



## IOT BASED CYBER-PHYSICAL SYSTEM FOR THE AUTOMATION OF SHIPYARDS

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**ABSTRACT:** The main objective of this concept is to monitor and track the ships by using integrated technology. In the transported piece, three labels were fixed in strategic positions in the base line of the block, so that regardless of the position with which the object is placed in the vehicle, one of them will always be within reach of the reader. This ensures that no parts are unloaded without at least one secured device. Zigbee, nodemcu, some general output devices are attached as extension for this project to improve the reliability and accuracy of this project. Two Android apps are used to see the output for this project.

**INTRODUCTION:** The Internet of Things (IoT) is a concept which is outcome of the merged field of computer science and electronics. IoT describes how everyday life objects will interact and communicate with other objects over the internet. In IoT objects are equipped with microcontroller and sensor devices and various software application and suitable protocol stack enable them to talk to other objects. The objects in IoT can be any "thing" such as people, devices, animal, building, vehicle or any physical thing which is part of our daily life. IoT is everything-to-everything communication. In general IoT can be described as a combination of Sensors, Connectivity and People & Processes. IoT combines smart devices with smart services to create compound applications for example intelligent transportation, smart cities, smart healthcare, smart home, smart building, digital farm, smart agricultural etc. IoT delivers on demand real-time services and assists in saving time, resources and even manpower. This comprehensive literature review explores the impact of IoT technology in several fields. The essential idea of the Internet of Things (IoT) has been around for nearly two decades, and has attracted many researchers and industries because of its great estimated impact in improving our daily lives and society. When things like household appliances are connected to a network, they can work together in

cooperation to provide the ideal service as a whole, not as a collection of independently working devices. This is useful for many of the real-world applications and services, and one would for example apply it to build a smart residence; windows can be closed automatically when the air conditioner is turned on, or can be opened for oxygen when the gas oven is turned on. The idea of IoT is especially valuable for persons with disabilities, as IoT technologies can support human activities at larger scale like building or society, as the devices can mutually cooperate to act as a total system. So far, much work has been done on realizing the IoT into practice. Due to the current economic crisis occurred in Brazil the industries are witnessing a new and rigorous process of retraction. However due to the great competitiveness in the international market it is extremely necessary that there is a constant optimization in the productivity of its industrial plants. With the need for improvement and the growing economic problem, the industries have to find better ways to best fit the scenario - cutting costs, reducing staffing, and improving manufacturing processes without a massive investment. In order to assist the commented areas, the technologies of identification and screening in industrial environments have demonstrated a vertiginous growth in the last years. The combination of Radio Frequency

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INTERNATIONAL JOURNAL OF ENGINEERING IN ADVANCED RESEARCH  
SCIENCE AND TECHNOLOGY

Volume.01, IssueNo.03, July -2019, Pages: 262-268

Identification (RFID) and Global Position System (GPS) with other technologies and means of communication are widely used in a variety of production environments, such as construction, manufacturing, retail, agriculture, health, logistics, aerospace, transport, manufacturing industry, among others. Intelligent systems that use these technologies offer several benefits at a low cost. By correctly identifying the inputs in each activity in the production levels, the efficiency of the process is increased due to the lower rework rate and material waste, thus increasing profitability. This work aims to embark RFID technology allied together technologies in a hardware and software framework, composing an embedded system for use in an industrial environment with the objective of identifying blocks in a shipyard, optimizing logistics and reducing time and money invested. High-resolution optical remote sensing images have become an important research topic in many marine applications. Due to their large scale and high efficiency, such images have been extensively used in ship detection, such as in dynamic harbor surveillance, maritime management, ship rescue and smuggling activity monitoring. In particular, ocean-going vessels and inshore ships are considered typical ship detection scenes.

