International Journal of Research
Available at https://edupediapublications.org/journals
e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 04 Issue 10
September 2017

A Review On Gps And Bluetooth Based Underwater Positioning System

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ABSTRACT: *This project mainly used to monitoring the positioning system based on surface nodes equipped with GPS and acoustic transducers Additionally we are adding obstacle sensors, mems sensors are adding easy to mount, since they can be placed in the hull of a ship or in the vehicle. If any critical condition occurs then alarm will on and inform the people. The Bluetooh protocol is used as the communication medium between the transmitter and receiving base station. Here in this project the receiving base station which consist of mobile phone. Inside the mobile phone android application. One of the main advantage by using Bluetooth is the communication path which is wide by using this method more detailed information could be obtained from the structural behaviour as well as the actual condition of the building structure. This will enable engineers use more precisely information for the structure analysis and repair as well as life time prediction.The main aim of this project is to underwater vehicle's damage and also we can get structural behaviour as well as the actual condition of the underwater position. If any critical condition that occurring the ship or in the vehicle. In this project work detailed study of installing various equipments, sensoring the information and which helps to minimise the damages for huge structures and loss human lives.*

In this project ARM LPC2148 communicates with LCD,sensors and GPS modem.In the Sensor section it has Mems, obstacle sensor are continuously monitoring on lcd. If the value gets abnormal it will send the data to the particular mobile phone by using Bluetooth module and buzzer will be on.

I. INTRODUCTION

THE precise location of underwater nodes remains an active research topic in the underwater community. To obtain the position of a submerged node is crucial in different applications, such as underwater sensor networks where the recorded data must be attached to a specific location, and the navigation of autonomous underwater vehicles (AUVs) and remotely operated vehicles (ROVs). Whereas obtaining the location of a vehicle at the sea surface can be achieved by means of the GPS [1], this technology cannot be used underwater due to the high attenuation of the electromagnetic waves in this medium. Close to the sea bottom, localization can be achieved by using different alternatives, such as Doppler velocity log (DVL) or simultaneous localization and mapping [2], [3]. Apart from deploying artificial landmarks, these systems usually do not need any external sensors in the environment to operate, what makes them more convenient than other systems that need certain infrastructure deployed in the ocean. On the other hand, the vehicle needs to be close to the bottom to locate itself, and this imposes an important restriction. This way, localization in the middle of the water column remains a challenging issue. A common approach is to use dead-reckoning systems to navigate below the sea surface, using a DVL as an acoustic Doppler current profiler or other inertial navigation sensors (INSs) to obtain the vehicle speed [4]. These systems can easily obtain their measures in the environment, but their errors are unbounded, unless some corrections are performed regularly [5]. Acoustic positioning systems are a practical solution to obtain the location in the middle of the water column, being an important part of most underwater navigation systems. They are traditionally classified in long baseline (LBL), short baseline (SBL), and ultra-SBL (USBL), depending on the distance between the different acoustic beacons. In LBL systems, the acoustic beacons are commonly separated between several hundred meters and a few kilometers. They measure the timesof-flight (TOFs) between the beacons and the submerged vehicle by means of sharing a common clock or by time stamps using underwater acoustic modems [6], [7]; alternatively, they can measure the time difference of arrival (TDoA) from the different beacons in the nonsynchronized systems [8]. This last scheme is also known as silent positioning, since the node to be located does not need to send any acoustic signal through the underwater channel, which allows to save energy in the vehicle. However, the location of the vehicle remains unknown for the crew. LBL systems provide good accuracy, but their deployment is costly, since the beacons need an absolute position, which was commonly obtained by anchoring the beacons to the sea bottom, and a calibration stage [9]. A more recent alternative to this configuration is the use of buoys equipped with GPS and acoustic transducers, which allows an easier deployment of the positioning system [10]. With regard to SBL and USBL systems, the distance between the acoustic beacons in SBL is usually around tens of meters, whereas in USBL systems is around tens of centimeters. These systems are easy to mount, since they can be placed in the hull of a ship or in the vehicle, but the ship and the vehicle need to be close to avoid geometric configuration problems related to the dilution of precision (DOP), so they are not suited for long-range missions. In addition, they need external sensors, such as a vertical reference unit and a heading reference unit to obtain the absolute position. Each technique has its own problems and benefits, so a common approach nowadays is to use the sensor fusion of different technologies in the same system . As they take an advantage of different localization techniques, these systems are more robust and offer a higher applicability. On the other hand, they are also usually more expensive and complex, as they consist of more sensors and navigation filters. Using this approach, in underwater environments, the vehicle usually rely on dead reckoning to navigate, and the errors in the estimated position are minimized by means of a positioning fix that can be obtained either by:1) making the vehicle surface periodically; 2) using an acoustic positioning system [4]; and 3) combining different sensors [3]. Although there are several alternatives available for underwater acoustic positioning systems, the study of the performance of such systems under different realistic conditions in the underwater environments is not commonly conducted. The evaluation of how different phenomena would affect the system could provide valuable information about the system performance prior to its deployment, what could save time and reduce costs. Whereas performing intensive field trials can be unfeasible to assess the performance under different environmental conditions, statistical studies using the synthetic signals allow such conditions to be adjusted for the expected values at the mission location, so these studies can provide insight to the expected performance. This way, in the last years, this kind of studies has been gaining more attention. The influence of the initial position error of each vehicle, node drift, and Gaussian errors in the INS sensors and acoustic ranges is considered. Gaussian errors in range estimations and heading measurements are considered. In the LBL system described, the errors in the transducers position, TOF, and sound speed measurements are considered. However, when studying the errors in range measurements, none of the previous systems considered the use of the directsequence spread spectrum techniques (DSSSs). In the rangebased positioning systems, pseudorandom noise signals can be used to obtain a good estimation of the TOF between the different nodes. Robustness against noise is also achieved, as well as some multipath resilience and multiuser capabilities. In addition, it has been shown that the DSSS techniques provide better performance in the range-based positioning systems than the classical approaches using tone or chirp signals . There are a few works that consider errors using DSSS techniques, and they mainly focus on the signal detection in environments with Gaussian noise. In the influence of Gaussian noise on the detection of Barker codes to calculate the TOF was considered for a USBL system; Watanabe et al. evaluated the effect of Gaussian noise and multipath in the performance of two different algorithms that try to find the direction of arrival of 255-b m-sequences in a USBL system. The main objective of this paper is the characterization of the performance of an underwater acoustic positioning system using DSSS signals by means of a statistical study. Different positioning algorithms have been evaluated. This paper considers the effect of the geometrical distribution of nodes, as well as the effect of underwater channel phenomena in the TOF estimation using DSSS signals. The positioning system that has been considered consists of different beacons equipped with GPS and acoustic transducers, which is a more versatile alternative than the traditional LBL systems. An underwater vehicle with unknown location equipped with an acoustic transducer is moving in the vicinity of the beacons. In this paper, the location of the underwater vehicle is calculated in one of the beacons (master node), which would typically be the ship where the crew is.

