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Feasibility Study and Implementation of Sea Researcher's Bio-Parameters Monitoring by Water Channel Model

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Abstract- **The analysis mentioned health services within the role of medicine and life support. Underwater communication is needed in several applications like transfer of messages and speech transmission between submarines Ships, aqualung different etc., and additionally to trace lost ships and find sunken planes. The designed system was a system ready to offer data on the user's health condition, during this case, a live of pulse and blood heat employing a pulse device (finger-tip sensor). It took the info from the blood flow on the forefinger for sixty seconds, and then displayed it on the alphanumeric display. The LM35 temperature device was used for blood heat information assortment. Changes within the device heat would be born-again into electricity, translated into digital type through a 10-bit ADC, processed by the PIC microcontroller, and displayed on the alphanumeric display. The complete system consists of two components, the on top of Water unit, and also the submarine unit for oceanographers model. The system realizes the dominant of the submarine model to attain numerous styles of movement once the antenna is three meters on top of the water. The space error, time error and speed error all meet the wants .The whole system operates merely and functions well.**

Index terms- **finger-tip, body temperature, microcontroller, underwater networks, wireless sensor networks**

I.INTRODUCTION

Underwater data communication is essential to our continued development of the underwater environment. In 2004, the US Commission on Ocean Policy directly stated, "Advanced communication capabilities are also required for scientists to remotely operate ocean exploration vehicles, similar to the highly successful use of space probes (USCOP, 2004)." Due to the extremely hostile environment which one interacts with while underwater, it is often much safer to make use of remotely controlled vehicles to perform manual tasks. Although our ability to make these vehicles self-guiding and autonomous is increasing, often the task is too undefined and sensor information must be relayed to a person who can make a decision. The decision must then be communicated back to the vehicle to be implemented. Much more research and development of these communication methods needs to be done to provide acceptable options to the system designer. This can be facilitated by delivering a successful methodology that can be implemented by hobbyists, business and academics. Each of these sectors can make immediate use of this type of ability to streamline research and increase public interaction with the underwater environment.

The previous technology used to address this need was the use of a cable which extended from the vehicles pilot to the vehicle. The first tethered ROV was used in 1953 (Christ and Wernli, 2007). It was immediately apparent that the tremendous problems involved with signal degradation and the lateral drag when such a device is deployed in even a slowly moving current necessitated a better solution than a cumbersome cable. This greatly limits the capabilities of the vehicle at the end of this tether cable and much of the design of a successful remote vehicle in the past depended on designing around the tether restrictions. Although such vehicles will be in use for years to come, they will inevitably be replaced by vehicles with the increased maneuverability and depth capabilities that can be realized by using acoustic digital data communication to replace the venerable tether.

In order to stimulate growth in the research, development and usage of acoustic digital data communications, it will be necessary to bring the price down to the point where it is casually attainable. Due to recent maturation of the microcontroller market, it is now more feasible than ever to begin to develop this basic methodology. Further contributing is the relative abundance of inexpensive piezoelectric elements capable of being used as transducers which originated in the home entertainment sector. It should be possible to assemble these factors to send digital information wirelessly through water, and to then decode it back into an accurate representation of that data that can be acted on at the remote location.

II. RELATED WORK

Some researchers have researched on temperature sensors and microcontrollers such as Yilei and Airong who designed a real-time temperature monitoring based on the operating system [1]. The system consisted of a DS18B20 sensor, an nRF24L01 wireless module, and a STM32F103ZET6 microcontroller. Fuady et al studied extreme machine learning and neural network to control the temperature and humidity of oysters based on microcontrollers [2]. The system consisted of a microcontroller and a DHT 11 sensor. Wang and Chi investigated the Arduino Uno platform wireless temperature and humidity monitoring system consisting of an Arduino microcontroller, a temperature sensor and humidity sensor, a 128641 LCD, and an nRF24L0 wireless module [3].

