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SPY-Robot based on ZIGBEE

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Abstract
The wireless communication technology is frequently spreading to many recent areas, counting the automation and significance of the utilization of the wireless technology in the data recovery, assembly control, tracking systems and thus the computerization of manufacturing process will grow. Intelligent mobile robot and indulging multi- agent robotic system can proved to be extremely efficient tool for speeding up the search and the research operation in distant areas. Robots are also convenient to do the jobs in the areas and in conditions that are disastrous for human beings. They can move anywhere which is unable to reach for humans and can enter into the gaps, also move through tiny holes that are impossible for human beings and even trained dogs. Our main aim in the following project is to build a computer controlled robot, which is able to send the status of the environment, the temperature conditions, and if any obstacle on its path is found, and the obstacle that is found in any distant place that is not accessible by the human beings then it can be controlled by ZIGBEE. The project uses regulated power supply of 5V, 750mA. A 7805 3- terminal voltage regulator has been used for the voltage regulation. The bridge type full wave rectifier is also used for rectifying the ac o/p of secondary of 230/18V transformer. Thereby is used in large number of applications such as military and firing. It have many advantages like easy to handle and less power consumption.

Keywords: SPY-Robot, ZIGBEE

1. Introduction
Espionage, Surveillance or spying requires one's extracting data that is supposed confidential or secretive needing the authorization of the information holder. Spying area in the military ground where the enemy stay can be noticed before taking any other action. A robot is basically a mechanical or virtual artificial agent. In actual, it is generally an electro-mechanical system that, just by its movements or appearance can convey any sense that it is intent or agency of its have. The Spy Robot is tiny robot along with a camera attached to itself. The main parts are –

1. The Body Of Robot
2. Camera.

The body of robot comprises of two wheels connected to geared motors. The motors will run by the relays which will then controlled by a pc or laptop through ZIGBEE. Our idea in making the following project is to design a wireless controllable robotic vehicle that can be controlled in a range of 40 meters using the ZIGBEE transmitter/receiver. Wireless camera can be used to transmit live pictures and the videos remotely. The SPYBOT is basically a robot which is controllable from anywhere in/around the network area. It is one of its main advantage of using ZIGBEE in the following project [2].

1.1 Main Features of Project
1. Effective implementation
2. Compact size and Low power consumption.
3. Control range is long due the use of RF device.
4. Robot can be monitored from a distant area (no need of 'LOS' arrangement).
5. Manoeuvring the path evading obstacles by its own.
6. Detection of land mine [5].

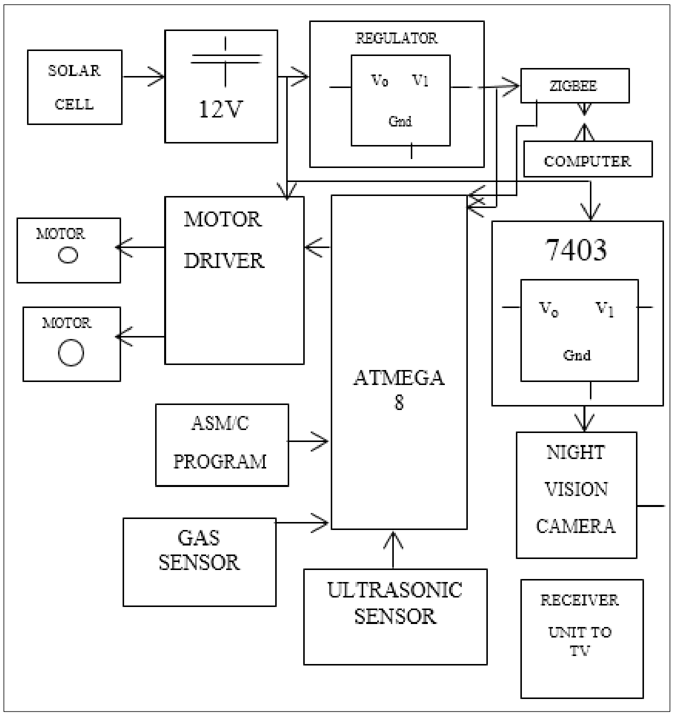

Fig 1: Block Diadram

2. Design Details
It consists of following parts:

2.1 ATMEGA8
The AVR core integrates an instruction set alongwith 32 general purpose registers. All these 32 registers are connected directly to the Arithmetic Logical Unit (ALU), enabling 2 independent registers to be retrieved in 1 single instruction

that is to be executed in 1 clock cycle. The architecture so obtained is more code efficient at the time of achieving throughputs which is up to 10 times faster than the conventional CISC microcontrollers [8].