II. LITERATURE REVIEW

An underwater acoustic positioning system is a system for the tracking and navigation of underwater vehicles or divers by means of acoustic distance and/or direction measurements, and subsequent position triangulation. Underwater acoustic positioning systems are commonly used in a wide variety of underwater work, including oil and gas exploration, ocean sciences, salvage operations, marine archaeology, law enforcement and military activities. The precise location of underwater nodes remains an active research topic in the underwater community. To obtain the position of a submerged node is crucial in different applications, such as underwater sensor networks, where the recorded data must be attached to a specific location, and the navigation of autonomous underwater vehicles (AUVs) and remotely operated vehicles (ROVs). Whereas obtaining the location of a vehicle at the sea surface can be achieved by means of the GPS , this technology cannot be used underwater due to the high attenuation of the electromagnetic waves in this medium. Close to the sea bottom, localization can be achieved by using different alternatives, such as Doppler velocity log (DVL) or simultaneous localization and mapping . Apart from deploying artificial landmarks, these systems usually do not need any external sensors in the environment to operate, what makes them more convenient than other systems that need certain infrastructure deployed in the ocean. On the other hand, the vehicle needs to be close to the bottom to locate itself, and this imposes an important restriction. The last decade has witnessed the emergence of Ocean Robotics as a major field of research. Remotely Operated Vehicles (ROVs) and, more recently, Autonomous Underwater Vehicles (AUVs) have shown to be extremely important instruments in the study and exploration of the oceans. Free from the constraints of an umbilical cable, AUVs are steadily becoming the tool par excellence to acquire marine data on an unprecedented scale and, in the future, to carry out interventions in undersea structures. Central to the operation of these vehicles is the availability of accurate navigation and positioning systems. The first provide measurements of the angular and linear positions of a vehicle.

