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A NOVEL APPROACH TO BUILD A LOW COST ARCHITECTURE FOR OFF THE SHELF TARGET TRACKING USING WIRELESS COMMUNICATION

W. Sai Raghavendran, Sure Venkatapathi Raju and K. Srilatha
Department of Electronics and Communication, Sathyabama University, Chennai, India
E-Mail: srilatha169@gmail.com

ABSTRACT

Now a day's border security that incorporate social, cultural, behavioural and organizational aspects of interactions among border security forces and smugglers. The integrated technology architectures made up of fixed mobile sensor and surveillance networks. These tools plays important role in border security operations, planning, analysis and training. Sensors are being used to improve border security and also collecting the large number of data and databases. These sensors can improve variety of problems, sometimes reacting to events and sometimes triggered by random events which are called false alarms. The aim of this proposed work is to enhance the ideas in a sensor network framework that can help to increase the security for the border crossing. In the proposed system provides security to the boat using GPS tracking and objects. Indian government is planning to introduce the new technology for tracking with in the border which carry illegal things (like government issued sugar, rice distribution without legal permission). The explosive materials for industrial purposes can be tracked by various wireless sensor networks.

Keywords: wireless integrated network sensors, embedded systems hardware-software code sign, localization, tracking, microcontrollers.

INTRODUCTION

Now-a-days network localization is the main challenging part in wireless communication systems, using the new technique known for beam forming we can reduce the cost of target tracking but this cannot be implemented in the real time technique which uses single antenna instead of multiple antennas, technique of using multiple antennas is used for space diversity in wireless communication [1], the use of beam forming focus the antenna beam in certain direction by increasing the signal strength seen in that direction and potentially decreasing the interferences coming from other directions, the traditional way of getting beam-steering is with radiofrequency shifters, but in this paper we used various wireless sensor to increase the accuracy and security of the of the border crossing using low cost architecture that includes various sensors, security includes missile detection, illegal border crossing and all ship securities. Tingting Zhang [1] For many wireless applications suitable and accurate position estimation of agent nodes is essential in range -based localization, these techniques system accuracy and energy capacity are affected by both transmit power and signal, in this papers the author have researched about the resource(power and bandwidth) allocation problem in wireless localization system They formulated to optical JPBA (joint power and bandwidth allocation) problems to maximize the localization accuracy and to minimize power consumption during localization, There are generally two kinds of nodes in location-aware networks Depending upon the positioning technique, the angle of arrival (AOA), the received signal strength (RSS) can be used to determine the location of a node [1]. Some work has been carried out using power allocation optimization in wireless localization networks We have proposed an optimal JPBA (joint power and

bandwidth allocation) formulation for cooperative localization network [1] Yuan Shen [2] Network localization object is essential for many location based applications in commercial , military and social sectors[1], the author establish a unifying optimization frame work for power allocation in both active and passive localization network, it has two categories range based ,range free technique it can locate object using distance/ angle ,measurements and later using connectivity or finger print information, localization is the major problem in wireless communication and WSN(wireless sensor network) [1], Compared to range-free ones, range-based techniques are more suited and hence widely used for high-accuracy localization rather than hardware complexity
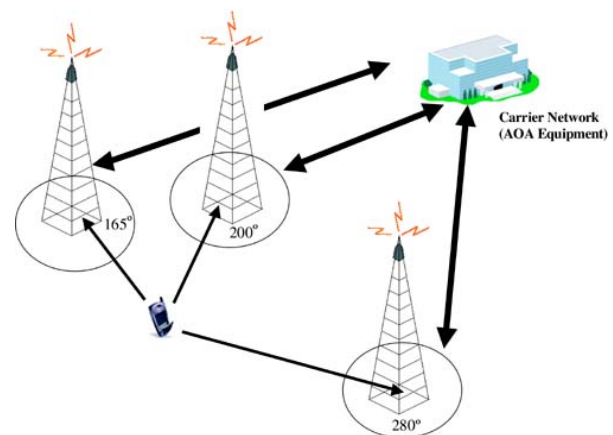

Figure-1. Angle of arrival.