#### **LITERATURE REVIEW**

Real-time tracking and management of vehicles has been a field of interest for many researchers and a lot of research work has been done for tracking system. Recently the various anti-theft modules like steering wheel locked equipment, network tracking system and traditional electronic alarm are developed along with client identification and real time performance monitoring. The paper presented by El-Medany, W.; Al-Omary et al describes a real time tracking system that provides accurate localizations of the tracked vehicle with low cost. GM862 cellular quad band module is used for implementation. A monitoring server and a graphical user interface on a website is also developed using Microsoft SQL Server 2003 and ASP.net to view the proper location of a vehicle on a specific map. The paper also provides information regarding the vehicle status such as speed, mileage. Hu Jian-ming; Li Jie; Li Guang-Hui describes an automobile anti-theft system using GSM and GPS module. The system is developed using high speed mixed type single-chip C8051F120 and stolen

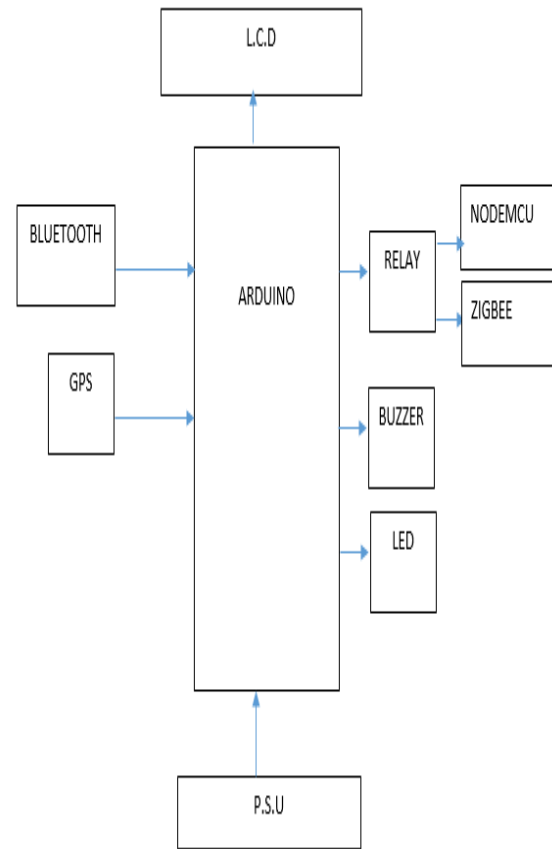
automobile is detected by the use of vibration sensor. The system remains in contact with automobile owner through the GSM module, for the safety and reliability of automobile. Fleischer, P.B.; Nelson et al describes development and deployment of GPS (Global Positioning System)/GSM (Global System for Mobile Communications) based Vehicle Tracking and Alert System. This system allows inter-city transport companies to track their vehicles in real-time and provides security from armed robbery and accident occurrences. Le-Tien, T.; Vu Phung describes a system based on the Global Positioning System (GPS) and Global System for Mobile Communication (GSM). It describes the practical model for routing and tracking with mobile vehicle in a large area outdoor environment. The system includes the Compass sensor-YAS529 of Yamaha Company and Accelerator sensor-KXSC72050 of Koinix Company to acquire moving direction of a vehicle. The system will acquire positions of the vehicle via GPS receiver and then sends the data to supervised center by the SMS (Short Message Services) or GPRS (General Package Radio Service) service. The supervised center comprises of a development kit that supports GSM techniques-WMP100 of the Wavecom Company. Finally, the position of the mobile vehicle will be displayed on Google Map. Internet of Things (IoT) is a concept and a paradigm that considers pervasive presence in the environment of a variety of things/objects that through wireless and wired connections and unique addressing schemes are able to interact with each other and cooperate with other things/objects to create new applications/services and reach common goals. In this context the research and development challenges to create a smart world are enormous. A world where the real, digital and the virtual are converging to create smart environments that make energy, transport, cities and many other areas more intelligent. The goal of the Internet of Things is to enable things to be connected anytime, anyplace, with anything and anyone ideally using any path/network and any service. Internet of Things is a new revolution of the Internet. Objects make themselves recognizable and they obtain intelligence by making or enabling context related decisions thanks to the fact that they can communicate information about themselves and they can access information that has been aggregated by other things, or they can be

components of complex services. In Al-Suwaidi and Zemerl work the problem was solved by proposing an application “Locating Friends and Family Using Mobile Phones with Global Positioning System (GPS)”. The architecture of the system is based on clientserver approach. The client phone registers and login into the server.

