Bidirectional Communication in Underwater Acoustic Sensor Network

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***Abstract*-Underwater Acoustic Sensor Networks (UW-ASNs) consist of devices with sensing, processing, and communication capabilities that are deployed underwater to perform collaborative monitoring tasks to support a broad range of applications. The enabling communication technology for distances over one hundred meters is wireless acoustic networking because of the high attenuation and scattering affecting radio and optical waves, respectively. In this work, the problem of data gathering is investigated by considering the interactions between the routing functions and the characteristics of the underwater acoustic channel. Two distributed geographical routing algorithms for delay-insensitive and delay-sensitive applications are proposed and shown through simulation experiments to meet the application requirements.**

Index Terms -Underwater acoustic network, wireless, communication, routing algorithm.

I.INTRODUCTION

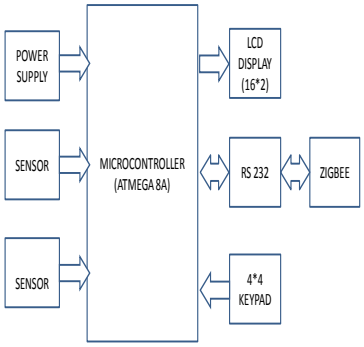
In submarines they using RADAR for communication but RADAR is half duplex. We cannot transfer and receive the data in same time. So we implement this project to transfer data in submarines in high frequency RF transceiver using aquatics algorithm in FULL duplex so that the data transfer and receive in same time.

The aim of this project is to develop under water communication system using the ZigBee protocol stack. This is very useful to find out any problem in caves and mines. An embedded system is a special purpose system in which the compute is completely encapsulated by or dedicated to the device or system it controls Personal digital assistants (PDAs) or handheld computers are generally considered embedded devices because of the nature of their hardware design, even though they are more expandable in software terms. This line of definition continues to blur as devices expand.

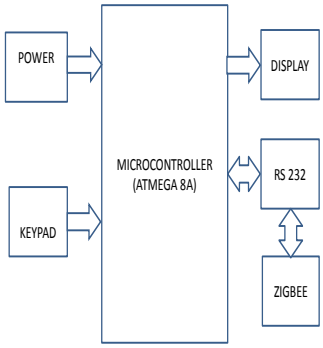
II.SYSTEM ARCHITECTURE [TRANSMITTER]

The system architecture of the transmitter section consists of the hardware components like the microcontroller, power supply, sensors, power supply, zig bee, keypad and RS 232.

The power supply is used to give the power for the whole circuit. The sensors are used for sensing the various parameters at one end. The microcontroller used here is Atmega 8A. The LCD is used for the display purpose. RS-232 is used as a interface between the microcontroller and the zigbee. The zigbee is used to transmit the information to the receiver. Keypad is used to type the input whatever we want.



III.SYSTEM ARCHITECTURE [RECEIVER]



IV. DELAY-INSENSITIVE ROUTING ALGORITHM

We introduce a distributed geographical routing solution for delay-insensitive underwater applications. Most prior geographical routing protocols assume that nodes can either work in a greedy mode or in a recovery mode. When in greedy mode, the node that currently holds the message tries to forward it towards the destination. The recovery mode is entered when a node fails to forward a message in the greedy mode as none of its neighbors is a feasible next hop.

Usually this occurs when the node - the so-called concave node - observes a void region between itself and the destination. Recovery mechanisms, which allow a packet to be forwarded to the destination when a concave node is reached, are out of the scope of this work. The protocol proposed in this section assumes that no void regions exist, although it can be enhanced by combining it with one of the existing recovery mechanisms.

V. OBJECTIVE OF PROPOSED ALGORITHM

The objective of our proposed routing solution is to efficiently exploit the underwater acoustic channel and to minimize the energy consumption. Therefore, the proposed algorithm relies on the packet-train transmission scheme, which is discussed in Sect. IV. In a distributed manner and only exploiting a local view of the network, it allows each node to jointly select its best next hop, the transmitted power, and the FEC code rate for each packet, with the objective of minimizing the energy consumption while taking the condition of the underwater channel into account.

The algorithm tries to exploit those links that guarantee a low packet error rate in order to maximize the probability that the packet is correctly decoded at the receiver. For these reasons, the energy efficiency of the link is weighted by the number of retransmissions required to achieve link reliability, with the objective of saving energy.

VI. HARDWARE

Power Supply

Microcontroller – ATmega 8A

Temperature sensor

LCD – 16*2

ZIGBEE CC2500

4*4 keypad

VI. SOFTWARE

Platform - AVR STUDIO

In System Programmer - ProgISP 172

Compiler – Win AVR

Simulation – Proteus 7.7sp

VII. POWER SUPPLY

A. Transformer

A transformer is an electro-magnetic static device, which transfers electrical energy from one circuit to another, either at the same voltage or at different voltage but at the same frequency.

B.Rectifier

The function of the rectifier is to convert AC to DC current or voltage. Usually in the rectifier circuit full wave bridge rectifier is used.

C.Filter

The Filter is used to remove the pulsated AC. A filter circuit uses capacitor and inductor. The function of the capacitor is to block the DC voltage and bypass the AC voltage. The function of the inductor is to block the AC voltage and bypass the DC voltage.