The main task of power allocation for network localization is to obtain the optimal trade-offs between localization accuracy and energy consumption. This task

can be commonly implemented using optimization methods, which have to give an importance in maximizing communication and networking performance under limited resources. To solve these problems we require the know the concepts of network parameters, which in practice are subject to uncertainty.
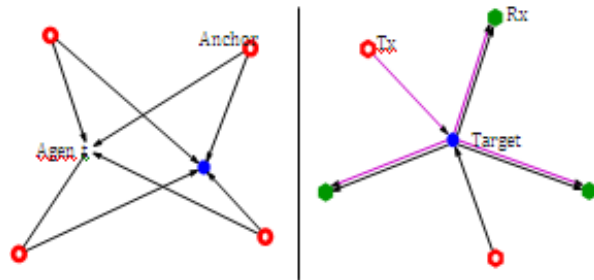

Figure-2. (a) Wireless localization (b) Radar Networ localization.

William Wei-Liang Li [3] in this paper the author presented an optimization framework for robust power allocation in network localization [2] [3]. It is based on the performance SPEB (square position error bound) and MDPEB (maximum directional position error band). He first showed optimal power allocation with perfect network parameters that can be efficiently obtained from conic programing and proposed robust power allocation scheme for robust power allocation the author designed an efficient algorithm that allows distributed computations among agents. Positional information is of main importance for future generation wireless networks, applications are cellular positioning, search and rescue work, blue-force tracking, localization accuracy is a critical performance measure of wireless location-aware networks, the properties wide band localization have derived in the form of the squared position error bound (SPEB) and directional position error bound (DPEB).
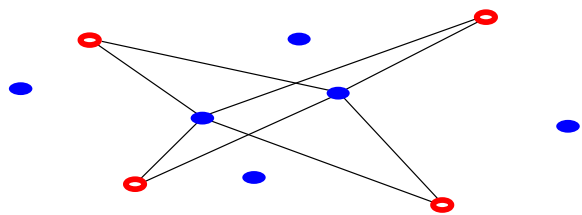
Figure-3. Location-aware networks: the anchors (red dots) localize the agents and (blue dot) based on inter-node range measurements.

Power allocation for wireless network localization plays a main role in reducing errors in localization or energy consumption, when the nodes are implied with limited power resources or quality-of service (QOS) [3] Shibu, Gowthami [4]. In this paper author discusses about border alert using WINS technology which gives an high security for the boat an stops all unknown illegal crossings Wireless Integrated Network Sensors (WINS) is used for monitoring and control capability using this we can easily identify a illegal things done by the strangers, The border area is divided into various number of nodes. Each node will be in contact with each other and finally all nodes are in contact with the main node. WINS provide a new monitoring technique and control capability for border of country, WINS low power so it is very cheaper than other security system like Radar, and also takes less delay to detect the target. As it uses very low power consumption it has low cost effectiveness.
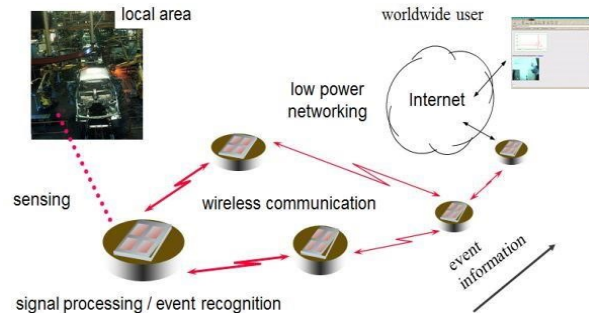
Figure-4. Wireless integrated network sensors.

In this proposed method, various sensors to calculate the accurate localization finding and various security sensors are used to have security while border crossing, the MEMS sensors used to find the boat tilt positions in x ,y and z directions, it is an analog device so we need an ADC to covert it from analog signal to digital signal but we are using Arduino Uno which has inbuilt ADC in it, ultrasonic detected the incoming missile launch and defends it from crassing, ultrasonic is an digital device and having no need of ADC, some ultrasonic devices are analog in nature so in this case ADC is must to convert from analog to digital signal