Other temperature measurement research includes an experiment to precise temperature measurement using platinum RTD PT1000 temperature sensor and Matlab by Chauhan and Neelakantan [4], a unit design for measuring the temperature of moving parts of the crank mechanism by Elkhutov using a temperature sensor and accelerometer [5], and Arduino-based temperature and humidity controls for condensation on engineered surface wettability by Gupta et al using a temperature sensor, a humidity sensor, and an Arduino Uno microcontroller [6].

Some other researchers have conducted research on body temperature. Saha, Raun, and Saha monitored the health of patients with smart ambulance systems using the Internet of Things (IOTs) [7]. The system consisted of a heart rate sensor, a temperature sensor, a microcontroller using Arduino, and a Raspberry Pi. Priyadharshini developed an embedded web server for health care systems using E-cards consisting of a heart rate sensor, a blood sugar sensor, a blood pressure sensor, a weight sensor, and an ATMEGA16 microcontroller [8]. Jayswal, Gupta and Gupta studied patient health monitoring systems based on the Internet of Things including a heart rate sensor, a temperature sensor, an ATMEGA328 microcontroller, and a Wi-Fi module [9].

Asmidar et al developed infant incubators for clinics in rural areas of Malaysia [10]. The system consisted of an ATMEGA2560 microcontroller, a DHT11 incubator temperature and humidity sensor, a DS18B20 baby body temperature sensor, a weight sensor, and an LM35 heating element temperature sensor. Sudha et al designed a system for patient monitoring in hospital management using Li-Fi [11]. The system consisted of a heart rate sensor, a blood sugar sensor, a temperature sensor, a respiratory sensor, a PIC 16F844 microcontroller, and a LIFI transmitter. Aziz et al developed a smart real-time health monitoring and tracking system using GSM/GPS technology that included a GPS position sensor, a microcontroller, a pulse sensor, a temperature sensor, and a GSM module [12]. Ganesh et al designed low-cost smart chairs for telemedicine and IoT- based health monitoring. It was an open-source technology to facilitate better health care [13]. The system consisted of a blood pressure sensor, a temperature sensor, a weight sensor, an analog signal processing module, microcontrollers, a GSM module, a Wi-Fi module, and a Bluetooth module. Dhande et al developed portable systems for monitoring vital signs with a Java-based computer display and recording of data that consisted of a heart rate sensor, a temperature sensor, a microcontroller, and a laptop [14]. Thomas et al examined sensing heart rate and body temperature digitally including an Arduino Uno microcontroller, a temperature sensor, a heart rate sensor, and a Bluetooth module [15].

Other research on body temperature measurements include body temperature measurements for remote health monitoring systems consisting of a temperature sensor, microcontrollers, and Zigbee by Mansor et al [16], continuous heart rate and body temperature monitoring systems using Arduino UNO and Android devices containing a temperature sensor, heart rate sensor, Arduino, low pass filter module and Bluetooth module by Asaduzzaman Miah et al [17], and design and implementation of smart health bands for measurement of blood pressure, pulse, and body temperature by Rahman, Islam and Ahmad [18].

Kioumars and Tang studied wireless networks for health monitoring, using heart rate and temperature sensors [19]. The system consisted of an Arduino microcontroller, a TMP36 temperature sensor, a heart rate sensor, and a wireless communication module. Gulcharan et al investigated the stability and reliability of the patient's wireless temperature monitoring devices using a temperature sensor, an Arduino microcontroller, and a Zigbee [20]. Rahman et al developed a device for remote monitoring of heart rate and body temperature using a heart rate sensor, temperature sensor, Ethernet host, web server, and a microcontroller [21].

III. METHODOLGY

The device was expected to meet the specification, namely, to count the number of heartbeats in one minute, and to measure body temperature constantly. Figure 1 displays the block diagram of the system. It shows that one of the fingers is inserted into the finger sensor transducer block, then the LED light that penetrates the finger will be received by the LDR where the frequency of the blood flow will be detected. The data will be processed on the microcontroller, and the results will be displayed on seven segments that show the number of hearts beats every minute.

