PC Regimented Defense Android using ZIGBEE

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Abstract- This paper focuses on the design and implementation of a supervision robot, the supervision system is indispensible to the robot, which is in charge of controlling the robot and provides interface to the operator. The last decades witness that several correlative robots have been developed successfully with different aims. The robot has a small and solid structure with tracks. Here the system consists of ZIGBEE wireless network to transmit the data to the robot; we can control the directions of the robot by using keys in PC. In robot section we have a wireless camera attached to the robot; this camera will take the videos of the surroundings of the robot in its direction. These videos can be monitored in PC by transmitting with camera transmitter and received by camera receiver attached to the PC. In order to utilize the hardware of the robot, a modular, simple yet robust supervision system has been developed for the robot, and real-time and reliable video transmission architecture has been built to facilitate the Tele operation of the robot. Experimental results both in the building and field show that the robot could achieve the design goal.

Key Terms—search robot, robot design, robot implementation, Supervision system, video transmission architecture

I. Introduction

Using robots in hazardous or dangerous situations can significantly reduce the risk of humans who need to work in such circumstances. The last decades witness that several correlative robots have been developed successfully with different aims. Unfortunately, most robots of this kind are too huge and heavy to carry out search tasks in some narrow areas of city such as narrow aisles of buildings or pipelines of factories. On the other hand, currently in tasks of counterterrorism in city, it is also in urgent desire to search the chassis of vehicle where it is a good place to hide dangerous materials, like bomb, and the risk is quite high for inspector to search the vehicle under such circumstance, but most of existing search robots are unsuitable because of their huge size.

II. The Hardware System Of The Robot

Micro controller: This section forms the control unit of the whole project. This section basically consists of a Microcontroller with its associated circuitry like Crystal with capacitors, Reset circuitry, Pull up resistors (if needed) and so on. The Microcontroller forms the heart of the project because it controls the devices being interfaced and communicates with the devices according to the program being written.

ZIGBEE wireless technology: ZIGBEE is a wireless networking technology. ZIGBEE Technology is a low data rate, low power consumption, low cost; wireless networking protocol targeted towards automation and remote control applications. ZIGBEE Technology is ideal for harsh radio environments in isolated locations.

L293D driver motor: The L293 is an integrated circuit motor driver that can be used for simultaneous, bi-directional control of two small motors. The L293 is limited to 600 mA, but in reality can only handle much small currents unless you have done some serious heat sinking to keep the case temperature down. Unsure about whether the L293 will work with your motor? Hook up the circuit and run your motor while keeping your finger on the chip. If it gets too hot to touch, you can't use it with your motor.

Liquid-crystal display (**LCD**) is a flat panel display, electronic visual display that uses the light modulation properties of liquid crystals. Liquid crystals do not emit light directly. LCDs are available to display arbitrary images or fixed images which can be displayed or hidden, such as preset words, digits, and 7-segment displays as in a digital clock. They use the same basic technology, except that arbitrary images are made up of a large number of small pixels, while other displays have larger elements.

Design of Proposed Hardware System:

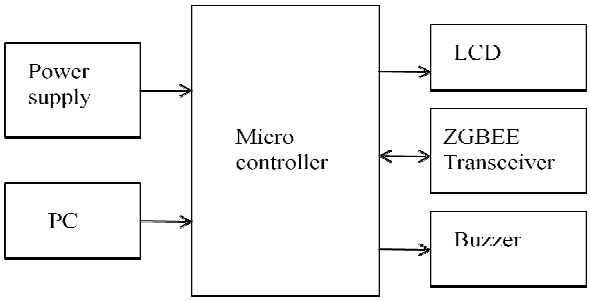

Fig.1.Control section

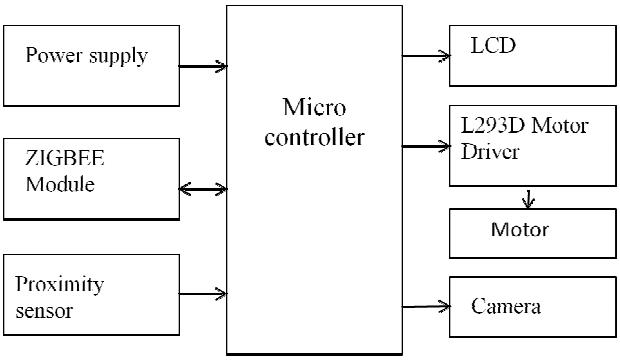

Fig.2.Receiver section

1. In the following design we have a ZIGBEE wireless technology to transmit and receive the data form transmitter section to receiver section.
2. Here we have two sections, control and robot sections. In control section we have PC and ZIGBEE transmitter. In control section we can press the keys in PC to control the directions of robot.
3. The information about the direction is transmitted from control section to robot section using ZIGBEE technology and controller.
4. In robot section we have ZIGBEE receiver and L293D motor drivers. These motor drives are used to move the robot in different directions.
5. From keypad we can give directions like front, back, left, right and stop. The direction of the robot is displayed on LCD.
6. In robot section we have a web camera attached to the robot; this camera will take the videos of the surroundings of the robot in its direction. These videos can be monitored in PC by transmitting with camera transmitter and received by camera receiver attached to the PC.