Shibu et al [5] Here author discuss about target tracking of border crossing boat using ZigBee, ZigBee is an module which can transmit and receive data each other, it transfers date at a rate of 250kb/sec and secured by an 128 bit encryption methods to avoid unnecessary connection with other frequencies it is based on an IEEE 802.15 standard.
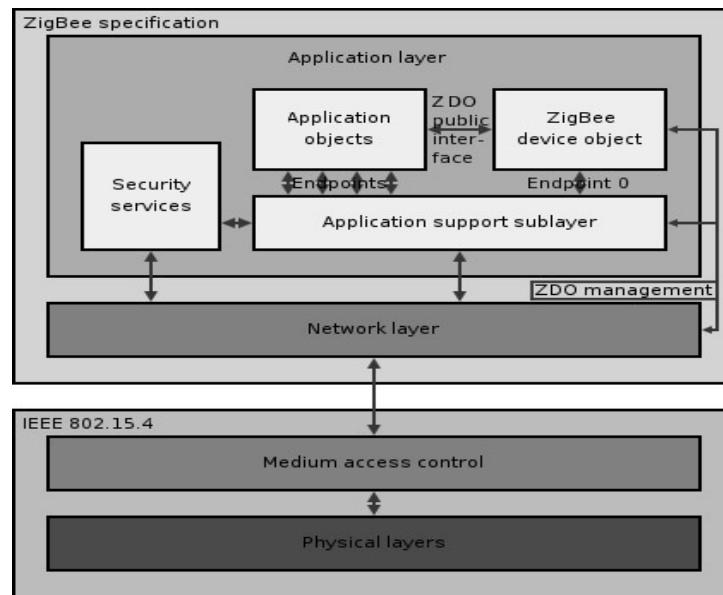
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Figure-5. ZigBee layers.

I. System analysis and process

A. Overview of existing system

In the existing system they used UAVs (Unmanned Aerial Vehicles) these looks like mini jet which can be operated using wireless control using human force, this UAVs have all types of sensors embedded in it can scan the area around it ,as this security is needed for the border crossing, as many of the illegal crossings were present, security is must in each and every border crossing ship, boat security is not only for the illegal crossing, it must have boat securities like, boat tilt, obstacle finder, vibrations in the sea, water pressure on boat etc. but all this type of boat crashing security is not present in the existing system, the key points about present UAVs are, these are very handled easily as it had a camera in front of the drone which can capture the picture of the enemies, these are communicated using RF signal(radio frequency signal) which is the very common signal used for communication, the frequency is 72 MHZ data link, Ground to aircraft (One-way flight controls) 5.8 GHZ video link, Aircraft to Ground(one-way) 72MHZ data link, ground to aircraft(two-way, autopilot and telemetry), which is operated with the wind speed of 18mph, these UAVs works under rechargeable batteries which gives an output power of 3Amp.

B. Disadvantages of existing system
- UAVs are more expensive

- Battery can be drained after some time that may more Chances of crashing is more

- Radio transmission can reveal operators where about and control stations, satellites and satellite ground segments which can be controlled by the enemies

- Finally, the Predator and UAVs, as of yet, are incapable of gathering evidence or further intelligence from the targets of its strikes. The Hellfire missile - originally designed to destroy enemy tanks and armoured vehicles

- This UAVs will have a chance of losing the control, this may lead to friendly file

- Many number of UAVs are not able to carry where ever they go as they are not so easy to carry

- More effectiveness should be there for firing the enemies as they should have more improved face recognitions

- The surveillance and intelligence to communicate with the operators is not so good

C. Future improvements
- These drones are improved with latest technology intelligence surveillances

- As these drones have more chances of crashing ,the hardware equipment and all the operations done by UAVs should be embedded in the boat itself

- These are equipped with rocket launchers and firing to defend the enemy lines

- The battery failure is the very important problem these drone operations are embedded in the boat itself where it gets continuous power supply

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D. Overview of proposed system