III. DESIGN OF HARDWARE

This chapter briefly explains about the Hardware implementation of authentication of helmet & alcohol sensing for riders safety. It discuss the circuit diagram of each module in detail.

3.1 LPC2148 (ARM7) MICROCONTROLLER:

The LPC2148 microcontrollers are based on a 32 bit ARM7TDMI-S CPU with real-time emulation and embedded trace support, that combines the microcontroller with embedded high speed flash memory of 512 kB. For critical code size applications, the alternative 16-bit Thumb mode reduces the code by more than 30 % with minimal performance penalty.

Due to their tiny size and low power consumption, LPC2148 microcontrollers are ideal for the applications where miniaturization is a key requirement, such as access control and point-of-sale. A blend of serial communications interfaces ranging from a USB 2.0 Full Speed device, multiple UARTS, SPI, SSP to I2Cs and on-chip SRAM of 8 kB up to 40 kB, make these devices very well suited for communication gateways and protocol converters, soft modems, voice recognition and low end imaging, providing both large buffer size and high processing power. Various 32-bit timers, single or dual 10-bit ADC(s), 10-bit DAC, PWM channels and 45 fast GPIO lines with up to nine edge or level sensitive external interrupt pins make these microcontrollers particularly suitable for industrial control and medical systems.

3.2 RS232 CABLE:

To allow compatibility among data communication equipment, an interfacing standard called RS232 is used. Since the standard was set long before the advent of the TTL logic family, its input and output voltage levels are not TTL compatible. For this reason, to connect any RS232 to a microcontroller system, voltage converters such as MAX232 are used to convert the TTL logic levels to the RS232 voltage levels and vice versa.

3.2.1. MAX232 IC:

Max232 IC is a specialized circuit which makes standard voltages as required by RS232 standards. This IC provides best noise rejection and very reliable against discharges and short circuits. MAX232 IC chips are commonly referred to as line drivers.

To ensure data transfer between PC and microcontroller, the baud rate and voltage levels of Microcontroller and PC should be the same. The voltage levels of microcontroller are logic1 and logic 0 i.e., logic 1 is +5V and logic 0 is 0V. But for PC, RS232 voltage levels are considered and they are: logic 1 is taken as -3V to -25V and logic 0 as +3V to +25V. So, in order to equal these voltage levels, MAX232 IC is used. Thus this IC converts RS232 voltage levels to microcontroller voltage levels and vice versa.

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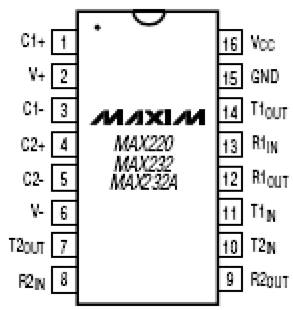

Fig:1 Pin diagram of MAX232 IC

3.3. POWER SUPPLY:

The power supplies are designed to convert high voltage AC mains electricity to a suitable low voltage supply for electronic circuits and other devices. A power supply can by broken down into a series of blocks, each of which performs a particular function. A d.c power supply which maintains the output voltage constant irrespective of a.c mains fluctuations or load variations is known as "Regulated D.C Power Supply".

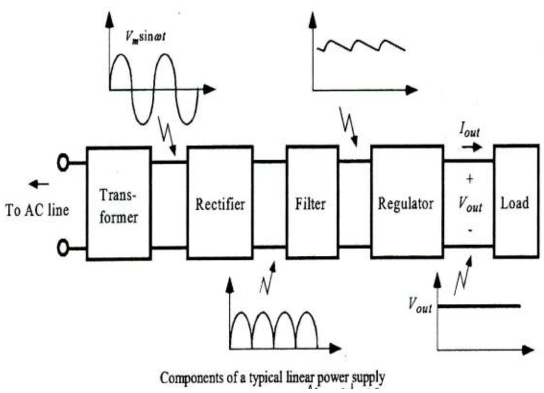

Fig:2 Block Diagram of Power Supply

3.4. IR SENSOR:

Infrared is a energy radiation with a frequency below our eyes sensitivity, so we cannot see it Even that we can not "see" sound frequencies, we know that it exist, we can listen them.

