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NEXT GENERATION WAR FIELD ROBOT

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Abstract

The advent of new high-speed technology and the growing computer Capacity provided realistic opportunity for new robot controls and realization of new methods of control theory. This technical improvement together with the need for high performance robots created faster, more accurate and more intelligent robots using new robots control devices, new drives and advanced control algorithms. This project describes a new economical solution of robot control systems. The presented robot control system can be used for different sophisticated robot applications.

KEY WORDS:

robot controls and realization , control algorithms , sophisticated robot .

I.INTRODUCTION

The project aims in designing a robot which is capable of detecting human beings and land mines in its path and which is wirelessly controlled through PC using Zigbee technology and the live images of the war field can be seen on the TV. This robot also shoots using the laser light. It is a very low cost robot used to monitor the Warfield. The robot can be moved in all the directions using the PC wirelessly.

Zigbee is a PAN technology based on the IEEE 802.15.4 standard. Unlike Bluetooth or wireless USB devices, Zigbee devices have the ability to form a mesh network between nodes. Meshing is a type of daisy chaining from one device to another. This technique allows the short range of an individual node to be expanded and multiplied, covering a much larger area.

The controlling device of the whole system is a Microcontroller. Whenever the user presses a button in the PC, the data related to that button is sent through Zigbee module interfaced to PC. This data will be received by the Zigbee module in the robot system and feds this to Microcontroller which judges the relevant task to the information received and acts accordingly. The live images from the camera in the robot system can be sent to TV through AV system. Whenever, land mines are detected, it alerts through buzzer alarm system. The Microcontrollers used in the project are programmed using Embedded C language.

This project utilizes two DC Motors respectively. The DC motor generates torque directly from DC power supplied to the motor by using internal commutation, stationary permanent magnets, and rotating electrical magnets. It works on the principle of Lorentz force, which states that any current carrying conductor placed within an external magnetic field experiences a torque or force known as Lorentz force. Advantages of a brushed DC motor include low initial cost, high reliability, and simple

control of motor speed. Disadvantages are high maintenance and low life-span for high intensity uses.

Maintenance involves regularly replacing the brushes and springs which carry the electric current, as well as cleaning or replacing the commutator. These components are necessary for transferring electrical power from outside the motor to the spinning wire windings of the rotor inside the motor.

The driver used for DC Motors is L293D. The Device is a monolithic integrated high voltage, high current four channel driver designed to accept standard DTL or TTL logic levels and drive inductive loads (such as relays solenoids, DC and stepping motors) and switching power transistors. This project makes use of a micro controller, which is programmed, with the help of embedded C instructions. This Microcontroller is capable of communicating with input and output modules. The controller is interfaced with dc motors, which are fixed to the Robot to control the direction of the Robot.

OVERVIEW

An embedded system is a combination of software and hardware to perform a dedicated task. Some of the main devices used in embedded products are Microprocessors and Microcontrollers.

Microprocessors are commonly referred to as general purpose processors as they simply accept the inputs, process it and give the output. In contrast, a microcontroller not only accepts the data as inputs but also manipulates it, interfaces the data with various devices, controls the data and thus finally gives the result.

The War field robot using 16F877A Microcontroller is an exclusive project that can move the robot according to the instructions given by Computer and also alerts through buzzer when any metal is being detected by it. It also alerts when any human beings are near by using PIR sensor.

HARDWARE DESCRIPTION

The block diagram of the project and design aspect of independent modules are considered. Block diagram is shown in fig: 1:

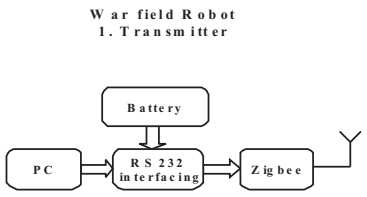

FIG .1: Block diagram of War field robot

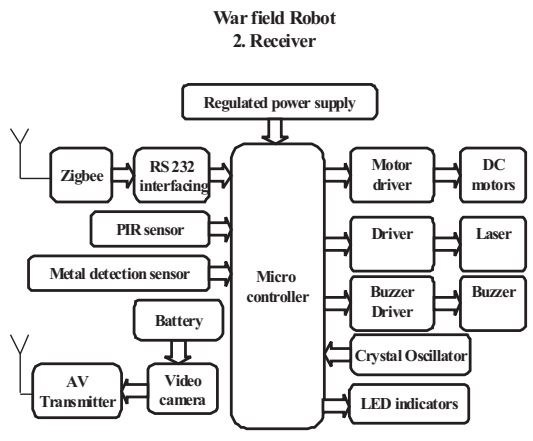

FIG 2: Block diagram of War field robot

War field Robot
3. AV Receiver

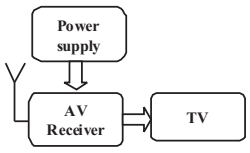

FIG 3: Block diagram of War field robot

The main blocks of this project are:

Micro controller (16F877A)
Reset button
Crystal oscillator
Regulated power supply (RPS)
Led indicator
RS232 cable
Zigbee module
Metal detection sensor
PIR sensor
Buzzer
Laser
DC Motors
DC motors drivers
Video camera

Micro controller: Circumstances that we find ourselves in today in the field of microcontrollers had their beginnings in the development of technology of integrated circuits. This development has made it possible to store hundreds of thousands of transistors into one chip. That was a prerequisite for production of microprocessors, and the first computers were made by adding external peripherals such as memory, input-output lines, timers and other. Further increasing of the volume of the package resulted in creation of integrated circuits. These integrated circuits contained both processor and peripherals. That is how the first chip containing a microcomputer, or what would later be known as a microcontroller came about.

The microcontroller used in this project is PIC16F877A. The PIC families of microcontrollers are developed by Microchip Technology Inc. Currently they are some of the most popular microcontrollers, selling over 120 million devices each year. There are basically four families of PIC microcontrollers

Crystal oscillator: The crystal oscillator speed that can be connected to the PIC microcontroller range from DC to 20Mhz. Using the CCS C compiler normally 20Mhz oscillator will be used and the price is very cheap. The 20 MHz crystal oscillator should be connected with about 22pF capacitor. Please refer to my circuit schematic.

There are 5 input/output ports on PIC microcontroller namely port A, port B, port C, port D and port E. Each port has different function. Most of them can be used as I/O port

REGULATED POWER SUPPLY: Power supply is a supply of electrical power. A device or system that supplies electrical or other types of energy to an output load or group of loads is called a power

supply unit or PSU. The term is most commonly applied to electrical energy supplies, less often to mechanical ones, and rarely to others.

A power supply may include a power distribution system as well as primary or secondary sources of energy such asConversion of one form of electrical power to another desired form and voltage, typically involving converting AC line voltage to a well-regulated lower-voltage DC for electronic devices. Low voltage, low power DC power supply units are commonly integrated with the devices they supply, such as computers and household electronics

RS232 : means recommended standard, it is a cable in which serial communications can be done. Information being transferred between data processing equipment and peripherals is in the form of digital data which is transferred in either a serial or parallel mode. Parallel communications are used mainly for connections between test instruments or computers and printers, while serial is often used between computer and other peripherals.

Serial transmission involves the sending of data one bit at a time, over single communications line. In contrast, parallel communications require at least as many lines as there are bits in a word being transmitted (for an 8-bit word, a minimum of 8 lines are needed) serial transmission is beneficial for long distance communications, where as parallel is designed for short distance or when very high transmission rates are required.

MAX232 integrated circuit: A MAX232 IC has a set of four external capacitors of the specification 1 microfarad .This IC is basically transceiver IC alike to assart chip used in data communicating devices like modem, drivers and other electronic system devices .The capacitance can have a deviation of up to 0.1 microfarad.

The Maxim MAX232 communications interface IC is used to convert +5 volt TTL or CMOS levels to RS232 levels. The dual level 10 volt signals are derived from the +5 volt power supply via charge pump circuitry. This feature eliminates the +/- 12V rails that used to be required with older technology devices such as the old industry standard 1488 and 1489 chips

The MAX232 from Maxim was the first IC which in one package contains the necessary drivers (two) and receivers (also two), to adapt the RS-232 signal voltage levels to TTL logic. It became popular, because it just needs one voltage (+5V) and generates the necessary RS-232 voltage levels (approx. -10V and +10V) internally. This greatly simplified the design of circuitry. Circuitry designers no longer need to design and build a power supply with three voltages (e.g. -12V, +5V, and +12V), but could just provide one +5V power supply, e.g. with the help of a simple 78x05 voltage converter.