In proposed system the main future improvement that we have improved is cost reduction, continuous power supply by placing the equipment in the boat itself, and equipped with more intelligence and surveillance, with more security sensors. We have used many latest security sensors with are embedded into the boat, in the proposed system it can give security to the boat also to avoid crashing. New monitoring system for is introduced which will continuously monitors the ship conditions and sended to the base stations using radio frequency communication, the main security sensors used for the analysis of the boat is, *MEMS(*Micro-Electro-Mechanical Systems) it is used to monitor the position of the boat in x, y, z directions which helps the boat to avoid tiltations, the MEMS is a special type of module which can also track the above moving devices using this, now a days MEMS is used for only object tracking above it, but it can also find the tiltations in the boat, as the MEMS is an analog device it needs an ADC0808/0809A (analog to digital converter) to convert the analog signal to digital as the microcontroller does not understand the analog inputs, but we are using ARDUINO UNO we is a capable of reading the analog inputs, ARDUINO UNO is embedded with an in-build ADC, so there is no need of external ADC ULTRASONIC SENSOR (HC-SRO4) which is an analog device that uses electrical–mechanical energy to measure distance from the sensor to the target object. These waves are sent in the sequence of rarefactions and compressions along the forward direction of the wave propagation through the medium; it is operated with an input of 5V pulse Working Voltage DC 5V, Working Current is 15mA, Working Frequency 40Hz, Max Range 4m, Min Range 2cm, Measuring Angle 15 degree, Trigger Input Signal 10uS TTL pulse, Dimension 45*20*15mm.We need to supply 10uS of pulse to start trigger the range, the module will send out a 8 cycles with the rate of 40 KHz. The Echo are produced when the trigger signal strikes the object and the reflected signal is known to be echo The range is calculated through the time interval between the trigger signal and received
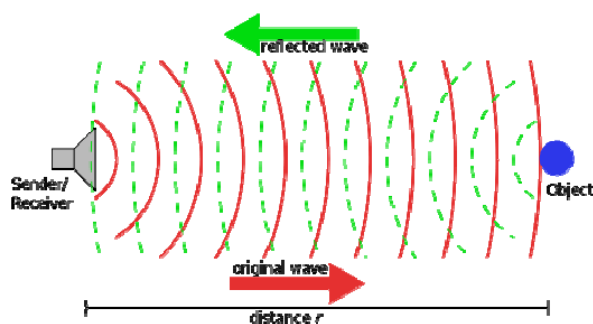
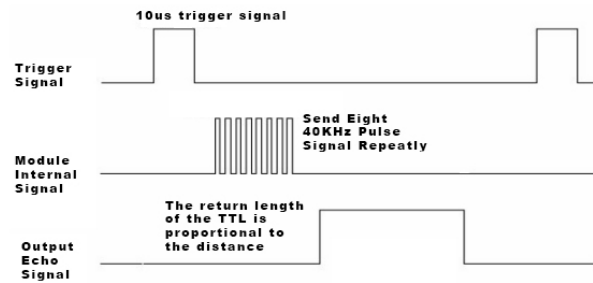

Figure-6. Ultrasonic waves 1.

Figure-7. Waveguides.

echo signal is given in the form of formula below

Formula: us / 58 = centimetres   (or)
uS / 148 =inch;

Range = high time level * velocity of (340M/S) / 2; as we are using over 60ms measurement cycle in order to prevent trigger signal loss. VIBRATIONSENSOR (SW-420 NC) works on electromechanical principle, vibration is directly proportional to Change in resistance and this change in resistance converted to 4-20mA.They're measuring differences in oscillation, so they probably want a -12 and +12 swing with 0 as the base linear ,we have used piezo electric to detect the vibrations ,this vibration sensor is used to detect the vibration in the boat, initially the value of the vibration is low (0) whenever more large amount of vibrations is detected the value goes to high (1)thus the microcontroller detects the value given as input to it and operated accordingly, VOICEBOARD is an voice recorder and playback module which can store up to 680sec of date into the microcontroller and played back again,APR33A3is an VOICEBOARD MODULE used for detecting the vibrations, this module can record voice for 680sec,it has an in built microphone which converts the recorded voice in to binary code and saved in to the flash memory of an micro-controller the operating voltage rage is about 3V~6.5V,which is compatible with any type of microcontroller

Localization plays a major role in location finding as every border crossing ship should have, so we are using location finding module know for GPS (global positioning system) LS20030~3 series products are complete GPS smart antenna receivers, these are embedded antenna and GPS receiver circuits, The GPS smart antenna will require an 66 satellites at a time while providing fast time-to-first-fix. Its capabilities meet the sensitivity requirements of car navigation and other location-based applications which were designed for a broad spectrum of OEM based system applications. This product is based on LOCOSYS 66 channel GPS SMD type receivers; MC-1513 uses MediaTek chip solution. It will provide the superior sensitivity and performance even in urban region and dense forest. PS continuously finds the ship location and sends to the base station using ZigBee module, PS is interface with RS232 serial communication port that is interface to any RS232 female pin jack, there are types of GPS modulesEM-506 uses 48 channels for

retrieving the location,LS20031 uses 60 channels with 5Hz band, GP-735 uses 56 channels,GP-20U7 also uses 56 channels,VENUS638FLPx uses 14 channels, GS-406 uses 50 channels, the accuracy of an GPS module can be decided with the no of channels and bandwidth

