IoT Based Ship

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Abstract- *Packet data networks at sea offer the potential for increased safety, connectivity and meteorological data acquisition. Existing solutions including satellite communication are expensive and prohibitive to most small vessels. In this paper, an Internet of Things (IoT) application is proposed as a marine data acquisition and cartography system over Ship Ad-hoc Networks (SANET). Ships are proposed to communicate over Very High Frequency (VHF) which is already available on the majority of ships and are equipped with several sensors such as sea depth, temperature, wind speed and direction, etc. On shore, 5G base station nodes represent sinks for the collected data and are equipped with Mobile Edge Computing (MEC) capabilities for data aggregation and processing. The sensory data is ultimately aggregated at a central cloud on the internet to produce public up to date cartography systems. We discuss the deployment limitations and benefits of the proposed system and investigate it's performance using four different MANET routing protocols which are Ad hoc On-Demand Distance Vector (AODV), Ad hoc On-Demand Multipath Distance Vector (AOMDV), Destination-Sequenced Distance Vector (DSDV) and Dynamic Source Routing (DSR) protocols. Simulation results illustrate the efficiency of the proposed system with packet delivery rates of up to 60 percent at shore base stations.*

Keywords- ship, IoT, navigation, systems

I. INTRODUCTION

A mobile Ad Hoc Network (MANET) is a system of mobile nodes which are connected by wireless links. Each of these nodes acts as a router and is free to move in any direction independently. MANETs are a popular telecommunication technology that can easily be applied to almost any environment having fast configuration and no need for any underlying infrastructures support. The popularity of MANETs is due to the wide range of available wireless services and increasing spread of communicating devices like cell phones, laptops, PDAs, etc., providing ubiquitous computing at low cost. Networks in the marine environment are not as mature as land-based wireless systems. Marine communication systems available today only provide the bare minimum essential services such as ship identification, positioning, location, course, heading, destination, tonnage, speed, etc... in the form of AIS (Automatic Identification System) using VHF radio frequencies. Inter ship satellite communication is possible but is a costly option when compared to conventional wireless communications and not affordable by most small to medium seagoing vessels [1].In efforts to standardize VHF data network communication at sea, the international telecommunication union (ITU) has defined Recommendation ITU-R M.1842-1".

They have defined marine band VHF radio to operate on internationally agreed frequencies in the band from 156MHz to 163MHz. They also provide a guideline on the use of digital technologies by VHF systems of different bandwidth. As expansion of the 5G radio spectrum, Of com has allocated VHF spectrum for the Internet of Things (IoT), aiming to encourage Machine to Machine (M2M) applications to use spectrum that will enable them to connect wirelessly over distances that are not possible with other frequencies. In this paper, we propose an Internet of Things (IoT) application as a marine data acquisition and cartography system over Ship Ad-hoc Networks (SANET).

II. LITERATURE SURVEY

2.1 Minje Cho, et.al (2015) Conducted study on "A Study on the Method of IoT-based Navigation Aids Management"This study A literature review and interviews with relevant field experts were used to analyze the problem of current navigation aids management. As such, it proposes a method of managing navigation aids that is applicable to IoT (Internet of Things) technologies. Currently, maritime transportation handles the majority of export/import cargoes. Large-scale and high-speed vessels make maritime transportation more complex, resulting in more maritime accidents. Navigation aids play an important role in reducing such maritime accidents, but their management system is still underdeveloped, necessitating the development of a method for their real-time management and efficient operation.

