*International Journal of Research in Advent Technology, Vol.3, No.5, May 2015*
*E-ISSN: 2321-9637*

# R-HEX ZIGBEE Defense Robot For Parameter Monitoring

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**Abstract:**The Objective of this project is to design and implement intelligent R-Hex robot using microcontroller. The robot is controlled by wireless communication using Zig-bee module. Forward, right move, left move and backward direction from the Microcontroller will drive the robot in any desired direction. Microcontroller gets command from transmitter module and transmit the information to the robot. Receiver microcontroller receives the data and performs the necessary movement of the robot using DC motors. R-Hex is designed to be an all-terrain walking robot that can deal with rock fields, mud, sand, and vegetation, across railroad tracks, up telephone poles, slopes, and stairways, 60% inclines and other rough terrain. The robot can mount the various types of sensors on the robot. In the areas where human have not reached and wanted to reach in this areas to know the environment is suitable to go there or not and to reach there what preparation have to do can be known by this robot.

**Index Terms***:* Defence Robot, Robot Navigation, Remote Sensing and Monitoring, Wireless Sensor Networks, Obstacles Avoidance.

## 1. INTRODUCTION

The main objective of the project is to design and implements a reliable and cheap communication channel to guide a mobile robot with safe and efficient operation. The mobile robot can operate and perform scanning, monitoring and control tasks that are tedious and repetitive in a dangerous environment. The mobile robot is provided with microcontroller-based data.

There has been a tremendous increase of interest in mobile robots and their applications. One of these applications is using wireless mobile robots to detect several variables in the environment.Legged robots have long captured the imagination of researchers for the promise, motivated by observations of animal locomotion, for outstanding rough terrain mobility and versatility. Yet, artificial legged machines of the past were hard pressed to compete in terms of outdoor rough terrain mobility even with similarly sized tracked and wheeled vehicles. This is about to change, thanks to improvements in actuation, sensing, materials, computation, and most importantly, our understanding of locomotion. A product of these improvements and understanding has been R-Hex, a six-legged robot which is currently the most agile and versatile untethered legged robot in existence. R-Hex has continuously improved over the years, and we will refer to the many iterations that have not been waterproofed (but have been ruggedized considerably) as “Research R-Hex”. This paper takes Research R-Hex as a point of departure and describes subsequently the R-Hex versions that were waterproofed and further ruggedized.

Using mobile robots equipped with sensors are becoming widely used, especially in environments where human involvement is limited, impossible, or dangerous. These robots can be used to perform some dangerous tasks that are difficult for human to do, especially in hazardous environments.

## 2. LITERATURE SURVEY

In the paper [1] the first generation prototype R-Hex 0.0 was developed in 1999. Then R-Hex 0.1 and R-Hex 0.2 were improvements on R-Hex 0.0. The improvement of R-Hex 0.1 is mainly the mechanism, resulting in a 10% weight reduction. R-Hex 0.2 incorporates tactile sensors to detect surrounding environment (Moore et al, 2002; Komsuglu et al, 2001). In recent years, controller with gait adaptive algorithm further enhances function of R-Hex (Weingarten, 2004).

In this paper [2] Wireless Sensor Network (WSN) technology together with mobile robots can be used to detect several variables in the environment.

In this paper [3] there has been a tremendous increase of interest in mobile robots and their applications. One of these applications is using wireless mobile robots to detect several variables in the environment.

In this paper [4] a global positioning system (GPS) has become an efficient tool in the civilian and military applications. GPS technology works under

different weather conditions and across the world by any person if he has a GPS receiver.

## 3. MODIFICATION

This paper used articulated springy legs instead of circular legs. Here we used various sensors for parameter measurements. In previous project RF technology is used here we used ZIGBEE for long range.