GPS-MT3333 usesMT3333 chipset from MediaTek. It has very sensitivity with excellent tracking capability even in dense forest. It is mostly use in GPS for military and ground based applications. This MT3333 has 66channels for GPS tracking. Output from GPS is given in the form of standard NMEA (national marine electronics association) format with a rate of 9600 bps. It has an LED indication to indicate GPS lock, which allows GPS module to quickly receive the location information on start-up. This module has UART serial communication to send and receive data from the host,
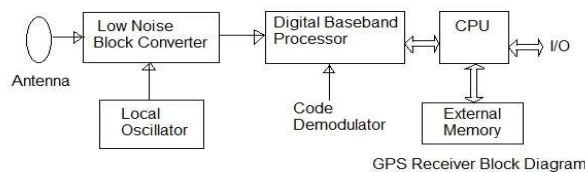
The block diagram of basic GPS module

Figure-8.

Antenna is connected to the low noise converter block which is having the local oscillator, digital baseband processor process the obtained data along with code demodulator, CPU plays a major role in controlling all the operations, every GPS receiver module has some amount of local in-built flash memory which is used to store the obtained data (longitude and latitude value) is stored onto the flash memory it is an volatile memory (temporarily) stored into it, processor is also a in built in microcontroller it has set of registers to perform operations and controlling operations of all types of sensors and modules, interrupts plays a major role in the microcontrollers, when an peripheral devices and external world devices, whenever the peripherals are connected it gives an request to the processor that request is known as the interrupt, interrupts may be external or internals that are worked accordingly with the type of interrupt ,every processor has set of flag registers to store the value set to do particular task by the processor

HARDWARE DESCRIPTION

In the block diagram various wireless sensor networks (WSN) they are, MEMS, VIBRATION-SENSOR (SW420NC), VOICEBOARD (APR33A3), ULTRASONIC SENSOR (HC-SRO4) these sensors are used for the security of the boat, like MEMS can identify the x, y, z positions of the boat, the output of the MEMS is in analog signal that is given to the ARDUINO UNO, this analog signal is directly understood by the ARDUINO UNO without any external use of ADC0808/0809, ULTRASONIC is used to find the obstacles, or any

missiles launched by the enemies, the module in the proposed method ULTRASONICSENSOR (HC-SRO4)
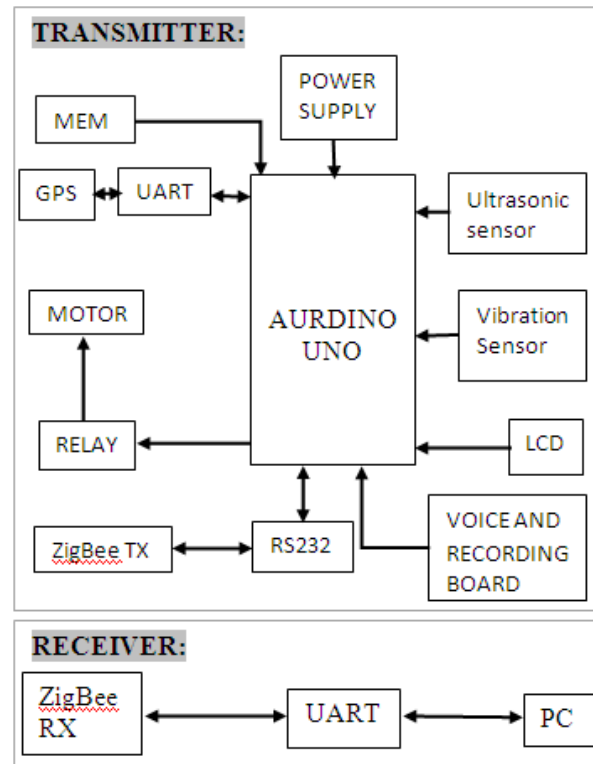

Figure-9. Target tracking architecture using Arduino.

