms electrical energy from one circuit to another without any direct electrical connection and with the help of mutual induction between two windings.

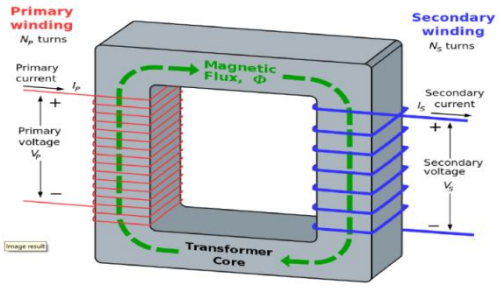

Fig.14 Principle of Transformer

The working principle of transformer is Faraday's law of electromagnetic induction. Usually, the mutual induction between two or more winding is responsible for transformation action in an electrical transformer.

(b)Rectifier

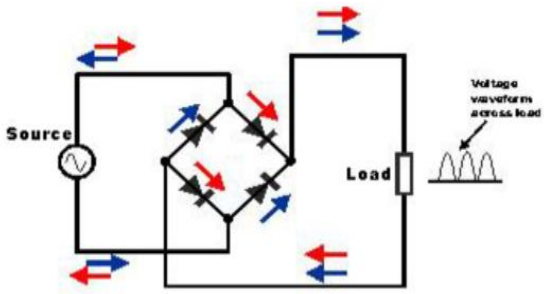

Fig.15 Working of Full wave Rectifier

The rectifier is used to reduce the ripple or voltage variations on a direct DC voltage by connecting capacitors across the load resistance. Full wave rectifier circuit is used here. In FWR, we use two diodes, one for each half of the wave. A multiple winding transformer is used whose secondary winding is split equally into two halves with a common center tapped connection. It produces an output during both half-cycles. Full rectifier advantages are flexible compared to that of half wave rectifier.

(c)Regulator

A voltage regulator is a voltage stabilizer that is designed to automatically stabilize a constant voltage level. It is used for two reasons:

- To regulate or vary the output voltage of the circuit.
- To keep the output voltage constant at the desired value in-spite of variations in supply voltage or in load current.

Voltage regulators circuit is used to control the output. It is classified as electromechanical or electronic. It can also be classified as AC regulators or DC regulators.

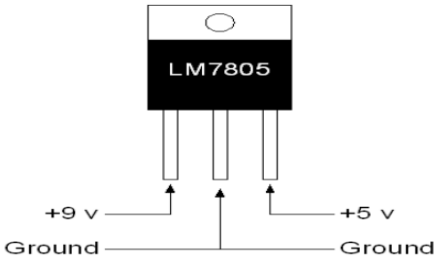

Fig.16 Voltage Regulator

When V_{in} increases, then V_{load} also increases. This increase in V_{load} will cause a reduced voltage of the transistor V_{be} as the zener voltage V_{zener} remains constant. This reduction in Vbe causes a decrease in the level of conduction which will further increase the collector-emitter resistance of the transistor and thus causing an increase in the transistor collector-emitter voltage and all of this causes the output voltage V_{out} to reduce. Thus, the output voltage remains constant. The operation is similar when the input supply voltage decreases.

C. Receiver

The important hardware components involved in the working principle of Receiver are:

1. Solar panel
2. PL2303USB
3. PC

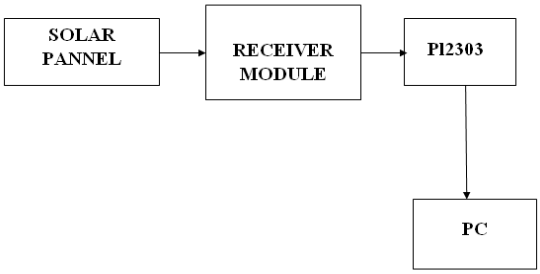

Fig.17 Block Diagram of Receiver

1. Solar Panel

A photovoltaic (PV) module is a package, connect assembly of typically 6x10 photovoltaic solar cells. Photovoltaic modules constitute the photovoltaic array of a photovoltaic system that generates and supplies solar electricity in commercial and residential applications. Photovoltaic modules use light energy (photons) from the Sun to generate electricity through the photovoltaic effect. A single solar module can produce only a limited amount of power; most installations contain multiple modules. Modules electrical connections are made in series to achieve a desired output voltage or in parallel to provide a desired current capability. A photovoltaic system typically includes an array of photovoltaic modules, an inverter, a battery pack for storage, interconnection wiring, and optionally a solar tracking mechanism.

2. PL2303 USB

It is a wired device which is used to transmit and receive data between the devices. It works under various baud rates like (9600 / 4800) to TX and RX data. Power LED is placed to indicate the power supply. Status LED is used to identify the transmitting and the receiving status. It can be interfaced with the PC.

3. PC

Connect A to B cable to PC and CONTROLLER. Install **DOCKLIGHT** software in both the PC. In PC check the COM port in which pl2303 is connected, by Right click My computer-Properties-Device Manager-Ports. Now select the particular COM in Dock light software, which is shown in PC. Set baud rate as 9600. Click on the keyboard button of the Dock light menu to display the output. Now, a command is given through DOCKLIGHT software, and the micro controller fetches the information and processed in micro controller.

IV. RESULT

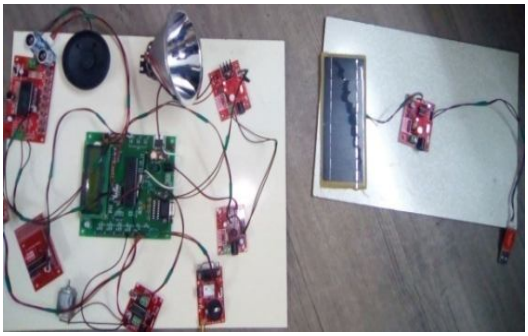

Fig.18 Proposed System

The result shows that output for ship's real time EEOI, sailing speed and engine speed under different environment conditions through the model of the dynamic relationship between environmental factors and ship energy efficiency.

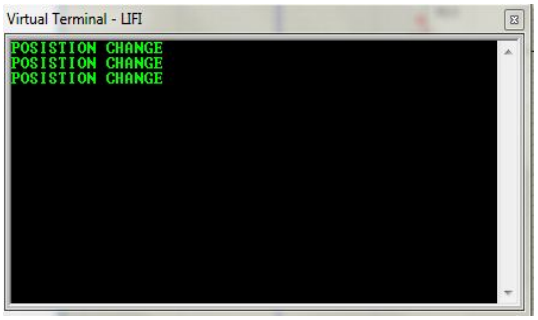

Fig.19 Simulation Output

V. ADVANTAGES

- New technology to rescue the ship.
- Command receiving is quick and through wireless technology.
- LIFI technology is used to receive and transmit the data.
- GPS is to find the correct ship to be rescued.

VI. CONCLUSION

This system provides effective results with more accuracy. To the best of our knowledge, no such method exists like our system.

VII. ACKNOWLEDGEMENT

We would like to thank all those who provide us the possibility to propose this project. A special gratitude to our Project Guide Mrs. M. Mary Grace Neela, Assistant professor and Project coordinator Mrs. S. Jeya Anusuya, Associate professor, whose contribution in giving suggestions and encouragement helped us for this project to complete.

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