2.2 Li Chongwen, et.al (2013) Conducted study on "Research on the application of the internet of things technology in port management"In this paper, The author will expound on the concept of intelligent port management system for improving

port functions by describing the use of IoT in container terminal management. The Internet of Things (IoT) refers to objects that can be uniquely identified and their virtual representations in an Internet-like structure. IoT technology is rapidly developing now that the relevant policy has been approved. IoT is becoming more widely used in port construction, and it will have a significant impact on the development of the port management system. The dissertation focuses on how IoT can be used in port management applications. From the perspective of port authorities, this dissertation defines IoT, its key technologies, and its operating principles, and connects them to port development. Port management system connects port facilities, cargo information, port logistics, and IoT perception and interconnection technical features to realize port intelligentization in terms of recognition, location, tracking, monitoring, and management. The author will present the concept of intelligent ports and conduct research on the application layer, including feasibility analysis and data modeling.

2.3 Marcus Handte, et.al (2016) Conducted study on "An Internet-of-Things Enabled Connected Navigation System for Urban Bus Riders" In this paper, We demonstrate how this paradigm can be applied to public transportation and introduce the Urban Bus Navigator, an Internet-of-Things-enabled navigation system for urban bus riders. UBN offers two novel information services to bus passengers: 1) Crowd-aware route recommendation and 2) micro navigationMicro navigation is the process of providing fine-grained contextual guidance to passengers on a bus journey by recognizing boarded bus vehicles and tracking the passenger's journey progress. Crowd-aware route recommendation collects and predicts crowd levels on bus trips in order to recommend better and less crowded routes to bus passengers. We present the technical system that powers the Urban Bus Navigator and report on findings from an in-the-field study in Madrid that show reduced barriers to public transportation use and a positive impact on how people perceive bus rides.

2.4 A Maulidi, et.al (2021) Conducted study on "The development of internet-of-things (IoT)-based ship monitoring system in madura strait" The system can transmit and receive static data, such as ship IDs and names, in the initial system design. Then it can transmit and receive dynamic data, such as the ships' geographical coordinates, in order to identify marine traffic in the surrounding areas. Later, this system could be improved so that it not only collects data but also analyzes the ship's condition. The 4.0 revolution industry has produced the internet and technology known as the Internet of Things (IoT), which are used in navigation and monitoring systems for ship safety. This monitoring system receives data from the AIS Transceiver, which is installed on the ship and integrated with the network infrastructure. As the AIS Receiver receives the signatures, the equipment transmits them to track the ships sailing and coming ashore. The development of an IoT-based monitoring system is becoming increasingly important as the number of ships transporting fuels and natural gas from mine-producing areas in the Madura Strait grows.

2.5 Elwas Cahya Wahyu Pribadi et.al (2021) Conducted study on "Application of Navigation Light Monitoring and Control in Ship's KRI Sampari 628 Based on Android" In this case, an android-based control and monitoring system for navigation lights that will be practical and efficient to use both inside and outside the BCC room. In order to prepare for the Fourth Industrial Revolution, the author employs the scientific field of Internet of Things (IoT) with the main electronic device, namely the Arduino UNO with a MEGA 2560 microcontroller as the system control center, and the ESP8266 wifi module for controller communication. The LDR is used to detect light, the relay is used to switch lights, the interface is built using Android applications, and the hardware is a collection of systems and prototypes. The current BCC (Bridge Control Console) system is still controlled manually, primarily through the ship's navigation lights, which requires the crew to come to the BCC room, which is difficult if the crew is located far from the BCC room. The author intends to create a digital system based on that problem.

2.6 Ahmadhon Kamolov, et.al (2019) Conducted study on "An IoT-Based Ship Berthing Method Using a Set of Ultrasonic Sensors" The purpose of this paper is to present a dedicated IoT-based system for automating linkage procedures through the use of port-mounted sensors and planned ship notification In the experimental system, we used a smartphone as an alternative to the system's client-side vessel and developed an Android app called "Smart Ship Berthing" instead of the charging program, such as NORIVIS 4, VDASH, ODYSSEY, and so on. To put our proposed server-side system to the test, we used a Raspberry Pi with an ultrasonic sensor to detect the ship and modify the empty berth for anchoring. The experimental results show that the set of UR sensors has high accuracy in detecting ships at the port for ship berthing, and our proposed system is easily implemented in a real marine environment. It is undeniable that many new technologies, such as the internet of things (IoT), big data, and cloud computing, are transforming every aspect of our lives.