In the above block diagram we have used various wireless sensor networks (WSN) they are, MEMS, VIBRATION-SENSOR (SW420NC), VOICEBOARD (APR33A3), ULTRASONIC SENSOR (HC-SRO4) these sensors are used for the security of the boat, like MEMS can identify the x, y, z positions of the boat, the output of the MEMS is in analog signal that is given to the ARDUINO UNO, this analog signal is directly understood by the ARDUINO UNO without any external use of ADC0808/0809, ULTRASONIC is used to find the obstacles, or any missiles launched by the enemies, the module is ULTRASONICSENSOR (HC-SRO4) which is operated with an input of 5V the output will be either high or low given to it, it is placed above the boat to get accurate values, this ULTRASONIC signals works on the principle of Ultrasonic waves are longitudinal mechanical waves which travel as a sequence of compressions and rarefactions along The direction of wave propagation medium, ultrasonic sensors are not only used for obstacle finding but also height .

In the proposed method VOICEBOARD boardAPR33A3.Which can record up to 680sec of voice. ARDUINOUNO. Is an microcontroller ,microcontroller in the sense minicomputer used to control and sense the operations done by the sensors and hardware modules, it has inbuilt memory and RAM, it is an open-source IDE to run the program can be downloaded for free. The Arduino

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programming language can be written in low level language and high level, The board features an Atmel ATmega328 microcontroller which is operated at 5 V, it has 2 Kb of RAM with 32 Kb of flash memory for storing programs The clock speed of the controller is 16 MHz and it has 1 Kb of EEPROM for storing parameters. Which can be executed about 300, 000 lines of C code per second. The controller has total of 28 pins in which 14 are digital I/O pins and 6 are analog input pins. There is a USB connector, which is used for flashing the source code into the microcontroller, Headers are used for interfacing to the I/O pins, All the operations are controlled by the ATmega328, when all the wireless sensor networks give an output high then microcontroller works according to that, and the output displayed on to the LCD and the information is sended to base station via ZigBee transmitter there is an another ZigBee receiver protocol available at the base station, so that the base station can analogize the obtained
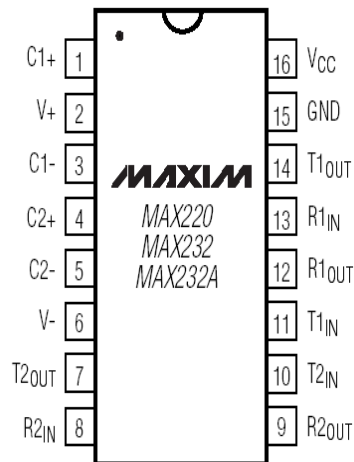

Figure-10. MAX232 1.

information's and gives the information about the border crossing limitations, MAX232 is an serial communication used for transmitting the data to the ZigBee transmitter and the receiver it is an 16 pin dip (dual inline package), A UART is usually an integrated circuit used for serial communications between two entity, likeperipheral device with serial port. UART is an (Universal Asynchronous Receiver and Transmitter) is used for serial communications between two entities. The UART transmitts the data in the form of bytes, and these are performed in the sequential mannar At the destination, a second UART re-assembles the bits into complete bytes. LCD here we used 2*16 LCD, that has 2 rows and 16 coloums and it has 8 data pins (D0-D7) with 3 controlling pins (RS, R/W, EN) regester select, Read write, enable these are the three controls, LCD is operated at 5v power supply and there are different aLCD also avilable in the market, here we used ZigBee transmitter and receiver to send the data to the base station but zigbee cannot be used in the real time environment, we have used ZigBee just to

transmitt the data, the range of the ZigBee is varied accordingly to the specification, when ever the sensors are high this data is sended to the base station using ZigBee transeiver, GPS (global positioning system) is an location finding module used to find coordinates of latitude and longitude, it is used to track the target with lat and log, now a days GPS is embedded in all mobile units and used for many applications, it uses 66channel to find the location, Output from GPS is given in the form of standard NMEA (national marine electronics association) format with a rate of 9600 bps. GPS receiver module has some amount of local in-built flash memory which is used to store the obtained data (longitude and latitude value) is stored onto the flash memory