## 4. SYSTEM DESCRIPTION

### *4.1 GENERAL BLOCK DIAGRAM*

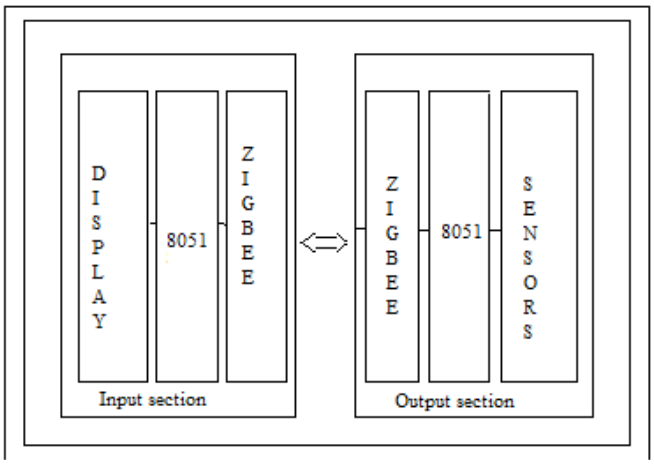


Fig 1. GENERAL BLOCK DIAGRAM

In the general block diagram consist of two section Input section and Output section. Display, Microcontroller and Zig-bee Module are consist in the Input section. Zig-bee module, Microcontroller and Sensors are consist in the output section.

### *4.2 TRANSMITTER*

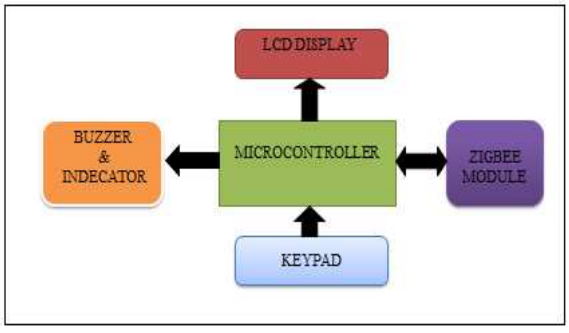


Fig 2. Transmitting section

#### *4.2.1 MICRO-CONTROLLER*

The AT89C52 is a low-power, high-performance CMOS 8-bit microcontroller with 8K bytes of in-system programmable Flash memory. The device is manufactured using Atmel's high-density nonvolatile memory technology and is compatible with the industry standard.80C51 instruction set and pin out. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional nonvolatile memory programmer. By combining a versatile 8-bit CPU With in-system programmable flash on a monolithic chip. The AtmelAT89S52 is a powerful micro controller, which provides a highly flexible and cost-effective solution to many embedded control applications. The AT89S52 provides the following standard features: 8K bytes of Flash, 256 bytes of RAM, 32 I/O lines, Watchdog timer, two data pointers, three 16-bit timer/counters, a six-vector two-level interrupt architecture, a full duplex serial port, on-chip oscillator, and clock circuitry. In addition, the AT89S52 is with static logic for operation down to zero frequency and supports two software selectable power saving modes. The Idle Mode stops the CPU while allowing the RAM, timer/counters, serial port, and interrupt system to continue functioning. The Power-down mode saves the RAM contents but freezes the oscillator, disabling all other chip functions until the next interrupt or hardware reset. More information please refer Data sheet 0f AT89S51.

#### *4.2.2 ZIGBEE MODULE*

Zig-Bee Module is a low-cost, low-power, wireless mesh networking standard. The low cost allows the technology to be widely deployed in wireless control and monitoring applications, the low power-usage allows longer life with smaller batteries, and the mesh networking provides high reliability and larger range. Temuco has developed an embedded antenna of wireless data communication module, which adopts standard Zig-Bee wireless technology. This module is in line with the Industry Standard applications of wireless data communication module.

#### *4.2.3 DISPLAY*

Dot matrix LCD modules is used for display the parameters and fault condition.16 characters 2 lines display is used. It has controller which interface data's and LCD panel. Liquid crystal displays (LCD's) have materials, which combine the properties of both liquids and crystals. Rather than having a melting point, they have a temperature range within which the molecules are almost as mobile as they would be in a liquid, but are grouped together in an ordered form similar to a crystal. An LCD consists of two glass panels, with the liquid crystal material sandwiched in between them. The inner surface of the glass plates are coated with transparent electrodes which define the character, symbols or patterns to be displayed polymeric layers are present in between the electrodes and the liquid crystal molecules to maintain a defined orientation angle.

One each polarizer's are pasted outside the two glass panels. These polarizer's would rotate the light rays passing through them to a definite angle, in a particular direction When the LCD is in the off state, light rays are rotated by the two polarizes and the liquid crystal, such that

the light rays come out of the LCD without any orientation, and hence the LCD appears transparent.