III. METHODOLOGY

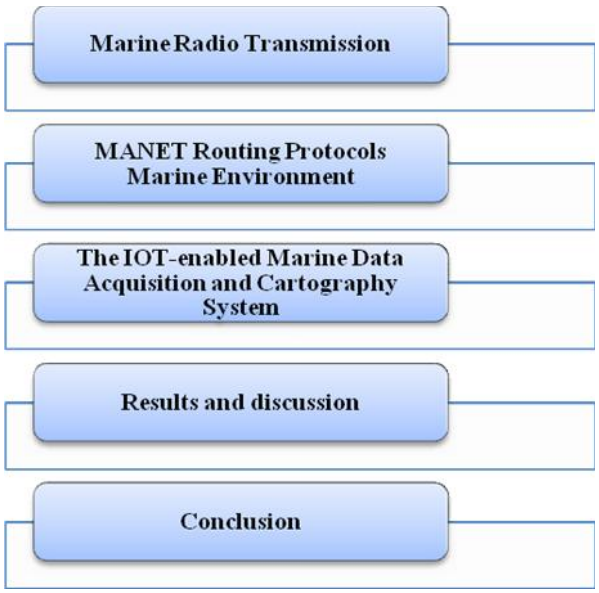


Fig 1: Flowchart

3.1 block diagram

The AVR32 is a 32-bitRISC microcontroller architecture produced by Atmel. The microcontroller architecture was designed by a handful of people. The multiply–accumulate unit can perform a 32-bit × 16-bit + 48-bit arithmetic operation in two cycles (result latency), issued once per cycle.

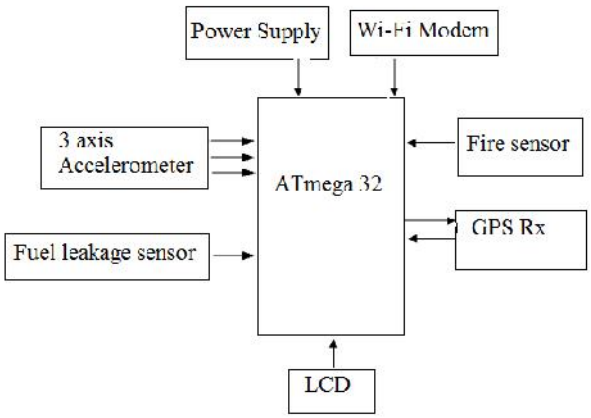


Fig 2: Block diagram

The Wi-Fi module allows microcontrollers to connect to a Wi-Fi network and make simple TCP/IP connections using Hayes-style commands. However, at the time there was almost no English-language documentation on the chip and the commands it accepted. The very low price and the fact that there were very few external components on the module which suggested that it could eventually be very inexpensive in volume.The Fire sensor, as the name suggests, is used as a simple and compact device for protection against fire. The module makes use of IR sensor and comparator to detect fire up to a range of 1 -2 meters depending on fire density.

IV. HARDWARE SYSTEM DESIGN

Hardware used as follows:

1. ATmega32 AVR

Fig 3: Atmega32 AVR

Features:

- High-performance, Low-power AVR® 8-bit Microcontroller
- Advanced RISC Architecture

2. Wi-Fi module

Fig 4: Wi-Fi Module

Features:

- Processor: L106 32-bit RISC microprocessor core based on the Tensilica Xtensa Diamond Standard 106Micro running at 80 MHz*
- 64 KB of instruction RAM, 96 KB of data RAM