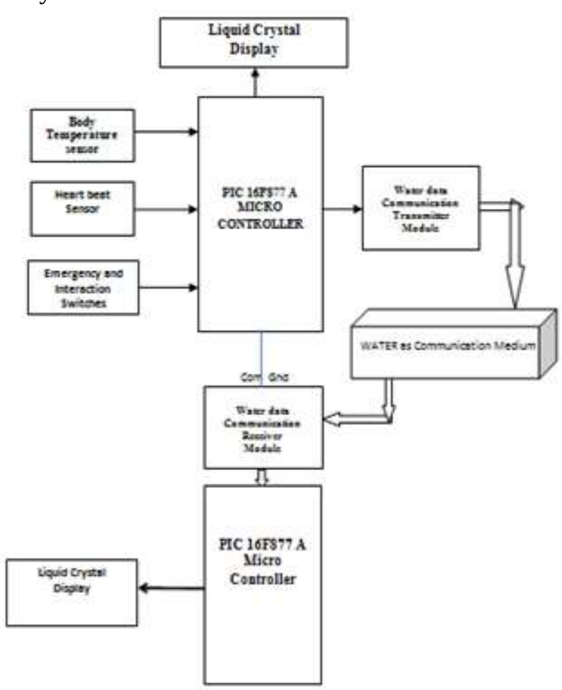

Fig 1 :Block Diagram of Proposed System

A. Hardware Requirements

- PIC16F877A Microcontroller
- Power Supply
- Heart Beat Sensor
- Temperature Sensor
- UWSN Transmitter
- UWSN Receiver
- Switch
- Lcd

B. Software Requirements

- MPLAB ID
- Embedded C

IV. HARDWARE IMPLEMENTATION

A. PIC Microcontroller

PIC is a family of modified Harvard architecture microcontroller made by Microchip technology, derived from the PIC1650 originally developed by General Instrument's Microelectronics Division. The name PIC is referred to as "Peripheral Interface Controller". PICs are popular with both industrial developers and hobbyists due to their low cost, wide availability, availability of low cost or free development tools, and serial programming (and re-programming with flash memory) capability. Microchip introduced the new PIC32MX family of 32-bit microcontrollers operates at 2.3V to 3.6V supply voltage with 80 MHz frequency. The initial device line-up is based on the industry standard MIPS32 M4K Core. The device can be programmed using the Microchip MPLAB C Compiler for PIC32 MCUs.

PIC microcontroller is the first RISC based microcontroller fabricated in CMOS (complementary metal oxide semiconductor) that uses separate bus for instruction and data allowing simultaneous access of program and data memory. The main advantage of CMOS and RISC combination is low power consumption resulting in a very small chip size with a small pin count. The main advantage of CMOS is that it has immunity to noise than other fabrication techniques. Various microcontrollers offer different kinds of memories. EEPROM, EPROM, FLASH etc. are some of the memories of which FLASH is the most recently developed. Technology that is used in pic16F877 is flash technology, so that data is retained even when the power is switched off. Easy Programming and Erasing are other features of PIC 16F877A.

TABLE 1. Various PIC Microcontrollers

PIC MCU device	PIC MCU No. of Pins	PIC MCU Flash memory
12F675	8	1k
16F88	18	4K
16F877A	40	8K

B. POWER SUPPLY

The potential transformer will step down the power supply voltage (0-230V) to (0-12V) level. Then the secondary of the potential transformer will be connected to the precision rectifier, which is constructed with the help of op–amp. The bridge rectifier produces a voltage output that is nearly twice that of the conventional full-wave circuit.

C. Heart Beat Sensor

Heart rate is a window into your muscles and lungs as it reveals how hard they are working! The need for an accurate, yet affordable heart monitor is essential to ensure ones health quality. So here’s a prefatory article to help you design/build a compact and cost-efficient heart rate (pulse rate) monitor that will provide an accurate reading of one’s heart rate. Remember, your heart rate is a very good indicator of your physical condition.

The non-invasive type of optical heart rate sensor consists of an electronic circuit that monitors heartbeat by clipping onto a fingertip. It does this by shining light into (or through) the finger and measuring how much light is reflected (or absorbed). This goes up and down as blood is pumped through the finger.