RESULTS AND DISCUSSIONS

ARDUINO UNO is the microcontroller which controls all the operations of the sensors like, MEMS, Vibration Sensor, Ultrasonic Sensor, Voice Board etc.
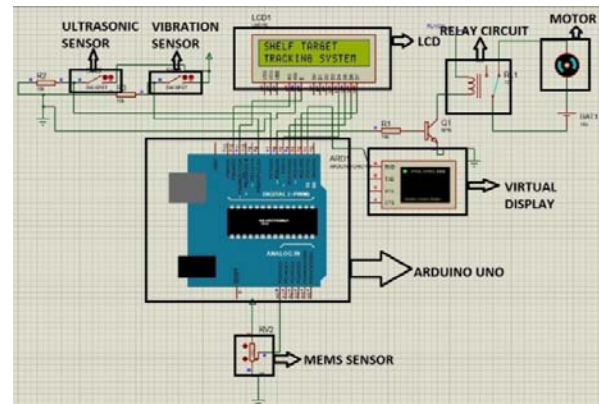

Figure-11. Hardware information.

Object detection

In the proposed work ultrasonic sensor used to detect objects, ultrasonics are digital output sensors that sends trigger signal to the forward direction whenever the trigger signal strikes the objects it reflects back to the ultrasonic in the form of echo's , the distance between the object an the ultrasonic is measured in centimetres.
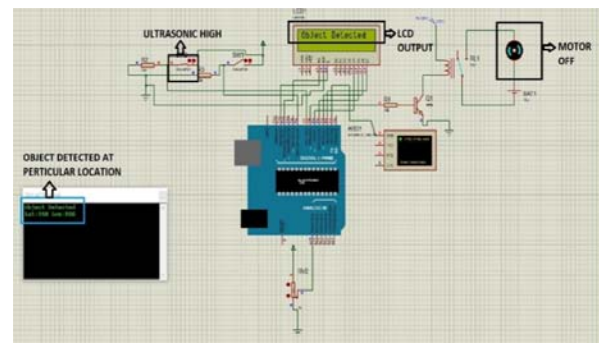

Figure-12. Object detection.

This value is received by the micro controller and stops the motor in the ships, this date is sended to the base station using wireless communication, this data is listened using voice board to alert the boat members.

Position changed

Position can be detected using the MEMS (micro electromachincal sensor) used to detect the X<Y<Z directions of the boat, whenever the value of the position in X<Y<Z is changed then microcontroller reads the values and sends the information to the base station, and also voice command is given to alert the boat members, when the position is changed motor off.
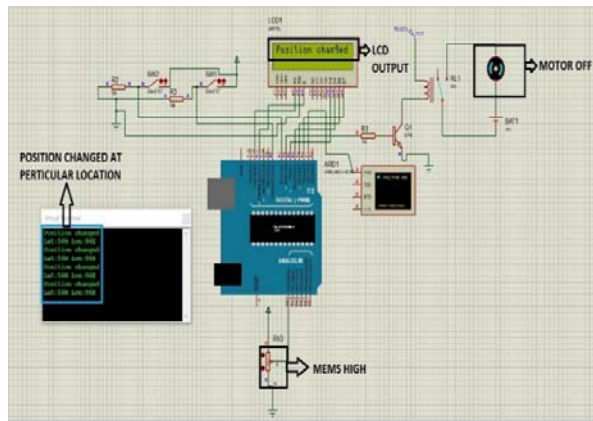

Figure-13. Position changed.

Vibration detected

Here we used vibration sensor to detect the vibrations to the boat that are caused by the huge waves, whenever the vibrations are detected, the value is sended to the microcontroller then the controller examines the input and sends to the base station, vibration detected command can be given using the voice board to alert the boat members, then controller off the motor.
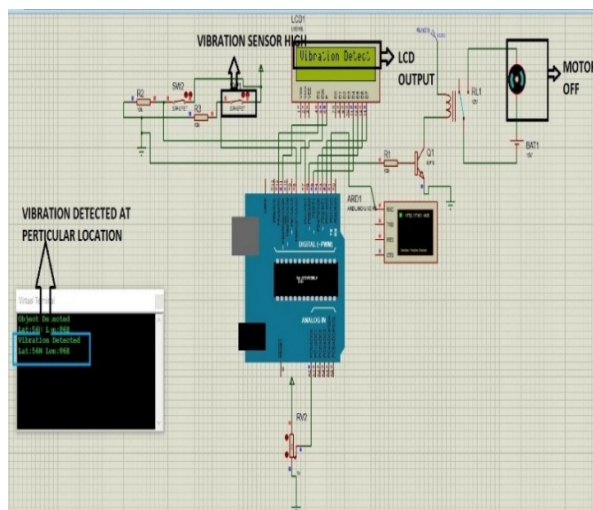

Figure-14. Vibration detected.