3. Fire sensor

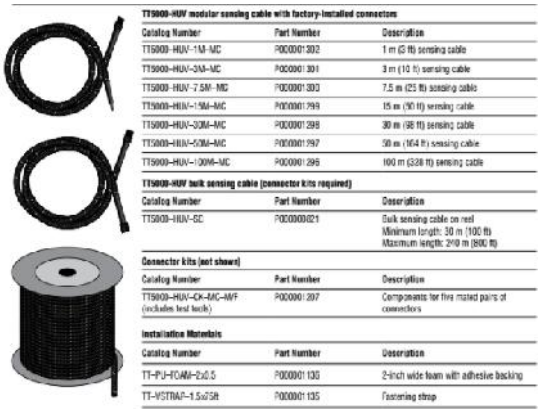
Fig 5: Fire sensor

Features:

- Allows your robot to detect flames from 2m away.
- Fire indicator led.
- Calibration preset for range adjustment.

4. Fuel leakage sensor

TraceTek® TT5000-HUV sensing cable detects the presence of liquid hydrocarbon fuels at any point along its length, yet it does not react to the presence of water. Installed with a TraceTek Sensor Interface Module and TraceTek Alarm Panel, the cable senses the hydrocarbon liquid, triggers an alarm and pinpoints the location of the leak within one meter.



TT5000-HUV modular sensing cable with factory-installed connectors

Catalog Number	Part Number	Description
TT5000-HUV-1M-MC	P000001302	1 m (3 ft) sensing cable
TT5000-HUV-3M-MC	P000001301	3 m (10 ft) sensing cable
TT5000-HUV-7.5M-MC	P000001303	7.5 m (25 ft) sensing cable
TT5000-HUV-15M-MC	P000001299	15 m (50 ft) sensing cable
TT5000-HUV-30M-MC	P000001298	30 m (98 ft) sensing cable
TT5000-HUV-50M-MC	P000001297	50 m (164 ft) sensing cable
TT5000-HUV-100M-MC	P000001296	100 m (328 ft) sensing cable

TT5000-HUV bulk sensing cable (connector kits required)

Catalog Number	Part Number	Description
TT5000-HUV-SC	P000000021	Bulk sensing cable on reel Minimum length: 30 m (100 ft) Maximum length: 240 m (800 ft)

Connector kits (not shown)

Catalog Number	Part Number	Description
TT5000-HUV-CK-MC-MF (includes test tools)	P000001207	Components for five mated pairs of connectors

Installation Materials

Catalog Number	Part Number	Description
TT-PU-FOAM-2x0.5	P000001100	2-inch wide foam with adhesive backing
TT-VSTRAP-1.5x25ft	P000001135	Fastening strap

Fig 6: Fuel leakage sensor

5. Axis Accelerometer

An accelerometer is a device that measures proper acceleration.[1] Proper acceleration, being the acceleration (or rate of change of velocity) of a body in its own instantaneous rest frame,[2] is not the same as coordinate acceleration, being the acceleration in a fixed coordinate system. For example, an accelerometer at rest on the surface of the Earth will measure an acceleration due to Earth's gravity, straight upwards (by definition) of $g \approx 9.81\ m/s^2$. By contrast, accelerometers in free fall (falling toward the center of the Earth at a rate of about $9.81\ m/s^2$) will measure zero.

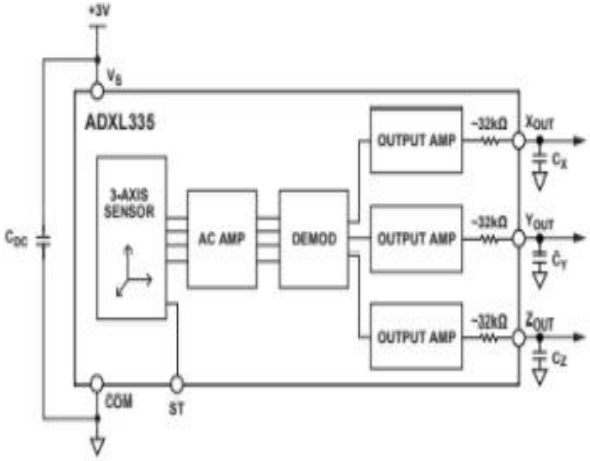


Fig 7: Axis Accelerometer

6. GPS

This L80 GPS module. It describes L80 module hardware interfaces and its external application reference circuits, mechanical size and air interface.