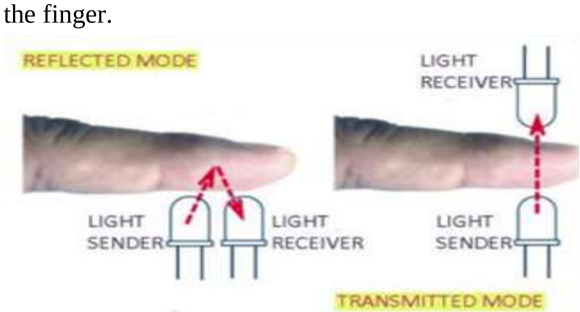

Figure 2. Heartbeat sensor

D. Temperature Sensor

Temperature sensor senses the temperature of body. It can sense the temperature of human body. It is an analog sensor and gives the output into form of analog signal. This signal is feed to ARM controller and ADC will convert it into digital form. Once converted into analog form the controller can process the digital temperature signal as per the application.

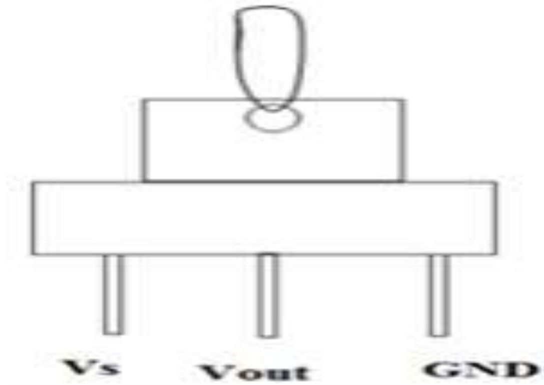

Fig 3- Temperature Sensor

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E. Switch module

A toggle may be a category of electrical switches that area unit manually motivated by a mechanical lever, handle, or rocking mechanism. The phrase “toggle switch” is applied to a switch with a brief handle and a positive snap-action, whether or not it really contains a toggle mechanism or not. Once the actuator-the toggle itself-is affected, the coil within switch moves the transferable contact into position either energizing the circuit or de-energizing it.

F. Underwater Wireless Transceiver

The modem hardware is split into three main portions: a wakeup receiver, a data receiver, and a single transmitter. The transmitter has three output frequencies, which correspond to the data mark, data space, and wakeup tone. It is not possible to transmit data and the wakeup tone simultaneously. Figure 4 is a block diagram of our modem hardware. The entire circuit operates from a 5 volt power supply. The power control block allows software control of power distribution so that the wakeup receiver, data receiver and transmitter can be independently turned off or on. Level shifters are used to provide compatibility with CMOS logic levels between 2.8 and 5.0 Volts.

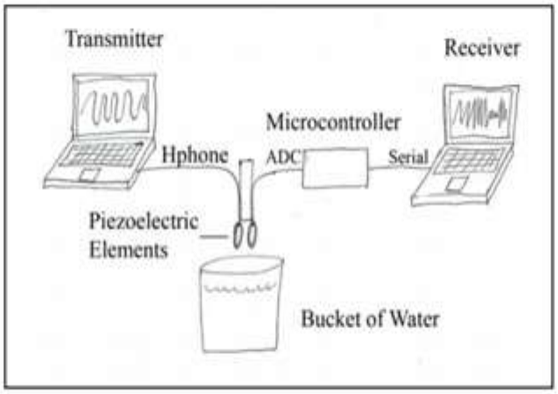

Fig 4. Functional Block Diagram for UWSN Transceiver

Operating Principle:

5 Power Control The modem operates from a single 5 volt supply. The choice of supply voltage is driven by the dual gate FETs used in the wakeup receiver. These are operated from a 12 volt supply in their intended application. We have been able to use them successfully at 5 volts but the gate threshold voltages of the transistors make 3 volt operation impractical. There is no technical reason that prevents one from building transistors with reduced threshold voltages, but the market demand is too small at the present time to interest semiconductor manufacturers. While the modem is basically a 5 volt design we need to interface with microcontrollers such as the Mica2 mote. The mote nominally operates on 3 volts. The precise operating voltage of the mote is rather unpredictable, as it runs directly from a battery, without any form of voltage regulation. So the actual battery voltage depends on the charge/discharge state of the battery. The modem design includes two features to allow interfacing to any voltage level from 2.8 to 5 volts. Digital input and outputs are tied through a Texas Instruments SN74TVC3010 voltage clamp which limits all digital output signals to the microcontroller supply voltage. The modem also includes a voltage regulator which is referenced to the microcontroller supply voltage. This regulator drops 5 volts down to the microcontroller voltage, and is used to power all of the analog output circuitry of the modem. This ensures that the analog outputs will never exceed the microcontroller supply voltage.