Various sensors are used in the above method MEMS, Vibration sensor, Ultrasonic sensor, these are detects individually and shown in the output of the LCD the detected output data is sended to the base station continuously through the ZigBee protocol.

Whenever interruption given by the any security sensor microcontroller gives acknowledgement to the particular sensor, then automatically switches off motor and gives command over the voice board.

Arduino has open-source IDE that can be downloaded for free. We have piezo electric sensor which detects the vibration created on the surface. We can also use shock sensor to detect vibrations, this vibration sensor is used to detect the vibration in the boat, initially the value of the vibration is low (0) whenever more large amount of vibrations is detected the value goes to high (1) thus the microcontroller detects the value given as input to it and operated accordingly, VOICEBOARD is an voice recorder and playback module which can store up to 680sec of date into the microcontroller and played back again,APR33A3 is an VOICEBOARD MODULE used for detecting the vibrations, this module can record voice for 680sec ,it has an in built, the module ULTRASONICSENSOR (HC-SRO4)which is operated with an input of 5V the output will be either high or low given to it, it is placed above the boat to get accurate values, this ULTRASONIC signals works on the principle of Ultrasonic waves are longitudinal mechanical waves which travel as a sequence of compressions and rarefactions along The direction of wave propagation medium, ultrasonic sensors are not only used for obstacle finding but also height .A UART is usually an individual (or part of an) integrated circuit used for serial communications over a computer or peripheral device serial,The Arduino programming language is an implementation of Wiring, a similar physical computing platform, which is based on the Processing multimedia programming environment.
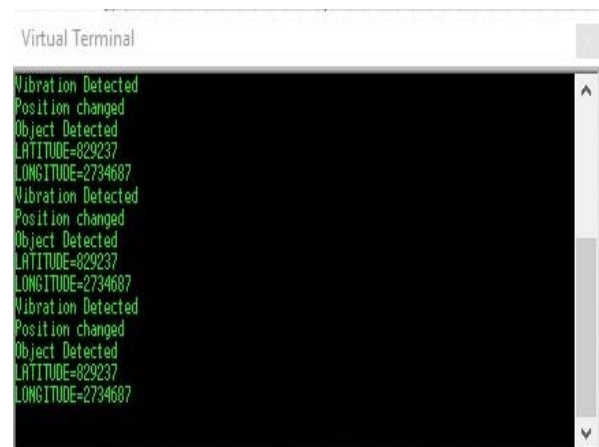

Figure-15. Virtual display.
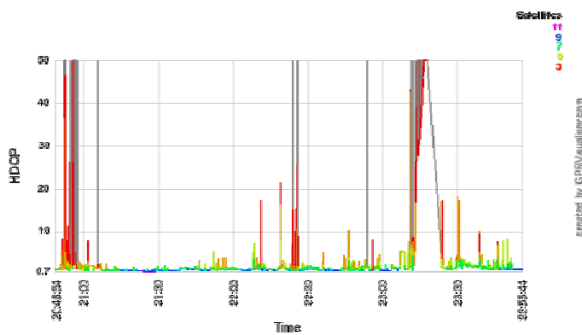
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Figure-16.

Advantages of proposed system

- As all sensors are embedded in the ship itself ,no need of UAVs to track the target.

- Cost of the proposed system is low.

- Accuracy of the GPS location is increased.

- Security of the border crossing system is also increased by the various wireless network sensors (WNS)

- Proposed system wireless sensors will avoid boat to crash into the sea.

Applications

- It is used to monitor the land and obstacles in the sea shore.

- On a national scale, transportation systems, and borders will be monitored for efficiency, safety, and security.

- These are used in marine purpose for detecting the tracking.

CONCLUSION

As now-a-days localization plays a major role in detecting the target device, this includes all the various wireless network sensors (WNS); we established a unifying optimization framework for power allocation in localization networks. The accuracy of the localization is increased by the wireless sensor network (WSN), power allocation also plays a major role in WSN still localization is the major problem in wireless communications, so the accuracy and power consumption can be established using various modern techniques which is illustrated in the above references, sensors are growing huge now as days, so we need to make used of low cost sensors and to implement the low cost target tracking architecture, these brings a huge innovation in the market side

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