Zigbee technology: ZigBee is an established set of specifications for wireless personal area networking (WPAN), i.e., digital radio connections between computers and related devices. This kind of network eliminates use of physical data buses like USB and Ethernet cables. The devices could include telephones, hand-held digital assistants, sensors and controls located within a few meters of each other.

ZigBee is one of the global standards of communication protocol formulated by the relevant task force under the IEEE 802.15 working group. The fourth in the series, WPAN Low Rate/ZigBee is the newest and provides specifications for devices that have low data rates, consume very low power and are thus characterized by long battery life. Other standards like Blue tooth and IrDA address high data rate applications such as voice, video and LAN communications.

The ZigBee Alliance has been set up as “an association of companies working together to enable reliable, cost-effective, low-power, wirelessly networked, monitoring and control products based on an open global standard”.

Once a manufacturer enrolls in this Alliance for a fee, he can have access to the standard and implement it in his products in the form of ZigBee chipsets that would be built into the end devices. Philips, Motorola, Intel, HP are all members of the Alliance. The goal is “to provide the consumer with ultimate flexibility, mobility, and ease of use by building wireless intelligence and capabilities into every day devices.

ZigBee technology will be embedded in a wide range of products and applications across consumer, commercial, industrial and government markets worldwide. For the first time, companies will have a standards-based wireless platform optimized for the unique needs of remote monitoring and

control applications, including simplicity, reliability, low-cost and low-power".

The target networks encompass a wide range of devices with low data rates in the Industrial, Scientific and Medical (ISM) radio bands, with building-automation controls like intruder/fire alarms, thermostats and remote (wireless) switches, video/audio remote controls likely to be the most popular applications. So far sensor and control devices have been marketed as proprietary items for want of a standard. With acceptance and implementation of ZigBee, interoperability will be enabled in multi-purpose, self-organizing mesh networks

Metal detection Sensor SM12:A metal detector is a device which responds to metal that may not be readily apparent.

The simplest form of a metal detector consists of an oscillator producing an alternating current that passes through a coil producing an alternating magnetic field. If a piece of electrically conductive metal is close to the coil, eddy currents will be induced in the metal, and this produces an alternating magnetic field of its own. If another coil is used to measure the magnetic field (acting as a magnetometer), the change in the magnetic field due to the metallic object can be detected The first industrial metal detectors were developed in the 1960s and were used extensively for mining and other industrial applications.

Uses include de-mining (the detection of land mines), the detection of weapons such as knives and guns, especially in airport security, geophysical prospecting, archaeology and treasure hunting. Metal detectors are also used to detect foreign bodies in food, and in the construction industry to detect steel reinforcing bars in concrete and pipes and wires buried in walls and floors.Industrial metal detectors are used in the pharmaceutical, food, beverage, textile, garment, plastics, chemicals, lumber, and packaging industries.

Contamination of food by metal shards from broken processing machinery during the manufacturing process is a major safety issue in the food industry. Metal detectors for this purpose are widely used and integrated into the production line.

Current practice at garment or apparel industry plants is to apply metal detecting after the garments are completely sewn and before garments are packed to check whether there is any metal contamination (needle, broken needle, etc.) in the garments. This needs to be done for safety reasons.

Working of PIR sensor:PIR sensors are more complicated than many of the other sensors explained in these tutorials (like photocells, FSRs and tilt switches) because there are multiple variables that affect the sensors input and output. To begin explaining how a basic sensor works, we'll use the rather nice diagram below (if anyone knows where it originates plz let me know).

The PIR sensor itself has two slots in it, each slot is made of a special material that is sensitive to IR. The lens used here is not really doing much and so we see that the two slots can 'see' out past some distance (basically the sensitivity of the sensor). When the sensor is idle, both slots detect the same amount of IR, the ambient amount radiated from the room or walls or outdoors.

