

Zigbee Controlled Boat with Wireless Video Transmission

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Abstract: This represents the usage of remote versatile robots utilizing Zigbee convention with the end goal of route utilizing PC, actualized with remote vision framework for remote checking and control. Its primary component is its utilization of the Zigbee convention as the correspondence medium between the portable robot and the PC controller. The equipment framework depends on the Atmega328 microcontroller and an Xbee module. The framework gives persistent visual observing through the camera appended to the portable robot, sending information to the control unit. Remote testing is done on the portable robot for inquiry and salvage missions by means of a set up radio recurrence (RF) correspondence utilizing DIGI XBee RF module.

Keywords: Zigbee, Remote checking and control, Atmega328, DIGI XBee RF module.

I. Introduction

A few top radio makers have actualized arrangements dependent on the IEEE 802.15.4 convention (Zigbee convention) which determines a remote connection for low-power personal area networks. Zigbee is widely used in embedded applications, such as environmental monitoring to improve agricultural yields, structural monitoring to track building and bridge integrity, industrial control to provide more sense points and control points at lower cost.^[1] These applications for the most part require various minimal effort hubs imparting over numerous jumps to cover a huge land region, and they should work unattended for a considerable length of time on unobtrusive batteries. Such requirements target a very different set of applications than do WPAN technologies such as Bluetooth, which eliminate wiring for headsets, game controllers, and personal devices. Accordingly, Zigbee's capabilities are more limited than other WPANs and WLANs – they have small frame sizes, low bandwidth, and low transmit power.^[2]

An execution of Zigbee remote sensor organize (WSN) in search and salvage application includes the utilization of portable robot coordinated with remote camera. The framework utilizes the camera to screen progressively the circumference around which the robot is set, for example, deterrents, pits, knocks, passageways and exits. The principle components of the framework are the central control rooms, where human administrators remotely screen the diverse visual elements of the surrounding infrastructure, and the portable robot, which is situated inside the infrastructure themselves giving information streams created by remote visual framework from the camera.^[3]

The objectives of the project include – to form the surveillance system for combining areas, monitor large spaces in oceans, wireless controlling of boat, live video transmission to the control room. Section I contains a brief introduction of wireless ZigBee Protocol. In Section II, some related work is discussed. Section III discusses the methodology of the ZigBee Protocol, transmission, reception, navigation controls and video transmission. In Section IV contains the list of components used. Section V describes about the advantages and limitations of the project. Finally, Section VI contains the conclusion of this work.

II. Related Works

To propose and implement the present work, different methodologies are being investigated. The reviewed literature has been classified into primary heads which helps in comprehensive analysis study. Literature as per their context can be studied by such an analysis. In our robot space, remote sensor systems is intended to accumulate and process sensor information from nature so as to have a superior comprehension of the behavior of the monitored entities. And the proper action, with control commands are issued by the wireless sensor networks, can be taken whenever necessary. Some of the important implementation techniques used for wireless control of robots are:

- One of the elementary techniques with using Radio Frequency (RF) mode and with camera on the robot surface. For the most part, the RF has the benefit of sufficient range up to 200 meters with legitimate receiving wires. Radio frequency (abbreviated RF) is a term that refers to alternating current (AC) having

characteristics such that, if the current is input to an antenna, an electromagnetic (EM) field is generated suitable for wireless broadcasting and/or communications. These frequencies cover a significant portion of the electromagnetic radiation spectrum, extending from nine kilohertz (9 kHz), the lowest allocated wireless communications frequency (it's within the range of human hearing), to thousands of gigahertz (GHz).^[4]

- Bluetooth - Bluetooth module provides a method to connect wirelessly with a PC or Bluetooth phone to transmit/receive embedded data such as GPS data, ADC voltage reading and other parameters. Bluetooth module can be associated with any gadget, through implicit UART interface to speak with other Bluetooth - empowered gadgets, for example, cell phones and handheld PCs. The module runs on a 3.6V to 6V supply.
- Zigbee Protocol - Among current protocols of wireless sensor networks, ZigBee protocol is a standardized, mature and practical wireless sensor networks protocol. ZigBee defines the application layer and network layer, utilizing the IEEE 802.15.4 standard as the communication protocols of medium access control (MAC) layer and physical (PHY) layer. ZigBee stack offers a practical application solution coupled with low rate, low cost, low energy consumption characteristics for wireless sensor networks. That is why ZigBee protocol is often selected to implement the wireless sensor networks in the service robot intelligent space.[1]

III. Proposed Methodology

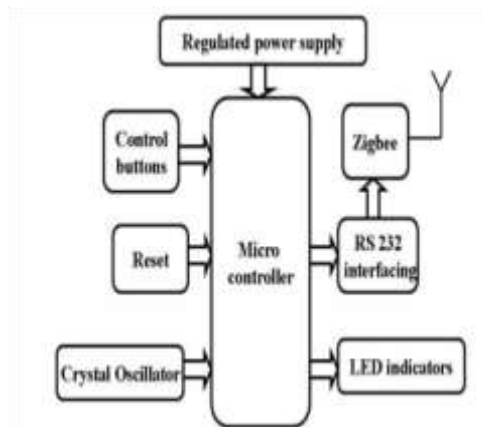


Fig. 1 Transmitter (Control Room)