The electronic system of the Mini-Hunter is modular, including embedded central control module, embedded vision module, embedded motion control module and wireless network module, which is shown in Fig.4. The embedded vision module is a digital camera which connects to the embedded central control module through the USB interface. The embedded motion control module connects to the embedded central control module through the RS232C serial port. It receives motion control commands from the embedded central control module, and then drives the motors in accordance with the commands. The embedded central control module is the core of the whole system. It is a high performance embedded computer system, which collects the data packages from the other modules, controls the motions of the robot. At the same time, it communicates with the human operator system through wireless network module which could transmit about 100m without obstacles based on wireless Ethernet, send back the state information of the robot and receive the control orders from the operator. These two modules are connected by the USB interface to ensure a fast and stable data transfer. Considering the weight of the robot, about 6.1Kg, and its size, two 2-watt DC motors are used to drive the robot with the differential control mode. The power of the robot is completely from the Ni-MH batteries of 24V which stay on the front of the robot and directly drive the motors. The additional power of 12V and 5V are given through DC-DC for the other devices of the robot.

III. Board Hardware Resources Features:

ZIGBEE Technology

ZIGBEE is a low-cost, low-power, wireless mesh network standard. The low cost allows the technology to be widely deployed in wireless control and monitoring applications. Low power-usage allows longer life with smaller batteries. Mesh networking provides high reliability and more extensive range. The technology is intended to be simpler and less expensive than other WPANs such as Bluetooth. ZIGBEE chip vendors typically sell integrated radios and microcontrollers with between 60 KB and 256 KB flash memory. ZIGBEE operates in the industrial, scientific and medical (ISM) radio bands; 868 MHz in Europe, 915 MHz in the USA and Australia, and 2.4 GHz in most jurisdictions worldwide. Data transmission rates vary from 20 to 250 kilobits/second. The ZIGBEE network layer natively supports both star and tree typical networks, and generic mesh networks. Every network must have one coordinator device, tasked with its creation, the control of its parameters and basic maintenance. Within star networks, the coordinator must be the central node. Both trees and meshes allow the use of ZIGBEE routers to extend communication at the network level.

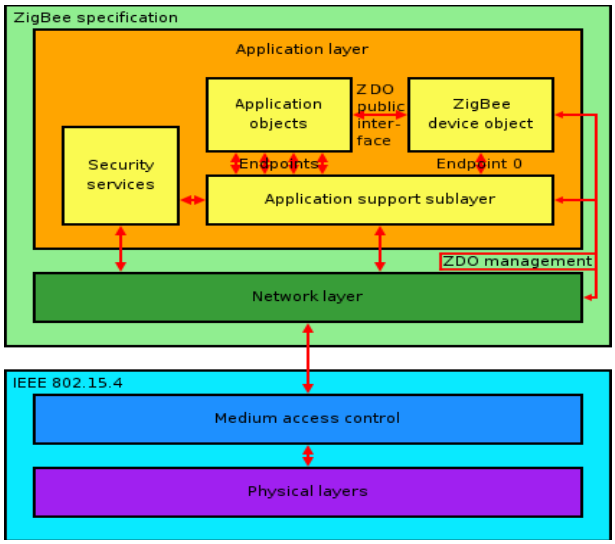

Fig.3.ZIGBEE protocol stack

ZIGBEE builds upon the physical layer and medium access control defined in IEEE standard 802.15.4 (2003 version) for low-rate WPAN's. The specification goes on to complete the standard by adding four main components: network layer, application layer, ZIGBEE *device objects* (ZDO's) and manufacturer-defined application objects which allow for customization and favor total integration. Besides adding two high-level network layers to the underlying structure, the most significant improvement is the introduction of ZDO's. These are responsible for a number of tasks, which include keeping of device roles, management of requests to join a network, device discovery and security.