The features provided by the ATmega8 are following:

1. 8K Bytes In-System Programmable Flash With Read-While-Write Capability
2. 512 Bytes EEPROM
3. 1K Byte SRAM
4. 23 General Purpose Input/Output Lines
5. 32 General Purpose Registers
6. 3 Flexible Timer or Counters With Compare Modes
7. Internal & External Interrupts
8. Serial Programmable USART
9. Byte Oriented Two wire Serial Interface
10. 6-Channel ADC
11. Programmable Watchdog Timer With Internal Oscillator
12. SPI Serial Port
13. Five Software Selectable Power Saving Modes.

The idle mode stops the CPU while allowing the Timer or Counters, SRAM, SPI port, and interrupt system to continue functioning. The Power down mode protects or save the register contents but freezes Oscillator, thus disabling other chip function till the next Interrupt or the Hardware Reset. In the Power-save mode, asynchronous timer continues running, allowing user to maintain the timer base when the rest of the device is sleeping [1]. The Analog to Digital Converter Noise Reduction mode stops CPU and all Input/Output modules except the asynchronous timer and Analog to Digital Converter, to reduce switching noise at the time of ADC conversions. In the Standby mode, the crystal or resonator Oscillator runs when the rest of the device sleeps. And thus this allows very fast start-up which is combined with low-power consumption.

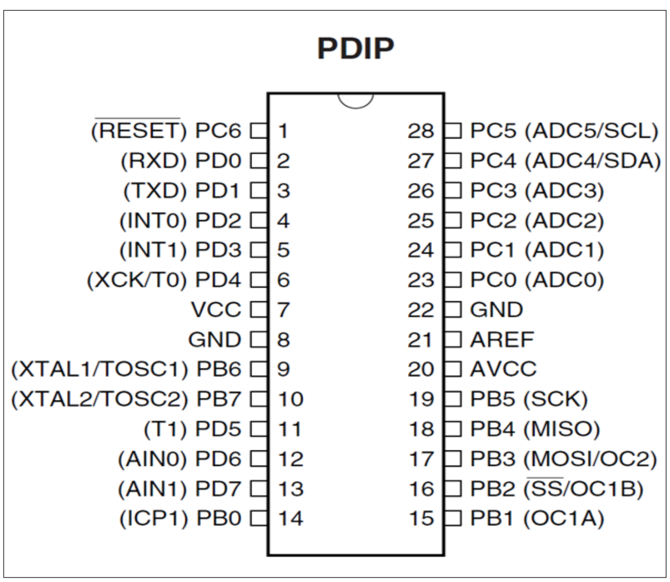

Fig 2: ATMEGA8

2.2 Zigbee

ZIGBEE's wireless networking standard which is aimed for remote control and the sensor applications and is suitable for the operation in the harsh radio environments and also in the isolated locations. ZIGBEE technology is implemented on the IEEE standard 802.15.4 that defines the MAC and physical layers. On the top of this, ZIGBEE also defines security and the application layer specifications which enables the interoperability between the products from distinct manufacturers. Thus in this way ZIGBEE's a superset of the 802.15.4 specification [3]. Along with the application for control and remote wireless sensing growing frequently it is calculated that the market size would be able to reach hundreds of millions of dollars as early as 2018. Thus making ZIGBEE technology extremely attractive proposition for many other applications. Though there's an growing number of wireless standards which are appearing, ZIGBEE has a different area on which it is to be focussed [13]. It is unintentional to compete with the standards such as Bluetooth, 802.11 and the like. Instead of which it has been optimised to ensure if it meets its intended requirements and thus fulfilling the needs for sensing applications and remote control.