When a warm body like a human or animal passes by, it first intercepts one half of the PIR sensor, which causes a positive differential change between the two halves when the warm body leaves the sensing area, the reverse happens, whereby the sensor generates a negative differential change. These change pulses are what is detected.

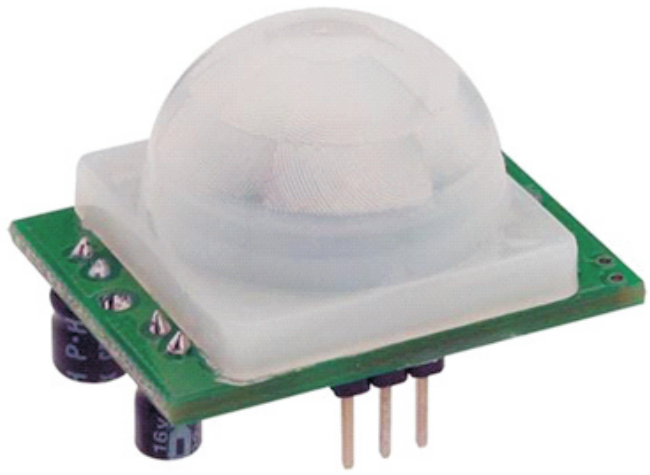

Fig: PIR sensor

Buzzer: Basically, the sound source of a piezoelectric sound component is a piezoelectric diaphragm. A piezoelectric diaphragm consists of a piezoelectric ceramic plate which has electrodes on both sides and a metal plate (brass or stainless steel, etc.). A piezoelectric ceramic plate is attached to a metal plate with adhesives. Applying D.C. voltage between electrodes of a piezoelectric diaphragm causes mechanical distortion due to the piezoelectric effect. For a misshaped piezoelectric element, the distortion of the piezoelectric element expands in a radial direction. And the piezoelectric diaphragm bends toward the direction. The metal plate bonded to the piezoelectric element does not expand. Conversely, when the piezoelectric element shrinks, the piezoelectric diaphragm bends in the direction Thus, when AC voltage is applied across electrodes, the bending is repeated, producing sound waves in the air.

To interface a buzzer the standard transistor interfacing circuit is used. Note that if a different power supply is used for the buzzer, the 0V rails of each power supply must be connected to provide a common reference.

If a battery is used as the power supply, it is worth remembering that piezo sounders draw much less current than buzzers. Buzzers also just have one 'tone', whereas a piezo sounder is able to create sounds of many different tones.

To switch on buzzer -high 1
To switch off buzzer -low 1

Notice (Handling) In Using Self Drive Method

1) When the piezoelectric buzzer is set to produce intermittent sounds, sound may be heard continuously even when the self drive circuit is turned ON / OFF at the "X" point shown in Fig. 9. This is because of the failure of turning off the feedback voltage.
2) Build a circuit of the piezoelectric sounder exactly as per the recommended circuit shown in the catalog. Hfe of the transistor and circuit constants are designed to ensure stable oscillation of the piezoelectric sounder.
3) Design switching which ensures direct power switching.
4) The self drive circuit is already contained in the piezoelectric buzzer. So there is no need to prepare another circuit to drive the piezoelectric buzzer.
5) Rated voltage (3.0 to 20Vdc) must be maintained. Products which can operate with voltage higher than 20Vdc are also available.
6) Do not place resistors in series with the power source, as this may cause abnormal oscillation. If a resistor is essential to adjust sound pressure, place a capacitor (about 1μF) in parallel with the piezo buzzer.

7) Do not close the sound emitting hole on the front side of casing.
8) Carefully install the piezo buzzer so that no obstacle is placed within 15mm from the sound release hole on the front side of the casing.

Fig: Picture of buzzer

LASER

A laser is a device that emits light (electromagnetic radiation) through a process of optical amplification based on the stimulated emission of photons. The term "laser" originated as an acronym for Light Amplification by Stimulated Emission of Radiation.[1][2] The emitted laser light is notable for its high degree of spatial and temporal coherence, unattainable using other technologies. Spatial coherence typically is expressed through the output being a narrow beam which is diffraction-limited, often a so-called "pencil beam." Laser beams can be focused to very tiny spots, achieving a very high irradiance. Or they can be launched into a beam of very low divergence in order to concentrate their power at a large distance.