Even that we can not see or hear infrared, we can feel it at our skin temperature sensors. When you approach your hand to fire or warm element, you will "feel" the heat, but you can't see it. You can see the fire because it emits other types of radiation, visible to your eyes, but it also emits lots of infrared that you can only feel in your skin.

Infra-Red is interesting, because it is easily generated and doesn't suffer electromagnetic interference, so it is nicely used to communication and control, but it is not perfect, some other light emissions could contains infrared as well, and that can interfere in this communication. The sun is an example, since it emits a wide spectrum or radiation.

The adventure of using lots of infra-red in TV/VCR remote controls and other applications, brought infra-red diodes (emitter and receivers) at very low cost at the market.

From now on you should think as infrared as just a "red" light. This light can means something to the receiver, the "on or off" radiation can transmit different meanings.Lots of things can generate infrared, anything that radiate heat do it, including out body, lamps, stove, oven, friction your hands together, even the hot water at the faucet.

To allow a good communication using infra-red, and avoid those "fake" signals, it is imperative to use a "key" that can tell the receiver what is the real data transmitted and what is fake. As an analogy, looking eye naked to the night sky you can see hundreds of stars, but you can spot easily a far away airplane just by its flashing strobe light. That strobe light is the "key", the "coding" element that alerts us.

Similar to the airplane at the night sky, our TV room may have hundreds of tinny IR sources, our body, the lamps around, even the hot cup of tea. A way to avoid all those other sources, is generating a key, like the flashing airplane. So, remote controls use to pulsate its infrared in a certain frequency. The IR receiver module at the TV, VCR or stereo "tunes" to this certain frequency and ignores all other IR received. The best frequency for the job is between 30 and 60kHz, the most used is around 36kHz

3.5 LCD:

A model described here is for its low price and great possibilities most frequently used in practice. It is based on the HD44780 microcontroller (Hitachi) and can display messages in two lines with 16 characters each. It displays all the alphabets, Greek letters, punctuation marks, mathematical symbols etc. In addition, it is possible to display symbols that user makes up on its own. Automatic shifting message on display (shift left and right), appearance of the pointer, backlight etc. are considered as useful characteristics.

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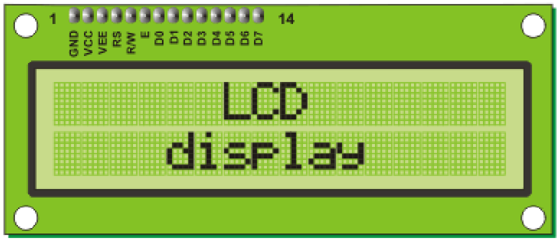

Fig: 3. LCD

3.6 BLUETOOTH:

Bluetooth is a wireless technology standard for exchanging data over short distances (using short-wavelength UHF radio waves in the ISM band from 2.4 to 2.485 GHz) from fixed and mobile devices, and building personal area networks (PANs). Invented by telecom vendor Ericsson in 1994, it was originally conceived as a wireless alternative to RS-232 data cables.

Bluetooth is managed by the Bluetooth Special Interest Group (SIG), which has more than 30,000 member companies in the areas of telecommunication, computing, networking, and consumer electronics. The IEEE standardized Bluetooth as IEEE 802.15.1, but no longer maintains the standard. The Bluetooth SIG oversees development of the specification, manages the qualification program, and protects the trademarks. A manufacturer must meet Bluetooth SIG standards to market it as a Bluetooth device. A network of patents apply to the technology, which are licensed to individual qualifying devices.

Bluetooth operates at frequencies between 2402 and 2480 MHz, or 2400 and 2483.5 MHz including guard bands 2 MHz wide at the bottom end and 3.5 MHz wide at the top. This is in the globally unlicensed (but not unregulated) Industrial, Scientific and Medical (ISM) 2.4 GHz short-range radio frequency band. Bluetooth uses a radio technology called frequency-hopping spread spectrum. Bluetooth divides transmitted data into packets, and transmits each packet on one of 79 designated Bluetooth channels. Each channel has a bandwidth of 1 MHz. It usually performs 800 hops per second, with Adaptive Frequency-Hopping (AFH) enabled.[15] Bluetooth low energy uses 2 MHz spacing, which accommodates 40 channels.