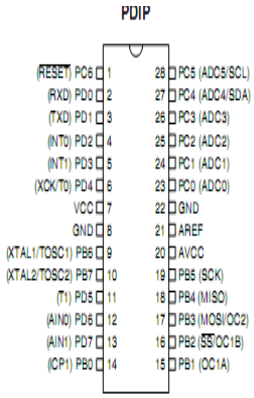
D.Voltage Regulator

Voltage regulator constitutes an indispensable part of the power supply section of any electronic systems. The main advantage of the regulator ICs is that it regulates or maintains the output constant, in spite of the variation in the input supply.

VIII. MICROCONTROLLER

The ATmega8A provides 8K bytes of In-System Programmable Flash with Read-While- Write capabilities, 512 bytes of EEPROM, 1K byte of SRAM, 23 general purpose I/O lines, 32general purpose working registers, three flexible Timer/Counters with compare modes, internal and external interrupts, a serial programmable USART, one byte oriented Two-wire Serial Interface, a 6-channel ADC (eight channels in TQFP and QFN/MLF packages) with 10-bit accuracy, a programmable Watchdog Timer with Internal Oscillator, an SPI serial port, and five software selectable power saving modes. The Idle mode stops the CPU while allowing the SRAM, Timer/Counters, one 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 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

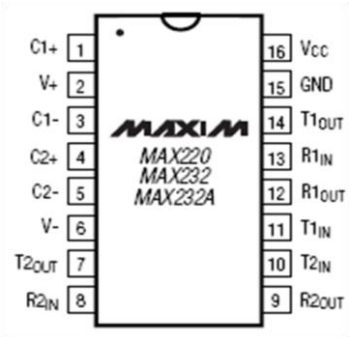
PIN CONFIGURATION



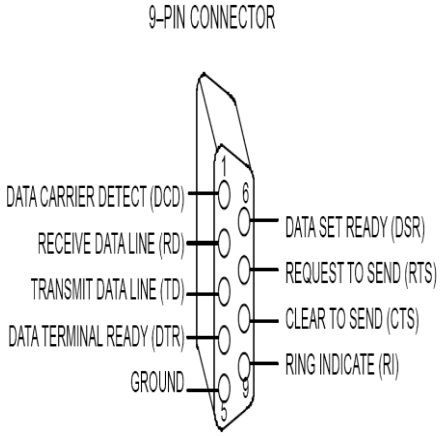
IX. MAX 232

The MAX220–MAX249 family of line drivers/receivers is intended for all EIA/TIA-232E and V.28/V.24 communications interfaces, particularly applications where ±12V is not available. These parts are especially useful in battery-powered systems, since their low-power shutdown mode reduces power dissipation to less than 5µW.

PIN DIAGRAM OF MAX 232



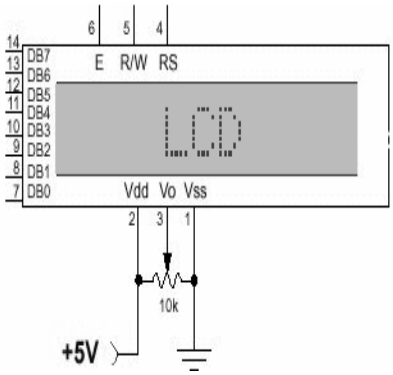
DB-9 CONNECTOR



X. LCD DISPLAY

A liquid crystal display (LCD) is a thin, flat display device made up of any number of color or monochrome pixels arrayed in front of a light source or reflector.Each pixel consists of a column of liquid crystal molecules suspended between two transparent electrodes, and two polarizing filters, the axes of polarity of which are perpendicular to each other.Without the liquid crystals between them, light passing through one would be blocked by the other. The liquid crystal twists the polarization of light entering one filter to allow it to pass through the other.

PIN DIAGRAM OF LCD



XI. ZIGBEE PROTOCOL

ZigBee is a wireless technology developed as an open global standard to address the unique needs of low-cost, low-power wireless M2M networks.The ZigBee standard operates on the IEEE 802.15.4 physical radio specification and operates in unlicensed bands including 2.4 GHz, 900 MHz and 868 MHzThe ZigBee protocol is designed to communicate data through hostile RF environments that are common in commercial and industrial applications.

XII. PROGRAMMER

The programmer used is a powerful programmer for the Atmel 89 series of microcontrollers that includes 89C51/52/55, 89S51/52/55 and many more.It is simple to use & low cost, yet powerful flash microcontroller programmer for the Atmel 89 series.It will Program, Read and Verify Code Data, Write Lock Bits, Erase and Blank Check. All fuse and lock bits are programmable. This programmer has intelligent onboard firmware and connects to the serial port. It can be used with any type of computer and requires no special hardware. All that is needed is a serial communication port which all computers have.

XIII. CONCLUSION

The project “Under Water Wireless Control Using ZigBee For Transmissions Systems” has been

successfully designed and tested. Integrating features of all the hardware components used have developed it. Presence of every module has been reasoned out and placed carefully thus contributing to the best working of the unit. Secondly, using highly advanced IC's and with the help of growing technology the project has been successfully implemented.

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