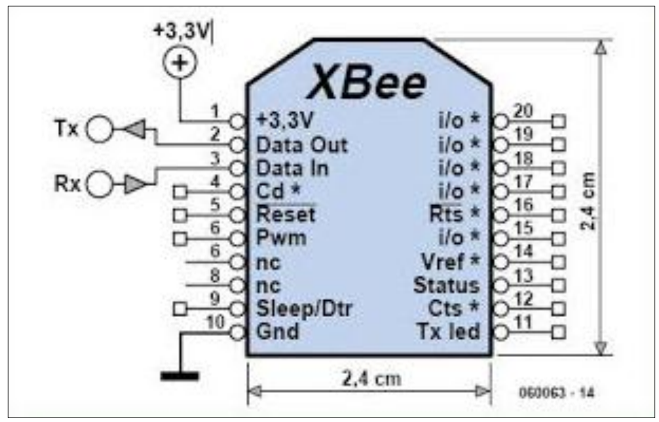

Fig 3: XBEE Module

2.3 Ultrasonic Sensor

An Ultrasonic sensor HCS-03 is a device which can measure distance of an object with the help of sound waves. It can measure the distance by sending sound waves at a certain frequency and listening for that particular sound wave to reflect back. By recording the time between the sound wave that is being generated and sound wave that bounces back, it is thus possible to calculate distance between the sensor and the particular object.

The sound travels in air at 344 m/s that is 1129 ft/s, the time can be taken for the sound wave to return back and multiplying it by the 344 meters or 1129 feet so as to find the round-trip distance of sound wave. Round-trip refers to the sound wave travelled two times the distance to the particular object before it' as detected by the ultrasonic sensor; it basically includes the 'trip' from sonar sensor to the particular object and the 'trip' from the particular object to the Ultrasonic sensor HCS-03(after the sound wave bounces off the object) [7]. In order to find the distance to that object, simply divide the round-trip distance by half.

It is essential to understand that some of the objects might not be able to be detected by ultrasonic sensors. This occurs because some of the objects are shaped or positioned in a certain way that the sound wave bounces off the particular object, but is deflected from the Ultrasonic sensor HCS-03. It's also possible for the object to be extremely small to reflect the sound wave back to the ultrasonic sensor to be detected [11]. Some other objects that can absorb the sound wave all together (cloth, curtains, etc), that means that there is no other way for the sensor to detect them exactly. These are some of the important factors to consider while programming and designing a robot with an ultrasonic sensor.

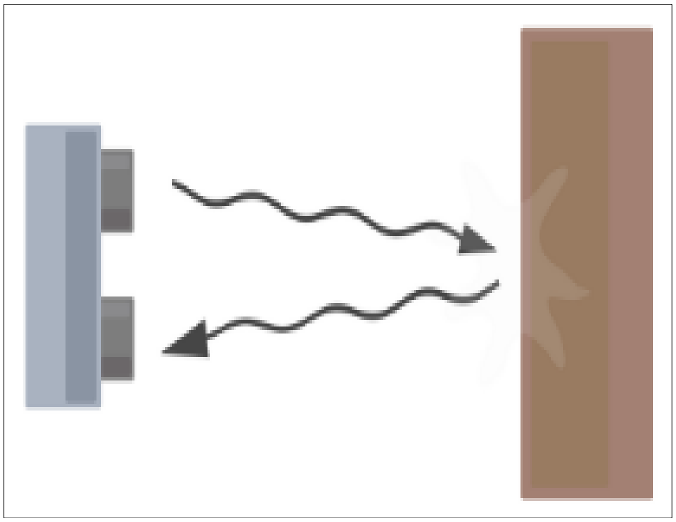

Fig 4: Ultrasonic Sensor Operation

2.4 Gas Sensor

This is the alcohol sensor named MQ-3, which is used to detect the ethanol in air. It is one of the gas sensors like others, so it works almost in the same way as with other gas sensors. Its cost is $6.90.Basically, it is used as breathalysers or as breath testers for the detection of the ethanol in human breath [4].

It has six pins, the cover and body. Though it has six pins, only four of them can be used. 2 of them are used for the heating system, which is H and the other two are for connecting the power and ground, which are A and B.

If you look inside the sensor, there is a little tube. This tube is the heating system which is made of AlO_2 and SnO_2 and inside of which there are heater coils, that practically produces heat. 2 pins called Pin H are connected to heater coils and the others are connected to the tube.

