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Implementation of Wireless Sensor Based Smart Vehicle

Vijayasaro V[1] ,Niveathasaro V [2]
[1]*viji.saro17@gmail.com,*[2]*niveathasaro.v@gmail.com*
[1] *Teaching Fellow, EEE Department, Anna University CEG Campus, Chennai.*
[2] *PG scholar, ECE Department, JJ college of engineering and Technology, Thiruchirapalli.*

Abstract

Wireless sensors play an vital role in the applications of real time embedded systems. This paper presents the prototype of robotic vehicle for wireless monitoring and control. The main objective of the paper is to develop a prototype of wireless robotic vehicle using camera monitor remote areas and send information to main location.The smart vehicle can be designed for various application such as agriculture, environmental conditions, such as temperature, sound, vibrations, light, movement, security system in military borders, avoidance of theft, satelites etc. This paper shows how machine intelligence to provide immediate response than humans. Machine intelligence is made by programmed PIC Micro controller. Software implementation have done by CCS Studio using embedded C language.

Index Terms: Robotic vehicle, PIC microcontroller, Wireless Sensors

Introduction

Wireless sensor networks place an important role due to their features and applications. Here in this paper we are using wireless robotic smart vehicle to monitor specific area and responds to Control station. Wireless smart vehicle is used to detectalive humans, fire, harmful gases, metals, obstacles at remote areas and send information to main location. The system uses machine intelligence to provide immediate response from sensors. The robot system is equipped with sensors those can alert the user when some anomaly appears within the range while robot is working.

The main feature of this robot differentiating it from others is execution of versatile tasks in night and rough areas. Robots are used for special applications like handling hazardous situations and tasks that need high accuracy and speed. A danger event is normally happened by the negligence of humans.

The global focus on terrorism and security may have geared up following the 9/11 attacks in the USA. The risk of terrorist attack can perhaps never be eliminated, but sensible steps can be taken to reduce the risk.

Nowadays tracking enemies at different areas are very much difficult for soldiers. There may be a chance of lost of lives of the soldier during war and emergency situations. So the idea is to replace a real soldier with robot soldier.

These definitions do give us a prototype idea about what comprises a robot, which needs to sense the outside world and act accordingly. There are motors, pulleys, gears, gearbox and many more mechanical systems, enabling locomotion. There are ultrasonic & Gas sensor that help the robot to collect information about its environment. There are Processors powered by powerful software that help the robot make decisions by sensing environmental data that is captured and also displays, etc that help the robot interact with humans.

All the above prototype module can be done by Embedded robot with software controlled. It can be operate automatically through intelligent steps of programs.

Literature Survey

We aim to develop a model which will be efficiently used to minimize terrorist causality. Nowadays wireless networks used for variety of application including humans day to day life needs as one of the electronic goods. Being able to achieve reliable long distance communication with user-friendly robot control is an important open area of research to robotics.

Automotive Ultrasonic Distance Measurement for Park Assist Systems.Author: ValeriyKyrynyuk, Ben Kropf, Balaji M V Ultrasonic parking assistance (UPA) systems are increasingly popular in cars because they enhance safety and driver convenience, especially in large cities. This application note shows you how to create an ultrasonic distance measurement system using enclosed ultrasonic transducers, which are typical in automotive applications.

A review of gas sensors employed in electronic nose applications K. Arshak, E. Moore, G.M. Lyons, J. Harris and S. Clifford are all based at the College of Informatics and Electronics, University of Limerick. The human nose has been used as an analytical tool in many industries to measure the quality ofperfumes and also cosmetic and chemical products. It is commonly used for assessing quality through odour and this I carried out using sensory panels where a group of people fills out questionnaires on the smells associated with the substance being analyzed.

Wireless Gesture Control Robot: An Analysis Monika Jain, Aditi, AshwaniLohiya, Mohammad Fahad Khan, AbhishekMauryaToday human-machine interaction is moving away from mouse and pen and is becoming pervasive and much morecompatible with the physical world. With each passing day the gap between machines and humans is being reduced with the introduction of new technologies to ease the standard of living.

Block Diagram

This project mainly focuse on security purpose. Sensor networks uses to detect parameters like human presence, harmful gases, pistols, bombs, mines, fire etc at remote areas. This whole robotic vehicle system works in two modes. First one is automatic mode and the other is user controllable mode. RF Camera is used to capture the real time video of monitoring environment. The real time video is transmitted to remote monitoring station through wireless RF transmitter which is connected with controller through UART. In automatic mode, Ultrasonic sensor is used to detect obstacle and also measure the distance from obstacles. The output of this is in the form of serial data in user controllable mode, user sends the signal to robotic vehicle using ZIGBEE which is connected with controller through UART and controls it manually. User could watch the surroundings through wireless camera built in the robotic vehicle and gives directions to change the path accordingly.