### IDENTIFICATION AND TRACKING:

Currently the Brazilian naval industry is undergoing a new crisis after the Transpetro contracts. However, most of the large construction projects in progress are Floating Production Storage and Offloading (FPSO) vessels through Promef orders. Each hull of this type of vessel has at least 18 structural megablocks, each one corresponding to a cross-section of the hull. A megablock is composed of 13 smaller blocks, manufactured in the building line, outside the dry dock. After the steps of building, subassembling and assembling a block, they undergo a corrosion treatment, are painted and soldered in megablocks. At the peak of the recent Brazilian naval industry, it was normal had several constructions in parallel as a way of accelerating the process. In most shipyards the methodology used for block tracking is completely manual, paper forms or illustrative pictures with pins are used. These manual methods generate great disorder, often causing loss of profit and waste, because did not find a block and not have the time to look for it was common to manufacture another in its place. In order to avoid this type of situation, a more modern methodology is necessary, in order to satisfy this condition a solution of hardware was projected. The hardware framework, called Hotlog, gets the record of the activities mentioned, recognizing the items through RFID tags. At the point where the assembly of the blocks begins, a Hotlog will be installed. RFID tags will also be placed on the baseline (BL) of the blocks, known as the bottom panel as well. This event will mark the beginning of the life of a block. After associating the blocks with the labels, the system will follow the movement of the same ones along the yard. The locomotion of a block within the yard is carried out by several transport vehicles. We chose to stick the system on board a vehicle called as Kamag. This way it will be possible to identify your transfer in the industrial plant through GPS. The location data is sent over the internet and stored in a database so that it can be accessed by the application.

### PROPOSED ARCHITECTURE:



**ARDUINO:** The Arduino Software (IDE) allows you to write programs and upload them to your board. In the Arduino Software page you will find two options: 1. If you have a reliable Internet connection, you should use the online IDE (Arduino Web Editor). It will allow you to save your sketches in the cloud, having them available from any device and backed up. You will always have the most up-to-date version of the IDE without the need to install updates or community generated libraries. 2. If you would rather work offline, you should use the latest version of the desktop IDE. Code online on the Arduino Web Edito To use the online IDE simply follow these instructions. Remember that boards work out-of-the-box on the Web Editor, no need to install anything. Install the Arduino Desktop IDE

**LIQUID CRYSTAL DISPLAY:** The LCD is used for the purpose of displaying the words which we are given in the program code. This code will be executed

on microcontroller chip. By following the instructions in code the LCD display the related words. Fig shows the LCD display.

### Introduction



**Fig. : LCD Display**

The LCD display consists of two lines, 20 characters per line that is interfaced with the PIC16F73. The protocol (handshaking) for the display is as shown in Fig. The display contains two internal byte-wide registers, one for commands (RS=0) and the second for characters to be displayed (RS=1). It also contains a user-programmed RAM area (the character RAM) that can be programmed to generate any desired character that can be formed using a dot matrix. To distinguish between these two data areas, the hex command byte 80 will be used to signify that the display RAM address 00h will be chosen Port1 is used to furnish the command or data type, and ports 3.2 to 3.4 furnish register select and read/write levels.