When sufficient voltage is applied to the electrodes, the liquid crystal molecules would be aligned on a specific direction. The light rays passing through the LCD would be rotated by the polarizeswhich would result in activating/highlighting the desired characters.

### *4.3. RECEIVER*

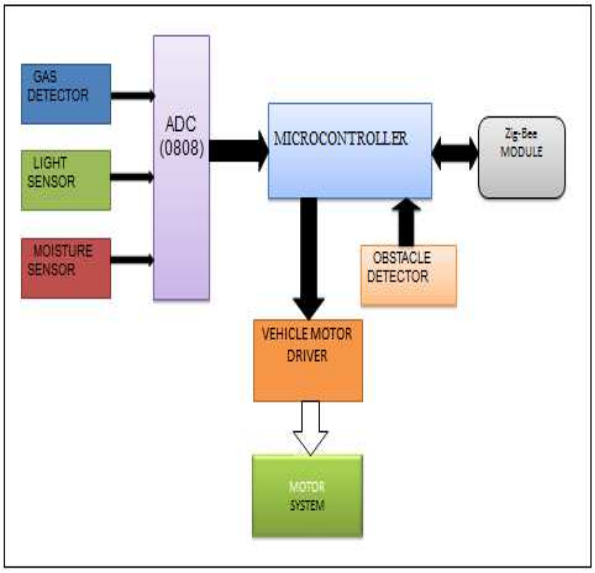


Fig 3. Receiving section

#### *4.3.1* IR Sensor

The IR Sensor-Single is a general purpose proximity sensor. Here we use it for collision detection. The module consist of an IR emitter and IR receiver pair. The high precision IR receiver always detects an IR signal. The module consists of 358 comparator IC. The output of sensor is high whenever it IR frequency and low otherwise. The on-board LED indicator helps user to check status of the sensor without using any additional hardware. The power consumption of this module is low. It gives a digital output.

#### *4.3.2 Gas Leakage Detector*

Now days, LPG gas is mostly used in Domestic as well as Industrial purpose. Because it has no bi-product that is 100% combustion is takes place .It is easily flammable, so while handling this, the possibility of accident is happened due to leakage of gas.The leakage of gas is very harmful for human being so we have design a project to take precaution and which avoids the harmful causes of an accident.Here, we use the gas sensor MQ-3, MQ-7 for sensing the LPG, gas which has so many features like high sensitivity, accuracy and it is capable of sensing butane, propane, smoke & alcohol also. Here we decided two levels logic 0 and logic 1.At logic 1 the microcontroller P89V51/PIC/ARM/AVR will take desired action and it display “GAS IS DETECTED” on the LCD screen and blow the buzzer. At logic 0 the microcontroller P89V51/PIC/ARM/AVR will take desired action and it display “GAS IS NOT DETECTED” on the LCD screen.

#### *4.3.3 Light Dependent Resistor (LDR)*

A Light Dependent Resistor (LDR) is a photo resistor is a device whose resistivity is a function of the incident electromagnetic radiation. Hence they are light sensitive devices. They are also called as photo conductors, photo conductive cells or simply photocell. They are made up of semiconductor materials having high resistance. Two cadmium sulphide (cds) photoconductive cells with spectral responses similar to that of the human eye. The cell resistance falls with increasing light intensity. Applications include smoke detection, automatic lighting control, and batch counting and burglar alarm systems.

#### *4.3.4 Humidity & Temperature Sensor*

This DFRobot DHT11 Temperature & Humidity Sensor features a temperature & humidity sensor complex with a calibrated digital signal output. By using the exclusive digital-signal-acquisition technique and temperature & humidity sensing technology, it ensures high reliability and excellent long-term stability. This sensor includes a resistive-type humidity measurement component and an NTC temperature measurement component, and connects to a high-performance 8-bit microcontroller, offering excellent quality, fast response, anti-interference ability and cost-effectiveness.

The figure below represents typical temperature and humidity dependency characteristics. Again, the Y-axis is indicated as sensor resistance ratio (Rs/Ro), defined as follows:

Rs = Sensor resistance at 1000ppm of methane at various temperatures/humilities

Ro = Sensor resistance at 1000ppm of methane at 20°C and 65% R.H.