Temporal (or longitudinal) coherence implies a polarized wave at a single frequency whose phase is correlated over a relatively large distance (the coherence length) along the beam.[3] A beam produced by a thermal or other incoherent light source has an instantaneous amplitude and phase which vary randomly with respect to time and position, and thus a very short coherence length.

Most so-called "single wavelength" lasers actually produce radiation in several modes having slightly different frequencies (wavelengths), often not in a single polarization. And although temporal coherence implies monochromatic, there are even lasers that emit a broad spectrum of light, or emit different wavelengths of light simultaneously. There are some lasers which are not single spatial mode and consequently their light beams diverge more than required by the diffraction limit. However all such devices are classified as "lasers" based on their method of producing that light: stimulated emission Lasers are employed in applications where light of the required spatial or temporal coherence could not be produced using simpler technologies.

Fig: Diagram of laser module

D.C. Motor

The DC motor you will find in modem industrial applications operates very similarly to the simple DC motor described earlier in this chapter. Figure 12-9 shows an electrical diagram of a simple DC motor. Notice that the DC voltage is applied directly to the field winding and the brushes. The armature and the field are both shown as a coil of wire. In later diagrams, a field resistor will be added in series with the field to control the motor speed.

When voltage is applied to the motor, current begins to flow through the field coil from the negative terminal to the positive terminal. This sets up a strong magnetic field in the field winding. Current also begins to flow through the brushes into a commentator segment and then through an armature coil. The current continues to flow through the coil back to the brush that is attached to other end of the coil and returns to the DC power source. The current flowing in the armature coil sets up a strong magnetic field in the armature.

Fig DC Motor

SOFTWARE DESCRIPTION

This project is implemented using following software's:

Express PCB – for designing circuit
PIC C compiler - for compilation part
Proteus 7 (Embedded C) – for simulation part

Express PCB is a software tool to design PCBs specifically for manufacture by the company Express PCB (no other PCB maker accepts Express PCB files). It is very easy to use, but it does have several limitations.

It can be likened to more of a toy then a professional CAD program.
It has a poor part library (which we can work around)
It cannot import or export files in different formats
It cannot be used to make prepare boards for DIY production

Express PCB has been used to design many PCBs (some layered and with surface-mount parts. Print out PCB patterns and use the toner transfer method with an Etch Resistant Pen to make boards. However, Express PCB does not have a nice print layout. Here is the procedure to design in Express PCB and clean up the patterns so they print nicely.

PIC Compiler:

PIC compiler is software used where the machine language code is written and compiled. After compilation, the machine source code is converted into hex code which is to be dumped into the microcontroller for further processing. PIC compiler also supports C language code.

It's important that you know C language for microcontroller which is commonly known as Embedded C. As we are going to use PIC Compiler, hence we also call it PIC C. The PCB, PCM, and PCH are separate compilers. PCB is for 12-bit opcodes, PCM is for 14-bitopcodes, and PCH is for 16-bit opcode PIC microcontrollers. Due to many similarities, all three compilers are covered in this reference manual. Features and limitations that apply to only specific microcontrollers are indicated within. These compilers are specifically designed to meet the unique needs of the PIC microcontroller. This allows developers to quickly design applications software in a more readable, high-level language. When compared to a more traditional C compiler, PCB, PCM, and PCH have some limitations. As an example of the limitations, function recursion is not allowed.

This is due to the fact that the PIC has no stack to push variables onto, and also because of the way the compilers optimize the code. The compilers can efficiently implement normal C constructs, input/output operations, and bit twiddling operations. All normal C data types are supported along with pointers to constant arrays, fixed point decimal, and arrays of bits.

PIC C is not much different from a normal C program. If you know assembly, writing a C program is not a crisis. In PIC, we will have a main function, in which all your application specific work will be defined. In case of embedded C, you do not have any operating system running in there. So you have to make sure that your program or main file should never exit. This can be done with the help of simple while (1) or for (;;) loop as they are going to run infinitely.

