An Autonomous Sailing Robot For Oceanographic Research

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Abstract- *Smart, compact, reliable and affordable instruments offer the promise of describing the parameters of the ocean with techniques with techniques reliant on ships and submarines. Autonomous sailing robots are used for collision avoidance and to study and monitor the physical parameters of the ocean. Robotic measurements at the ocean help us to better understand the climatic changes.*

In the past few years, there has been a lot of research on the autonomous sailing robots. Different researchers have used different controllers, sensors, actuators, etc for the oceanographic research. Recently, there is a lot of research going on to reduce pollution. Autonomous sailing robots also help in reducing pollution.

Keywords- ARM7,DC Motors, IR Sensor, Oceanography, pH Sensor, RF Technology, Ultrasonic Sensor

I. INTRODUCTION

Autonomous sailing robots are used for a number of applications. These sailing robots are basically designed to detect and monitor parameters of the ocean, as it is not possible for humans to stay in harsh environments with no consumable food and basic requirements. So instead of a person being engaged to monitor the parameters of the ocean, we can use an autonomous sailing robot for this purpose.
In this paper, we present a smart and inexpensive sailing robot. The robot will detect obstacles using IR sensor and the GPS will track the location and a warning message will be sent to the authorized person via GSM. Ultrasonic sensor is used to measure the depth of ocean and also to detect obstacles which are under water. In worst conditions, if the distance between the obstacle and robot is less then brakes will be applied automatically. The sailing robot is then made to move forward, backward, left or right using switches. RF technology is used for transmission and reception. pH sensor detects the quality of water.

II. RELATED WORK

Block Diagram:

1. Transmitter Section:

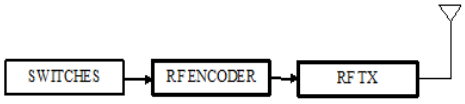

Fig 1: RF Transmitter Section

2. Receiver Section:

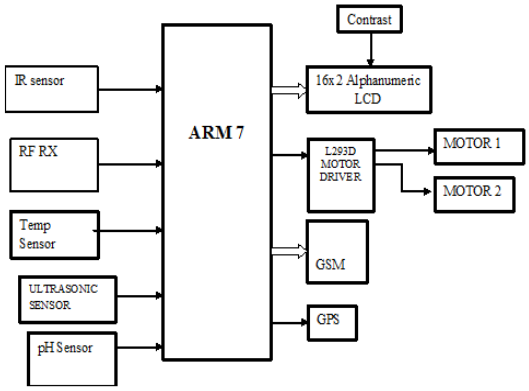

Fig 2: RF Receiver Section

The above figure shows the block diagram of the autonomous sailing robot. The RF decoder receives signal from the transmitter. The RF decoder is used for serial to parallel conversion of data. Various sensors are interfaced to the ARM7 (LPC2148) microcontroller to detect the parameters. The transmitter section consists of RF encoder and switches. Four switches are used. The switches are used to change the direction of robot when an obstacle is detected. The robot can be moved in forward, backward, left or right direction.

III. DESIGN STUDY

In this paper, Radio Frequency (RF) signals are used for transmission and reception. RF refers to the rate of oscillation of electromagnetic radio waves in the range of 3 kHz to 300GHz, as well as the alternating currents carrying the radio signals. RF technology is used for wireless

communication as it has wide frequency range. In this paper, we are using the frequency of 433 MHz, which is in the frequency range. The fundamental components for RF communication are: RF transmitter, RF receiver, encoder and decoder.

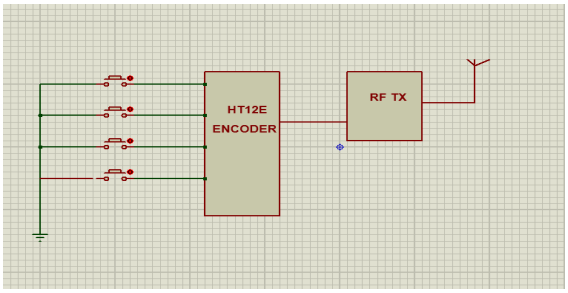

Fig 3: Circuit Diagram of Transmitter Section

HT12E encoder IC is used in the transmitter section for parallel to serial conversion of data. It encodes the 12 bit parallel data into serial for transmission through an RF transmitter. These 12 bits are divided into 8 address bits and 4 data bits.

HT12D decoder IC is used in receiver section for serial to parallel conversion of data. It decodes the serial addresses and data received by, an RF receiver, into parallel data and sends them to output data pins. The serial input data is compared with the local addresses 3 times continuously. The input data code is decodedwhen no error or unmatched codes are found. HT12D is capable of decoding 12 bits, of which 8 are address bits and 4 are data bits.