Implementation of algorithms made for user side and vehicle side are different. They are written in embedded C language. The algorithm for the robot vehicle side for automatic mode and user side is written in such a way that it can take its own decisions and user can control it manually when needed and can place it in an automatic mode for default operations.

The main hardware components for this paper mentioned below

- PIC Micro controller
- 12V 1A Rechargeable Battery
- Max 232 Communication
- Zigbee Transceiver
- DC Motor
- Robot Module
- Ultra Sonic Sensor
- Gas Sensor

This section describes the detailed block diagram for both the robot section and the control and monitoring section with the operations of the different units respectively.In this project microcontroller is the heart of the whole system.The main advantage of CMOS and RISC combination is low power consumption resulting in a very small chip size with a small pin count.

The main advantage of CMOS is that it has immunity to noise than other fabrication techniques. Various microcontrollers offer different kinds of memories. EEPROM, EPROM, FLASH etc. are some of the memories of which FLASH is the most recently developed. Technology that is used in pic16F877 is flash technology, so that data is retained even when the power is switched off. Easy Programming and Erasing are other features of PIC 16F877.

ZigBee is used in applications that require only a low data rate, long battery life, and secure networking. ZigBee has a defined rate of 250 kbit/s, best suited for periodic or intermittent data or a single signal transmission from a sensor or input device.

For ultrasonic sensor we are using Ping sensor. The Ping sensor is a device you can use with the BASIC Stamp to measure the distance of the object. With a range of 3

centimeters to 3.3 meters, it can be used for any robotic applicatications. It's also remarkably accurate, easily detect ing an object's distance down tothehalfcentimeter.

MQ-6 gas sensor has high senility to Propane, Butane and LPG, also response to Natural gas. The sensor could be used to detect different combustible gas, especially Methane, it is with low cost and suitable for different application.

Robot Section

The Robot section mainly for the purpose of monitoring action by using ultrasonic and gas sensors output microcontroller detects the obstacles and take the picture of obstacles/humans using RF camera and sends the information to control section. The Microcontroller uses Zigbee technology to transfer data. For vehicle movement here we are using DC motor as Relay Board.

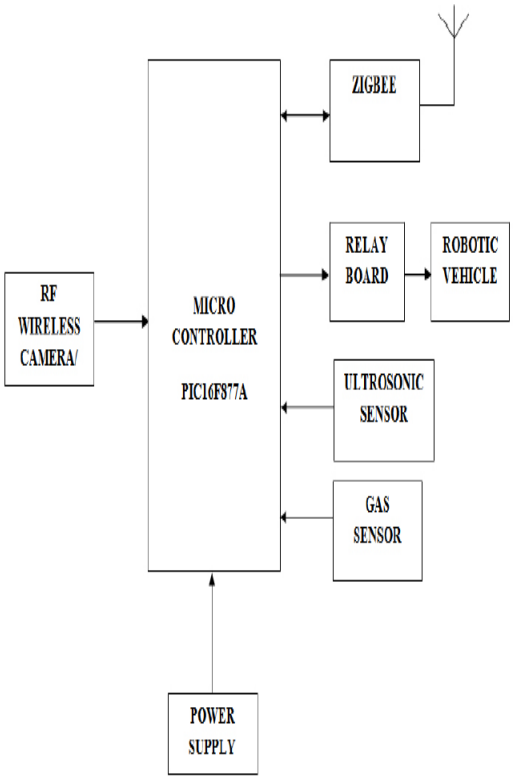

Figure 3.1: Robot Section

Control Section

In Control section, it receives data from the monitoring area through Zigbee technology to Laptop/Pc using MAX-232. Here human who are receiving data in laptop decides robot mode and send the mode to robot section**.** MAX-232 is a standard for serial binary data interconnection between a Data terminal equipment and a Data Circuit-terminating Equipment. It is commonly used in computer serial ports.

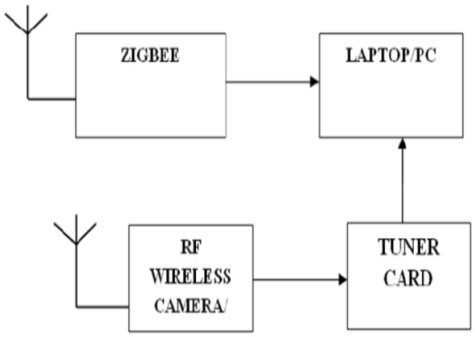

Figure 3.2: Control Section

Results and Discussions

In this paper we are using code composer Studio using IDE.Code Composer Studio comprises a suite of tools used to develop and debug embedded applications. It includes an optimizing C/C++ compiler, source code editor, project build environment, debugger, profiler, and many other features.