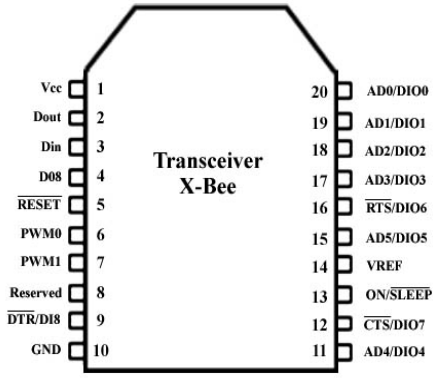

Fig.4.Pin diagram of X-Bee Transceiver

Data is presented to the X-Bee module through its DIN pin, and it must be in the asynchronous serial format, which consists of a start bit, 8 data bits, and a stop bit. Because the input data goes directly into the input of a UART within the X-Bee module, no bit inversions are necessary within the asynchronous serial data stream. All of the required timing and parity checking is automatically taken care of by the X-Bee's UART. Just in case you are producing data faster than the X-Bee can process and transmit it, both X-Bee modules incorporate a clear-to-send (CTS) function to throttle the data being presented to the X-Bee module's DIN pin. You can eliminate the need for the CTS signal by sending small data packets at slower data rates.

Motor Driver (L293D)

A motor driver circuit is designed to drive an electromagnetic load, such as a brushed or brushless motor, stepper motor or a solenoid or relay. Motors typically require voltages and/or currents that exceed what can be provided by the analog or digital signal processing circuitry that controls them. The motor driver provides the interface between the signal processing circuitry and the motor itself. It is essentially the "amplifier" for the motor. Motor drivers can be constructed from discrete components, completely integrated inside an IC, or may employ both discrete and integrated components. When current and voltage levels allow, integration of the entire motor driver inside a single IC generally provides the highest level of functionality and performance at the smallest physical size.

In addition to providing high-voltage and high-current drive, motor drivers also often integrate control circuitry, such as current regulation or digital state machines to operate the motor. Integrated motor drivers from TI also include robust protection schemes, including short-circuit, over current, over temperature, shoot-through and under-voltage protection, to prevent system failures in the event of electrical or mechanical faults.

Wireless camera

Fig.5. Wireless cam

Tiny size for discreet observation and portability Built-in microphone for audio monitoring 4 channels optional to avoid possible interference camera (Effective range:3m) Up to 100m (330ft.) transmission range in open space.

IV. Conclusion

This paper represents a design and implementation of a mini-size search robot, which is mainly used to search the chassis of vehicle and some narrow areas of city for detection of dangerous materials are the mobile platform of the robot. The Mini-Hunter Searches the Chassis of Vehicle has been introduced and analyzed, and the structure of the electronic system of the robot has been given. A friendly and practical human-robot interface has been developed. In order to make the robot system achieve its functionality, a modular, simple yet robust supervision system has been designed. To address the challenge of transmitting video via wireless network with limited bandwidth and unstable condition, real-time and reliable video transmission architecture of the supervision system has been introduced in detail. Finally, two sets of experiments demonstrate that the design and implementation of the robot is reasonable and efficient.

References

[1] G. e. H.W.Stone, ”HAZBOT: A hazardous materials emergency response mobile robot,” in Proceeding of the IEEE International Conference on Robotics and Automation, Nice, France, 1992, pp. 67-73.
[2] B. L. S.Galt, DS Cooke, AA Collie, ”A tele-operated semi-intelligent climbing robot for nuclear application,” in Proceedings of the Fourth Annual Conference on Mechatronics and Machine Vision in Practice 1997, pp. 118-123.
[3] H. H. Liam Cragg, ”Application of Mobile Agents to Robust Teleoperation of Internet Robots in Nuclear Decommissioning,” in Proceesing of IEEE ICIT Maribor, Slovenia, 2003, p. 177301778.
[4] J. B. a. A. S. Yan Guo, ”Designed and Implementation of a Semiautonomous Search Robot,” in Proceeding of the 2009 IEEE: Internationial Conference on Mechatronics and Automation, Changchun, China, 2009, pp. 4621-4626.
[5] (2007). RFC3550. RTP: A Transport Protocol for Real-Time Applications[EB/OL]. Available: http://www.cnpaf.net/Class/Rfcen/0532918542915198.html
[6] Available: http://msdn.microsoft.com/enus/library/dd375454(VS.85).aspx.
[7] Available: http://www.xvid.org/.
[8] Available: http://research.edm.uhasselt.be/jori/jrtplib/jrtplib.html
[9] R. Arkin,”Motor schema based navigation for a mobile robot: An approach to programming by behavior,” in Proceedings of IEEE International Conference on Robotics and Automation Raleign, North Carolina 1987, pp. 264-271.
[10] D. M. W. a. K. K. R.T.Pack, ”A Software Architecture for Integrated Service Robot Development ” in Proceedings of the IEEE International Conference on Systems. Man and Cybernetics, Orlando, 1997,pp.3774-3779.

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