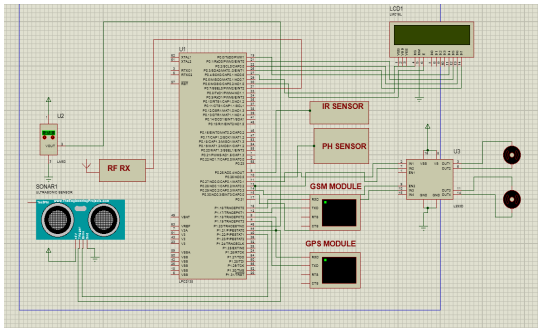

Fig 4: Circuit Diagram of Receiver Section

The receiver section consists of various sensors interfaced to theARM7 (LPC2148) microcontroller. These sensors are used to measure different parameters and display them on LCD. DC motors are used to change the direction of robot, when switches are pressed in the transmitter section.

IV. METHODOLOGY

In this paper, an autonomous sailing robot is operated using batteries. GPS is used to track the location and GSM module is used for communication purpose. If any sensor exceeds their set value, the GPS tracks the location and sends message to the authenticated person via GSM. pH sensor is used to check the quality of water. If any chemicals are added to water, the pH value of water changes. This information can be sent to the respective department and accordingly action can be taken.

The ultrasonic sensor is used to measure the depth of the ocean. It can also detect obstacles which are underwater and send a warning message via GSM. The IR sensor is used to detect obstacles in front of the boat. When obstacle is detected, it tracks the location and sends message to the respective person via GSM. If the distance between the robot and obstacle is less then brakes are automatically applied.

The direction of robot can be changed by pressing the switches on the transmitter side. In this way, collision can be avoided.

LM35 temperature sensor is used. It gives us information about the atmospheric temperature of that region. L293D motor driver is used to drive the DC motors.

V. EXPERIMENTAL RESULT

The autonomous sailing robot is used to explore all the details of the ocean. It tracks the location using GPS, if any obstacle is detected. When obstacle is detected, warning message is displayed on LCD and message is sent to the authenticated person using GSM. The robot detects obstacles, measures temperature and also depth of the ocean. The quality of water can be checked using pH sensor.

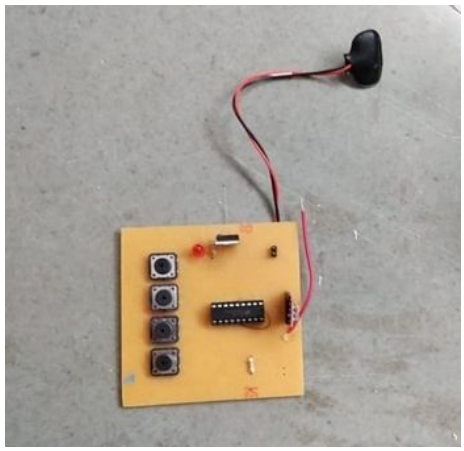

Fig 3: RF Transmitter

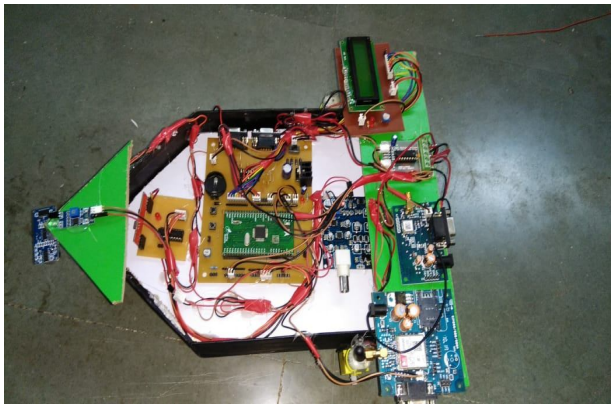

Fig 4: RF Receiver

VI. CONCLUSION AND FUTURE SCOPE

The autonomous sailing robots can be used for various for applications. Various parameters of the ocean can be tested and analyzed. These robots can be used for navigational research and ocean exploration. In future scope, pick and place mechanism can be implemented using a robotic arm. Wireless camera can be connected for security purposes. Through the wireless camera, we can we get a live footage of the particular ocean region. Oil detection sensors can be used, to detect the oil content in ocean, if any leakage takes place. Instead of using batteries, we can use renewable sources of energy. Solar panels or tidal energy can be used to generate power.

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