### **NODEMCU ESP8266:**

The ESP8266 series, or family, of Wi-Fi chips is produced by Espressif Systems, a fabless semiconductor company operating out of Shanghai, China. The ESP8266 series presently includes the ESP8266EX and ESP8285 chips. **ESP8266EX** (simply referred to as ESP8266) is a system-on-chip (SoC) which integrates a 32-bit Tensilica microcontroller, standard digital peripheral interfaces, antenna switches, RF balun, power amplifier, low noise receive amplifier, filters and power management modules into a small package. It provides capabilities for 2.4 GHz Wi-Fi (802.11 b/g/n, supporting WPA/WPA2), general-purpose input/output (16 GPIO), Inter-Integrated Circuit (I<sup>2</sup>C), analog-to-digital conversion (10-bit ADC), Serial Peripheral Interface (SPI), I<sup>2</sup>S interfaces with DMA (sharing pins with GPIO), UART (on dedicated pins, plus a transmit-only UART can be enabled on GPIO2), and pulse-width modulation (PWM). The

processor core, called "L106" by Espressif, is based on Tensilica's Diamond Standard 106Micro 32-bit processor controller core and runs at 80 MHz (or overclocked to 160 MHz). It has a 64 KiB boot ROM, 32 KiB instruction RAM, and 80 KiB user data RAM. (Also, 32 KiB instruction cache RAM and 16 KiB ETS system data RAM.) External flash memory can be accessed through SPI. The silicon chip itself is housed within a 5 mm × 5 mm Quad Flat No-Leads package with 33 connection pads – 8 pads along each side and one large thermal/ground pad in the center. The ESP8266 is a System on a Chip (SoC), manufactured by the Chinese company Espressif. It consists of a Tensilica L106 32-bit **micro controller** unit (MCU) and a **Wi-Fi transceiver**. It has **11 GPIO pins\*** (General Purpose Input/Output pins), and an **analog input** as well. This means that you can program it like any normal Arduino or other microcontroller. And on top of that, you get Wi-Fi communication, so you can use it to connect to your Wi-Fi network, connect to the Internet, host a web server with real web pages, let your smartphone connect to it, etc ... The possibilities are endless! It's no wonder that this chip has become the most popular IOT device available. The ESP8266 WiFi Module is a self contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your WiFi network. The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor. Each ESP8266 module comes pre-programmed with an AT command set firmware, meaning, you can simply hook this up to your Arduino device and get about as much WiFi-ability as a WiFi Shield offers (and that's just out of the box)! The ESP8266 module is an extremely cost effective board with a huge, and ever growing, community.

**BLUETOOTH COMMUNICATION:** 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. It can connect several devices, overcoming problems of synchronization. Bluetooth is managed by the Bluetooth Special Interest Group (SIG), which has

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**INTERNATIONAL JOURNAL OF ENGINEERING IN ADVANCED RESEARCH  
SCIENCE AND TECHNOLOGY**

**Volume.01, IssueNo.03, July -2019, Pages: 262-268**

more than 19,000 member companies in the areas of telecommunication, computing, networking, and consumer electronics. Bluetooth was standardized as IEEE 802.15.1, but the standard is no longer maintained. The SIG oversees the development of the specification, manages the qualification program, and protects the trademarks. To be marketed as a Bluetooth device, it must be qualified to standards defined by the SIG.

**IMPLEMENTATION:** Bluetooth operates in the range of 2400–2483.5 MHz (including guard bands). 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. The transmitted data are divided into packets and each packet is transmitted on one of the 79 designated Bluetooth channels. Each channel has a bandwidth of 1 MHz. Bluetooth 4.0 uses 2MHz spacing which allows for 40 channels. The first channel starts at 2402 MHz and continues up to 2480 MHz in 1 MHz steps. It usually performs 1600 hops per second, with Adaptive Frequency-Hopping (AFH) enabled.

#### CONCLUSION

The result was considered satisfactory, with the arrangement developed by the group defining the position for installation of labels in the block baseline and Hotlog. The question of using GPS to define the position of a block on the shipyard is a more complete solution than that demonstrated. Bluetooth and IOT are developed and tested with utmost security. Android developed in this project plays vital role and deployed with most perfect output.

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INTERNATIONAL JOURNAL OF ENGINEERING IN ADVANCED RESEARCH  
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Volume.01, IssueNo.03, July -2019, Pages: 262-268

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