We first describe the control and data interfaces between the microcontroller and the modem. We promote simplicity in the interfaces, which uses a minimal set of I/O pins. The control interface includes state control, transmission power control and a wakeup signal. The data interface includes digital data output, both digital and analog data input, and the received signal strength (RSSI) measurement. Our initial prototype directly connects the modem to a Mica2 mote through an interface card. The Mica2 mote has an Atmel Atmega128L microcontroller running at 7.3MHz. We provide individual power control over the transmitter, the wakeup receiver and the data receiver. Each of them can be powered on or off, which forms 7 valid states, as listed in Table 1. These states are controlled by three output pins, each specifying receive/transmit mode, data channel powered on/off, and wakeup channel powered on/off. Data and wakeup tones cannot be transmitted at the same time, because they share the same transmitter. For simplicity we currently support four discrete power levels for transmission from 15dBm to 33dBm at a 6dBm step. The wakeup receiver is dedicated to detecting incoming wakeup tones. The microcontroller can be put into sleep while leaving the wakeup receiver on. When a tone is detected the wakeup receiver will generate an interrupt, activating the microcontroller, which then will turn on the data receiver. The wakeup receiver and the data receiver can be turned on at the same time. However, in our current design, the wakeup channel and data channel are not independent. When there are signals in both channels, they may interfere with each other.

V. RESULTS AND DISCUSSION

In this paper, we have proposed a system in which oceanographers body temperature, heart rate, body movements and results that are being monitored by the system. The various sensors are placed on the oceanographers body and they take the readings and send the corresponding signal to the PIC microcontroller. The Here, various sensors are used to measure the patient’s body temperature, heart rate, and their respective results are sent to the water medium via water data transceiver and can be monitored from above water surface through the

UWSN receiver facilitated via UART communication. The experimental setup is shown in figure 5.

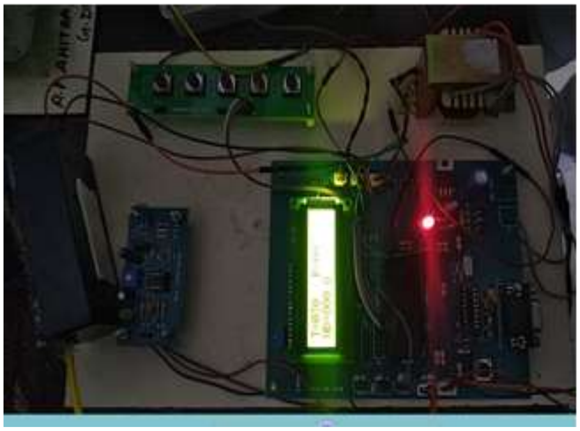

Fig 5: Experimental Setup Transmitter side

Fig 6: Underwater Communication Setup

VI. CONCLUSION

High-speed underwater optical communication has now become an enabling technology that has many prospective employments in a range of environments from the deep sea to coastal waters. In this paper, we have presented and proved the prototype for an automatic system that guarantees a constant monitoring of oceanographers health parameters and prediction of any kind of disease or disorder that prevents the oceanographers from the emergency situation. The proposed system can be set-up in the boats or ships and massive amount of data can be obtained and tested with many peoples. Even the results can be made to be accessed from mobile through an application. The system can be further improved further by adding artificial intelligence system components to facilitate the doctors and the patients. The data, consisting medical history of many patients' parameters and corresponding results, can be explored using data mining, in search of consistent patterns and systematic relationships in the disease.

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