Intelligent and highly optimized CCS C compilers contain Standard C operators and Built-in Function libraries that are specific to PIC registers, providing developers with a powerful tool for accessing device hardware features from the C language level. Standard C preprocessors, operators and statements can be combined with hardware specific directives and CCS provided built-in functions and example libraries to quickly develop applications incorporating leading edge technologies such as capacitive touch, wireless and wired communication, motion and motor control and energy management.

Pic Boot Loader Output

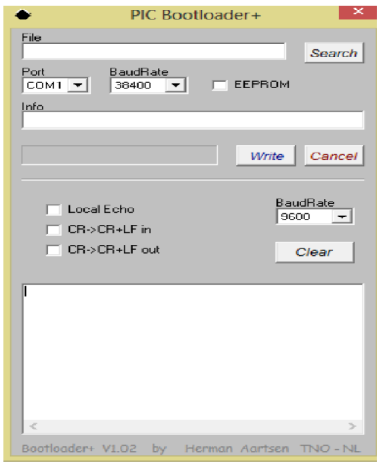

Figure 4.1: PIC Boot Loader Output

In this fig 4.1 PIC Boot loader output window displays the various conditions present in the system. It tells us whether the robot is in automatic mode or user controllable mode and whether the gas detector is working or not.

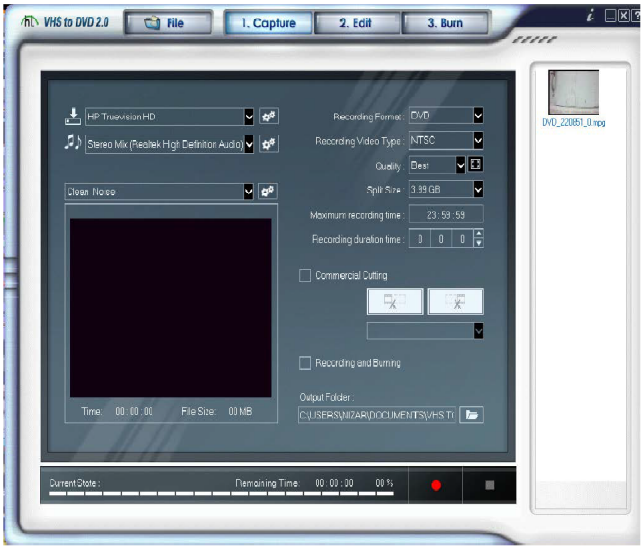

Figure 4.2: Video Screen

In this fig 4.2 video screen views the real time feed of the movements captured by the robot's camera.

Prototype

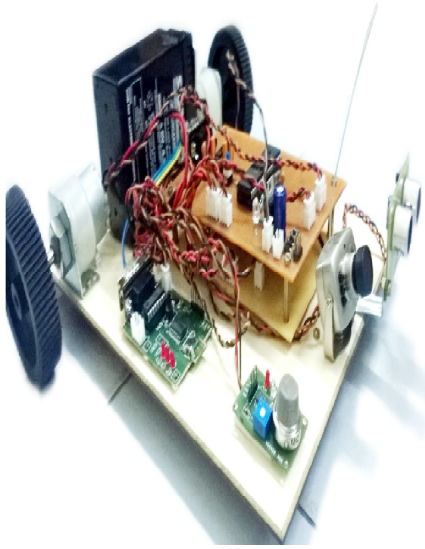

Figure 4.3: Prototype

This fig 4.3 shows that the prototype of Wireless controlled smart Robotic vehicle used for variety of security applications..

Conclusion and Future Work

Thus, we have implemented the multipurpose smart robotic vehicle using wireless camera. The two types of operating modes such as automatic mode and user controllable mode were verified by using this robotic vehicle system. The algorithm for the robot vehicle side and user side for automatic mode was written and verified to take its own decisions and control manually for default operations. We have used the RF camera to capture the real time video of monitoring the environment in which the real time video was transmitted to the remote monitoring system through the RF wireless transmitter. In automatic mode the ultrasonic sensor was used to detect obstacle and also measure the distance from the respective obstacles. Thus we could watch the surroundings through the wireless camera built in the robotic vehicle and gives directions to change the path accordingly.

We propose some changes in the design of prototype to become more efficient and reduce power consumption by using MSP430 Microcontroller instead of PIC Microcontroller. Also we use solar energy instead of electrical battery.

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