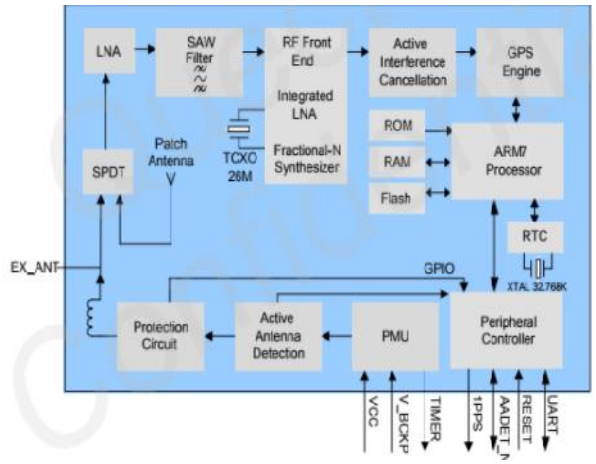


Fig 8: Block Diagram of GPS

L80 GPS module with an embedded patch antenna (15mmx15mmx4mm) and LNA brings high performance of MTK positioning engine to the industrial applications. It is able to achieve the industry's highest level of sensitivity, accuracy and TTFF with the lowest power consumption in a small-footprint lead-free package. With 66 search channels and 22 simultaneous tracking channels, it acquires and tracks satellites in the shortest time even at indoor signal level.

7. DC motor driver IC

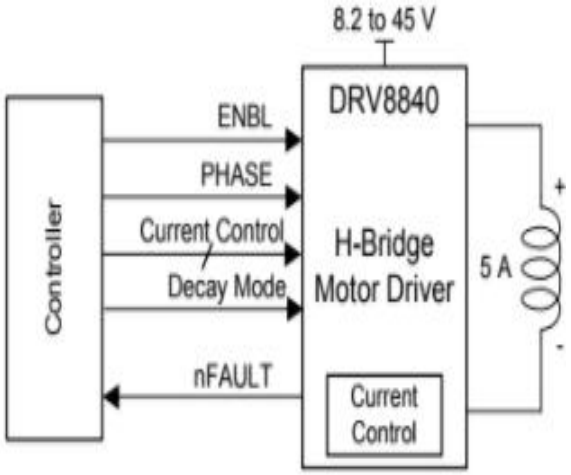


Fig 9: DC motor driver IC simplified circuit

Features

- Single H-Bridge Current-Control Motor Driver
- 8.2-V to 45-V Operating Supply Voltage Range
- Five Bit Current Control Allows up to 32 Current Levels

8. 20*4 LCD Display

LCD Smartie is open-source software for Microsoft Windows which allows a character LCD to be used as an auxiliary display device for a PC. Supported devices include displays based on the Hitachi HD44780 Controller, the Matrix Orbital Serial/USB LCD, and Palm OS devices (when used in conjunction with PalmOrb). The program has built in support for many systems statistics (i.e. cpu load, network utilization, free disk space...), downloading RSS feeds, Winamp integration and support for several other popular applications.

Features

- High contrast lcd supertwist display
- Controller ks0073 (near 100% compatible with hd44780)

V.SOFTWARE SYSTEM DESIGN/ ANALYSIS METHOD

5.1 Proteus Professional v7.8

With this software you now can build electronic project simulation firstly before implement to real condition to know how your project will work perfectly. Proteus Professional v7.8 SP2 for Windows also provide the features that called with ISIS and ARES that allow you to design electronic circuit and simulate it and then you also can create PCB layout design at once using this software.