We have to add header file for controller you are using, otherwise you will not be able to access registers related to peripherals.

#include <16F877A.h> // header file for PIC 16F877A//

Proteus:

Proteus is software which accepts only hex files. Once the machine code is converted into hex code, that hex code has to be dumped into the microcontroller and this is done by the Proteus. Proteus is a programmer which itself contains a microcontroller in it other than the one which is to be programmed. This microcontroller has a program in it written in such a way that it accepts the hex file from the pic compiler and dumps this hex file into the microcontroller which is to be programmed. As the Proteus programmer requires power supply to be operated, this power supply is given from the power supply

circuit designed and connected to the microcontroller in proteus. The program which is to be dumped in to the microcontroller is edited in proteus and is compiled and executed to check any errors and hence after the successful compilation of the program the program is dumped in to the microcontroller using a dumper.

Advantages:

1.Detection of metals in mines.
2.This Robot can be operated from anywhere in the world.
3.Fast response.
4.Efficient and low cost design.
5.Low power consumption.

Disadvantages:

1.The quality of tone received depends on the network signal strength.
2.Status and feed back of robot is not obtained.
3.Limited distance.

Applications:

1.It can be used in places where humans cannot work.
2.Mainly in military applications, robots play a vital role for detection of explosives.
3.Can be used to detect metals.
4.Can be used in mines.

5.Result

The project "War field robot" was designed such that the robot can be operated using PC which is capable of detecting human beings and land mines in its path and which is wirelessly controlled through PC using Zigbee technology and the live images of the war field can be seen on the TV. This robot also shoots using the laser light. It is a very low cost robot used to monitor the Warfield. The robot can be moved in all the directions using the PC wirelessly.

CONCLUSION

Integrating features of all the hardware components used have been developed in it. Presence of every module has been reasoned out and placed carefully, thus contributing to the best working of the unit. Secondly, using highly advanced IC's with the help of growing technology, the project has been successfully implemented. Thus the project has been successfully designed and tested.

Future Scope

Our project "War field robot" is mainly intended to operate a robot using PC. The system also to detects the metallic presence and the PIR sensor detects any human presence in its way and if any human presence is being detected it stops and buzzers an alarm system. The micro controller is programmed in such a way that the depending on the pressed key the robot will move intelligently and with the help of metal detection sensor it detects the presence of metallic objects in mines and alerts through buzzer alarm system.

The drawback of this project is that the status of robot is not known. This can eliminate by having a GSM module, which gives the status of robot working. We can also add Ultrasonic module, which is used for obstacle detection with GSM module which gives respective information.

By connecting wireless camera to the robot, then we can see the outer world from our personal computer only by using GPRS and GPS. We can use this robot at so many fields and we can use to handle

so many situations.

By connecting bomb detector to the robot, we can send it to anywhere i.e (battle field, forests, coal mines, to anyplace) by using our personal computer and we can able to detect the bomb at field, here sensor detects the bomb and gives information to micro controller and it gives the information to transceiver and it sends the information to the personal computer.

By connecting temperature sensor to the robot we can get the temperature of dangerous zones in personal computer itself instead of sending human to there and facing problems at field we can send robot to there and sensor will detect the temperature and it gives information to the micro controller and micro controller gives the information to the transceiver from that we can get the data at pc side. By connecting smoke sensor to the robot we can get the information related concentration of smoke or gases in respective field's i.e. (coal mines, dangerous zones, etc). sensor sense the information and it give to the micro controller and it gives to the transceiver and from that we get the information in personal computer.

By connecting corresponding instruments to the robot we can use it in agriculture for farming purpose. This robot can move either forward and backward and left and right depend upon our instructions so we can do some part of agriculture from pc only by using robot.

By connecting firing instrument and wireless camera to the robot we can fire the target from pc. Here by using camera we can see the opposite target and we can fire the target from personal computer by pressing selected button and we can easily handle the situations like Mumbai terrorist's attack without loss of human life's and we can decrease our soldiers effort too.

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