Originally, Gaussian frequency-shift keying (GFSK) modulation was the only modulation scheme available. Since the introduction of Bluetooth 2.0+EDR, π/4-DQPSK (Differential Quadrature Phase Shift Keying) and 8DPSK modulation may also be used between compatible devices. Devices functioning with GFSK are said to be operating in basic rate (BR) mode where an instantaneous data rate of 1 Mbit/s is possible. The term Enhanced Data Rate (EDR) is used to describe π/4-DPSK and 8DPSK schemes, each giving 2 and 3 Mbit/s respectively. The combination of these (BR and EDR) modes in Bluetooth radio technology is classified as a "BR/EDR radio".

Bluetooth is a packet-based protocol with a master-slave structure. One master may communicate with up to seven slaves in a piconet. All devices share the master's clock. Packet exchange is based on the basic clock, defined by the master, which ticks at 312.5 µs intervals. Two clock ticks make up a slot of 625 µs, and two slots make up a slot pair of 1250 µs. In the simple case of single-slot packets the master transmits in even slots and receives in odd slots. The slave, conversely, receives in even slots and transmits in odd slots. Packets may be 1, 3 or 5 slots long, but in all cases the master's transmission begins in even slots and the slave's in odd slots.

Bluetooth is a standard wire-replacement communications protocol primarily designed for low-power consumption, with a short range based on low-cost transceiver microchips in each device. Because the devices use a radio (broadcast) communications system, they do not have to be in visual line of sight of each other; however, a *quasi optical* wireless path must be viable. Range is power-class-dependent, but effective ranges vary in practice. See the table on the right.Officially Class 3 radios have a range of up to 1 metre (3 ft), Class 2, most commonly found in mobile devices, 10 metres (33 ft), and Class 1, primarily for industrial use cases,100 metres (300 ft).[3] Bluetooth Marketing qualifies that Class 1 range is in most cases 20–30 metres (66–98 ft), and Class 2 range 5–10 metres (16–33 ft).

IV. WORKING:

This paper presents a characterization of an underwater positioning system based on surface nodes equipped with GPS and acoustic transducers. The positioning system calculates the coordinates of an underwater vehicle in one of the surface nodes or beacons, by the emission, detection, and reply of acoustic encoded signals. The characterization of the system has been performed by means of a statistical study, considering different numbers of beacons, beacons' position and physical phenomena, such as

e-ISSN: 2348-6848
p-ISSN: 2348-795X
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noise, multipath, and Doppler spread.The error propagation caused by these phenomena and the geometrical configuration of the system has been quantitatively assessed in different positioning algorithms, based on trilateration and iterative procedures. The results show how the different phenomena affect the vehicle estimated position errors for the different positioning algorithms. In addition, the obtained errors inside the projected area of the beacons are ~1 m or lower,rising to a few meters for the worst case scenario, showing thefeasibility of the acoustic positioning system.

This project mainly used to monitoring the positioning system based on surface nodes equipped with GPS and acoustic transducers Additionally we are adding obstacle sensors, mems sensors are adding easy to mount, since they can be placed in the hull of a ship or in the vehicle. If any critical condition occurs then alarm will on and inform the people. The Bluetooh protocol is used as the communication medium between the transmitter and receiving base station. Here in this project the receiving base station which consist of mobile phone. Inside the mobile phone android application. One of the main advantage by using Bluetooth is the communication path which is wide by using this method more detailed information could be obtained from the structural behaviour as well as the actual condition of the building structure. This will enable engineers use more precisely information for the structure analysis and repair as well as life time prediction.The main aim of this project is to underwater vehicle's damage and also we can get structural behaviour as well as the actual condition of the underwater position. If any critical condition that occurring the ship or in the vehicle. In this project work detailed study of installing various equipments, sensoring the information and which helps to minimise the damages for huge structures and loss human lives.

In this project ARM LPC2148 communicates with LCD,sensors and GPS modem.In the Sensor section it has Mems, obstacle sensor are continuously monitoring on lcd. If the value gets abnormal it will send the data to the particular mobile phone by using Bluetooth module and buzzer will be on.