## 5. ALGORITHM ANDFLOW-CHART:

1. Initialize all peripherals.
2. Drive motors according to instructions.
3. Stop motors at certain distance.
4. Sense all parameters & converted into voltage level.
5. Compare voltage level & send information to Tx.
6. If voltage level rice to desire voltage level then go to step 1.
7. If voltage level rice above desire voltage then stop.

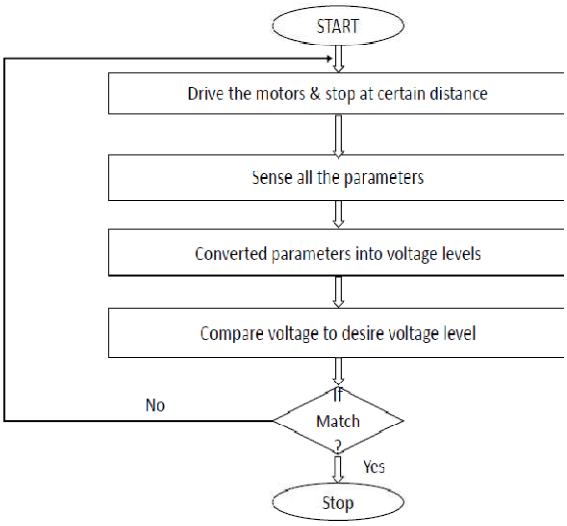


Fig 5. Flow chart of R-hex Robot

## 6. APPLICATIONS:

1. As a remote spy.
2. To know the geographical conditions in ARMY operations.
3. To catch the atmospheric conditions in the regions out of human reach.
4. To know the presence of the poisonous gases in the mines.

## 7. ADVANTAGES:

1. Its legs have an advantage over wheels when it comes to rough terrain.

2. In the areas where human have not reached and wanted to reach in this areas to know the environment is suitable to go there or not and to reach there what preparation have to do can be known by this robot.

3. Highly reliable.

## 8. *EXPERIMENTAL RESULTS*

1. The fig 6 shows the total hardware setup of this project in which the various sensors, microcontroller & zigbee module mounted on them.

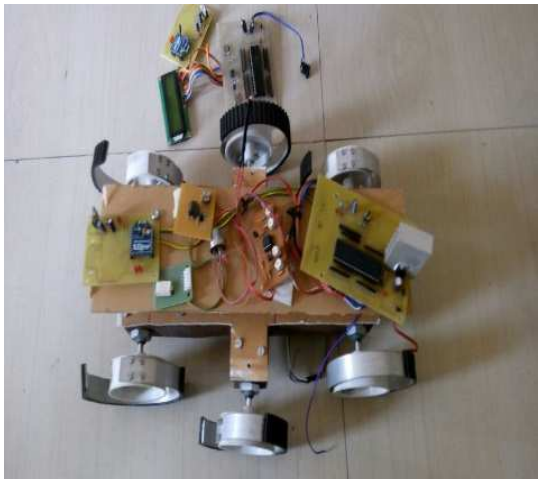

Fig 6.MainOutput

2. The fig 7 shows the checking of messagewhich are received or not from the receiver section. This is the final stage after that actual working of project start & message display on LCD.


Fig 7. Output of LCD

3. The fig 8 shows LDR output which show the low light indication on display.

Fig 8. Output of Light Sensor

4. The fig 9 shows the output of moisture in atmosphere which indicate on display with high moisture.


Fig 9. Output of Moisture Sensor

5. The fig 10 shows the output of gas leakage sensor in which the message seen on display when gas are detected.


Fig 9. Output of Gas Sensor

## 9. FUTURE SCOPE

1. We can install camera on robot for capturing images, videos & live recordings using image processing for further study of parameters.
2. We can use various sensors like Fire sensor, Color sensor, Soil sensor & Bomb detection sensor etc. on robot for monitoring.
3. We can use this robot underwater monitoring by doing some modifications in it legs & body parts.

## 10. CONCLUSION

This paper have introduced a series of robot designs all built using a common modular architecture of actuation, computation. This laboratory on legs infrastructure has encouraged the rapid prototyping and development of both dynamic legged robot designs, as well as robot behaviors in consequence of the favorable morphologies, sensorimotor capabilities and behavior development environment this modular architecture affords.

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