Proteus has the ability to simulate the results of both digital and analog design or a combination of both, Supports simulation and simulation graphically appealing, supports simulation of various types of microcontroller such as PIC, the 8051 series. Having models are interactive peripherals such as LED, LCD display, RS232, and various types of other libraries, Supports virtual instrument-instrument such as a voltmeter, ammeter, oscilloscope, logic analyzer, etc.,

5.2 Express PCB

Express PCB is used for circuit board layout. The software is easily installed, and a snap to learn and use. It will save your time when designing your PCB. Using Express PCB is as easy as placing the components on the page and wiring the pins together. The schematic can then be linked to your PCB file, so that the PCB knows what needs to be connected together.

There are two stages in the process to creating the circuit board. In the first stage, you build the schematic using the Express PCB schematic editor. In the second stage you layout the circuit board. It is possible to skip directly to the layout editor. However, doing the schematic first will allow you to link the schematic into the layout editor reducing the probability of error.

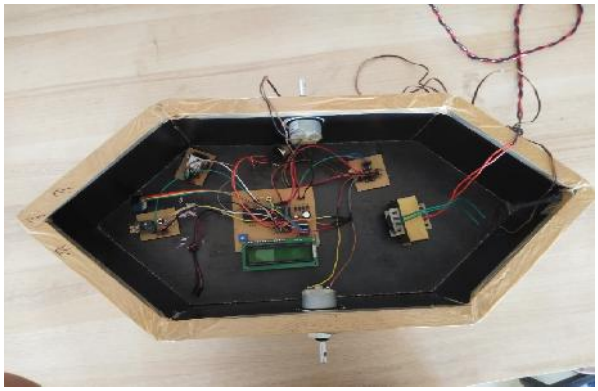
5.3 MikroC Pro for AVR

MikroC PRO for AVR is a full-featured C compiler for AVR devices. The feature rich environment you can experience today is the result of 15 years of dedicated work and steady progress. The ever-increasing number of hardware and software libraries, intuitive IDE, integrated Visual TFT software, detailed documentation, a full box of additional tools.

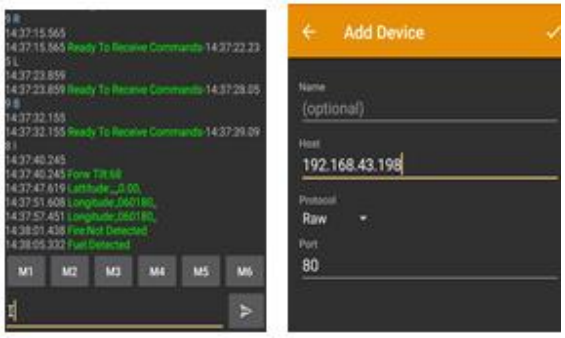
MikroC offers a unique mechanism to easily use libraries in your project, just select the libraries you need and they will be instantly available in your code. No need for dozens of #include directives. You can also install and manage third-party libraries using our package manager and library manager.

VI. RESULT

6.1 Output 1: Ship



6.2 Output 2: Add device



6.3 Output 3: Ship moving forward

6.4 Output 4: Ship moving Backward

6.5 Output 5: Ship moving Left

6.6 Output 6: Ship moving Right

6.7 Output 7: GPS Data Received

6.8 Output 8: GPS Track

6.9 Output 9:Fuel leakage Det.Rescue needed

VII. CONCLUSION

Due to increased shipping and the high cost of other available technologies, the demand for data networks in the marine environment for safety and convenience shows an increasing trend. In this project implementing IoT data networks in a marine environment has been shown using the existing Wi-Fi communication infrastructure available on all ships

7.1 advantages of proposed system

- Every movement of Ship can be monitored accurately.
- Ships Accidents can be avoided
- Cheaper

7.2 Applications of proposed system

- Ship communication system
- Submarine communication system
- Air craft communication system

7.3 Future scope

- By adding compass we can define the boundaries for the regions and countries.

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