4.1Block Diagram

Sensor Section:

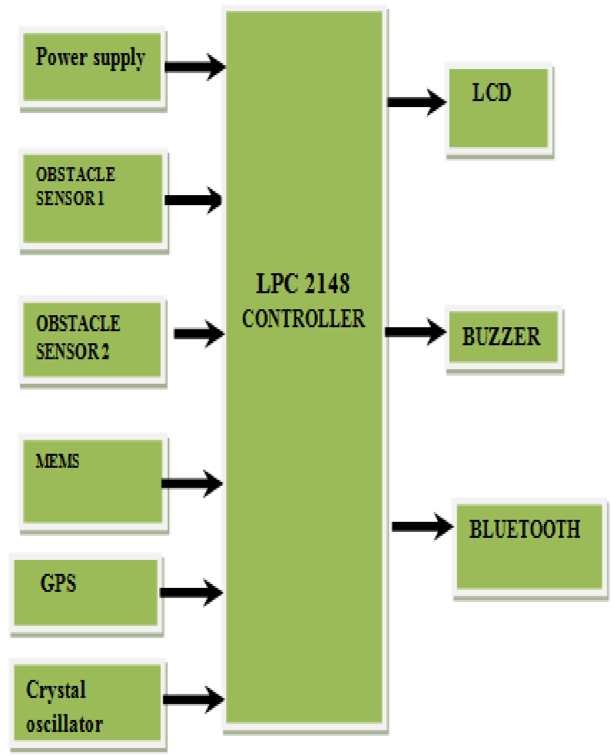

Fig 4 block diagram

Mobile Section:

Hardware Requirements

- LPC2148 BASED OUR OWN DEVELOPED BOARD
- POWER SUPPLY
- Obstacle sensors
- Mems sensors
- Bluetooth module
- Max232
- LCD
- Buzzer
-

Software Requirements

- EMBEDDED 'C'
- KEIL TO WRITE CODE
- LPC2100 FLASH UTILITY TO BURN THE CHIP

Advantages

- Remote monitoring is possible from anywhere in the field.
- Continuous surveillance is done through monitoring section.

Applications

- It can be implemented in Paddy fields and environmental conditions,hospitals.

V.CONCLUSION

In this paper, an underwater positioning system based on beacons equipped with GPS and acoustic transducers has been characterized for different measurement errors related to environmental conditions and geometrical configurations. This system uses Kasami codes to improve the detection of the acoustic signals, obtaining a better estimation of the distances between the nodes, process gain against noise and allowing for multiuser capabilities. Considering the measurement process of the system, any additional underwater vehicle in the environment only requires a different code to be identified and located. The vehicles would respond to the same code emitted by the ship, and taking an advantage of good cross-correlation properties of certain coding schemes, such as Kasami codes, no time guard protocol is needed, and the same measurement cycle and positioning algorithms can be used. This way, the number of underwater vehicles located by the positioning system could be easily increased, at an expense of slightly increasing the computational time in the ship. The codes used by the underwater vehicles should be known by the beacons and the ship, so they can distinguish from which one the received signal is coming, in order to calculate their position. Other considerations were made in the description of the system in Section II-A. One requirement to operate correctly is the successful communication protocols, both at the sea surface using the radio frequency link, and underwater using acoustics. The design of these protocols is out of the scope of this paper, but it should be noted that the collisions in the radio frequency communication does not seem important, as the propagation speed is that of speed of light, and the same information can be sent again with no remarkable delay. On the contrary, missing an underwater data packet is more important, considering the propagation time in this channel. This loss of the underwater data can be caused by several factors, such as the vehicle being located in a region with poor communication coverage due to underwater acoustic propagation features, high noise levels, or the near-far effect caused by the detection of the more energetic response as the valid one for the others vehicles, if considering several ones. One way to mitigate these effects would be a gain control for the emitted signals and a Kalman filter to obtain robustness again outliers and missing data.

VI.FUTURE WORK

As a future work, larger environments and underwater vehicle's depths could be considered, evaluating then the performance of the initial position of the Gauss–Newton algorithm and larger sound speed uncertainties. In addition, the effect of depth measurement errors and beacons drift in one measurement cycle should be considered in these larger environments. Integrating the acoustic positioning system with an INS into a navigation system using a Kalman filter would allow to evaluate how the system would respond to not successful communications and outliers.

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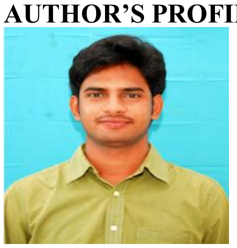

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