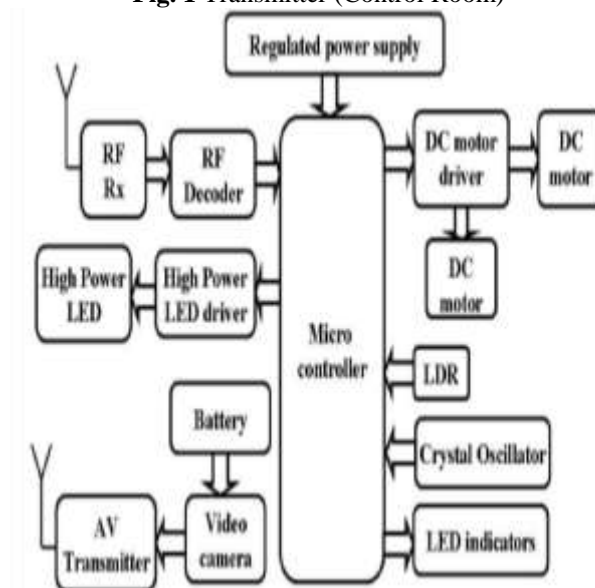


Fig.2 Receiver (Boat)

The controlling gadget of the entire framework is a Microcontroller. At whatever point the client presses a button in the Zigbee remote control, the information identified with that button is sent through Zigbee module in remote control. This information will be processed by the Zigbee module in the vessel and will be fed to the Microcontroller which makes a decision about the significant reply to the data processed and acts appropriately. The live pictures from the camera in the vessel can be sent to TV through AV framework. The TV gives the review of live pictures. This framework additionally has night vision ability. The Microcontrollers utilized in the venture are modified utilizing Embedded C language. This undertaking finds most helpful for sea investigate applications.

IV. Components

This project primarily makes use of the following modules:

- Zigbee S2C Modules
- Zigbee Explorer Board
- Arduino Nano

1. Zigbee S2C Modules and Explorer Board:



Fig. 3 Zigbee S2C Module and Zigbee Explorer Board

The new Zigbee S2C module is incredible with both UART and SPI correspondence. Working recurrence band is the indus-preliminary, logical and medicinal (ISM) radio band ISM 2.4 – 2.5 GHz. It uses Silicon labs EM357 handset. The Module is quicker and has more RAM and ROM with much decreased power utilization. Interface specification are: UART 1 Mb/s most extreme (burst), SPI 5 Mb/s greatest (burst). The scope of S2C has additionally expanded considerably as the transmit yield control is twofold. Additionally it takes supply voltage from 2.1V to 3.6V DC.

This is an easy to utilize, USB to sequential base unit for the Digi XBee line. This unit works with all XBee modules including the Series 1 and Series 2.5, standard and Pro modules. Fitting the unit into the XBee Explorer, append a small scale USB link, and you will have direct access to the sequential and programming pins on the XBee unit. The feature of this board is a FT231X USB-to-Serial converter. That is the thing that interprets information between your PC and the XBee. There's additionally a reset pin, and a voltage regulator to supply the XBee. Also, there are four LEDs to investigate your XBee: RX, TX, RSSI (range), and power pointer. This board likewise breaks out every one of the XBee's I/O pins to a couple of breadboard-perfect headers. So in the event that you need to make utilization of the XBee's all-encompassing usefulness, you can solder some header pins into those, or even simply bind some wire.

2. Arduino Nano:

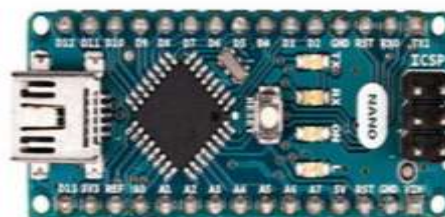


Fig. 4 Arduino Nano

The Arduino Nano is a complete package and bread-board-accommodating board dependent on the ATmega328P (Arduino Nano 3.x). It has pretty much a similar capability of the Arduino Duemilanove, yet in an alternate bundle. It needs just a DC control jack, and works with a Mini-B USB link rather than a standard one. The Arduino Nano can be fueled by means of the Mini-B USB connection, 6-20V unregulated outer power supply, or 5V controlled outside power supply. The power source is naturally chosen to the highest voltage source. The ATmega328 has 32 KB, (likewise with 2 KB utilized for the bootloader. The ATmega328 has 2 KB of SRAM and 1 KB of EEPROM.

V. Advantages And Limitations

- **Advantages:**

1. Zigbee can't be hindered by normal materials. It can infiltrate most solids and go through obstacles.
2. Zigbee has longer range.
3. Zigbee modules have low power consumption and hence offers longer battery life.
4. These robots are also useful to do jobs in areas and in situations that are hazardous for humans.
5. It can be remotely controlled.

- **Limitations:**

1. It requires knowledge of the system for the owner to operate Zigbee compliant devices.
2. Replacement cost will be high when any problem occurs in Zigbee compliant home appliances.
3. Like other wireless systems, Zigbee based communication is prone to attack from unauthorized people.

VI. Conclusion

Zigbee has been demonstrated as a useful answer for minimal effort observing and controlling gadgets. The undertaking shows that actualizing Zigbee arrange convention 802.15.4 with microcontrollers Atmega328 should be possible effectively.

The remote correspondence advances are quickly spreading to numerous new regions including computerization. The significance of the utilization of remote advancements in the information securing, building control, checking frameworks and computerization of assembling procedures will develop. Keen versatile robots and agreeable multi-operator automated frameworks can be effective apparatuses to accelerate hunt and research activities in remote regions.

These robots are additionally valuable to do tasks in regions and in circumstances that are dangerous for human. They can go anyplace that isn't reachable by people and can go into holes and travel through little gaps that are unthinkable for people. In that capacity, the extent of this undertaking to show the effective remote versatile robot route can be additionally improved. The following stage is to manufacture a self-sufficient robot, which can send the natural status, the temperature condition with shrewd obstruction evasion framework.

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