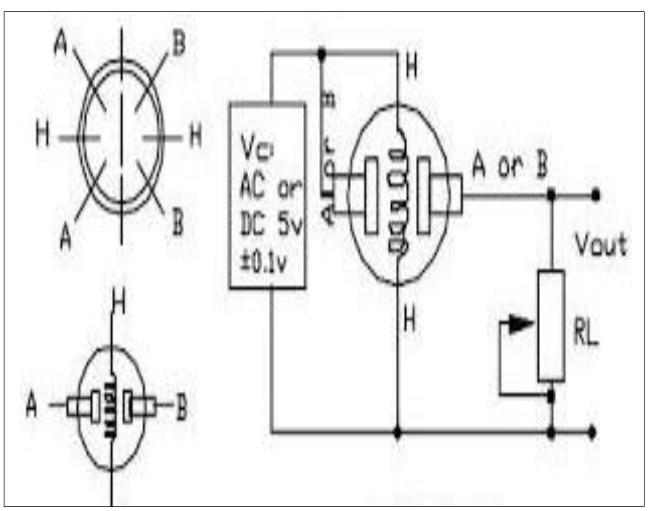

Fig 5: Gas Sensor

3. Methodology

It is divided into two sections- Hardware and Software Implementations.

The hardware implementation consist of the development of ZIGBEE, Touch screen sensor and LCD and also uses the SPY-ROBOT when the software implementation focus on the program of microcontroller using Proteus [12].

3.1 Hardware Implementation

Microcontroller's a programmable device. A microcontroller ATMEGA8 has a CPU in addition to RAM, ROM, Input/Output ports and timer embedded on a single chip. The on-chip ROM, RAM and number of Input/Output ports in microcontroller ATMEGA8 make them ideal for many other applications where the cost and space is critical [6]. Here we have used ATMEGA8. And also, bomb detection, gas leakage detection, bomb diffusion are included. The robot can move through rugged surfaces too. Receiver receives video signals from the camera. There are 3 motor drivers that are used in robot section. The first 2 motor controls the movement of robot motor. The 2nd motor driver controls the Camera movement in the robot. The 12Volt battery supply is given to motors for making the robot to move and also to give the supply to camera.

3.2 Software Implementation

The software part comprises of programming ATMEGA8 microcontroller using keil. This programming is done using C language. In the proteus software, we have used the virtual terminal instead of ZIGBEE and a variable register instead of touch screen [8].

3.3 Operations

The pc is used to control the robot. The robot uses a ZIGBEE at its end, thus when the ZIGBEE will be synced with one on the pc or laptop side then it's ready for operation. When the robot's synced the camera is synced too with the laptop that helps us to see the video of the area, the robot entered [9]. The visuals're obtained on the screen which are clear, therefore we can also see the graph of the parameters we intend to measure.

4. Observations and Experiments

The SPY-ROBOT platform works with flexible control. Therefore for benchmarking its operation range and quality image – video transmission are required. There are various protocols that are used for the communication between the server and the mobile which is operated on the basis of GUI. The one which we are using is ZIGBEE [10]. Though there are many other protocols we are using ZIGBEE as there are certain limitations in other protocols. The SPY-ROBOT's operational range is actually dependent on the range of all the protocols. Like Bluetooth if used have very limited range thus not used. Wi-Fi whereas is not used as its connection is not present everywhere and hence is unreliable. DTMF however is a good option but some of its disadvantages makes it unsuitable and thus ZIGBEE is used.

5. Conclusions and Summary

In this paper we have developed a reliable mechanism of communication and control and capture image-video data for a SPY-ROBOT. It can be used in various applications like Military applications, Landmine detection, Firing situations, Wireless security and surveillance in hot spots, Search and rescue operation, Maneuvering in hazardous environment. Though in this system we are using ZIGBEE connectivity for wireless communication, well instead of that if we can use ZIGBEE+ WI-FI, so we can connect the system directly to the internet. [14] Through the internet we can control the system via remote location. The designed robot satisfies all basic planned goals that this research seeks for. Hardware prototype is firstly designed and verified using PROTEUS workspace along with simulation results for the designed robot movements. These results make us confident in thinking that the underlying design will be encouraging to build a more complex mobile-driven requirements robot later on.

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