

Crawling Bot

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Abstract— The scorpion is eight-legged carnivorous arthropod, which is found worldwide such as in deserts and jungle. Scorpions are a type of arachnids (not insects) that are most closely related to spiders and ticks. They can break into a run, blazing across the granular surface with stupendous agility. Their ability to navigate over different types of terrain such as sand, rocks makes them unique. Our interest isn't purely biological though. Few Robots built that use wheels and tracks are nearing their performance limits. While there are some robots, that are designed to have legs as that of an insect which proves to be a good alternative. Robots with legs as that of an insect are fast and are also useful to tackle outdoor attacks. Robots are programmed to perform many tasks. Crawling bot is a six-legged robot with inherently high mobility. It is designed such that it is Powerful and has independently controlled legs to devour rough terrain with minimal operator input. This bot climbs in rock fields, mud, sand, vegetation, railroad tracks, and telephone poles and up slopes and stairways.

Key words: Microcontroller, Zigbee Module, C-shaped legs

I. INTRODUCTION

Inspired by crabs, scorpion and other creatures, we would like to build robots that navigate on wheels, which have six spring-loaded and C-shaped wheels. The wheels can be programmed and moved as per the user needs. This robot is more useful for current military and as rescue vehicle. The Crawling Bot has will have six legs, all connected to DC geared motors. There will be three layers the lower will be of gear motors and the battery; the middle will be of microprocessor and other system components. And top most will be the Lcd display. The legs will be in C-Shape specially designed for walking on granular medium. The pattern of rotating the motors will give the various types of crawling motion to the robot. The pattern can be changed through programming. The bot can be controlled by a p or PC via Zigbee modem. Robots perform many of the tasks through only programming that living things take for granted like; say walking from a concrete surface onto a sandy one. For humans, shifting from a hard surface to the beach requires a minor adjustment. But for a bot to stroll along the beach or in the desert is not an easy job to do. In fact, it can quickly turn into a sand trap, which is not a good thing. The reason robots struggle in sand is that feet experience both solid- and fluid-like forces as they move through sand. Robots, can't feel the difference; they need to be given instructions in order to adjust their movements.

In order to understand the impact of different type of materials on robot structure (footsteps) the study of robots is the key to building a robot that can easily adapt to changes in the surface it.

II. INSIDE THE SYSTEM

There are several body parts which interact with the bot in order to allow it to overcome granular surface. In the middle layer is a computer that acts as the main functioning unit, the legs support and are responsible for the movement of the body by coordinating as two tripods that is the two outer legs on one side and the middle leg on the opposite side. Relative to the ground, Crawling bot bounces like a two legged pogo stick; the robot's legs, like those of a cockroach, are sprawled to give it more stability.

A. C-shaped Leg:

As the bot moves forward or backward, each step taken by the bot is balanced and the weight of the bot is adjusted by the wheels which provide support.

B. Power Management Unit:

Boards a voltage regulator and other circuitry control the charge and discharge of lithium polymer batteries.

III. BLOCK DIAGRAM DESCRIPTION

The following are the short explanations of the working principle of various major blocks or sections used in the system:

A. Power Supply

In this unit various voltages are supplied to each unit as per requirements. This section consists of Transformer, Rectifier, Filter and Regulator. The Rectifier used here will be Bridge Rectifier which will convert 230VAC into desired 5V/12V DC.

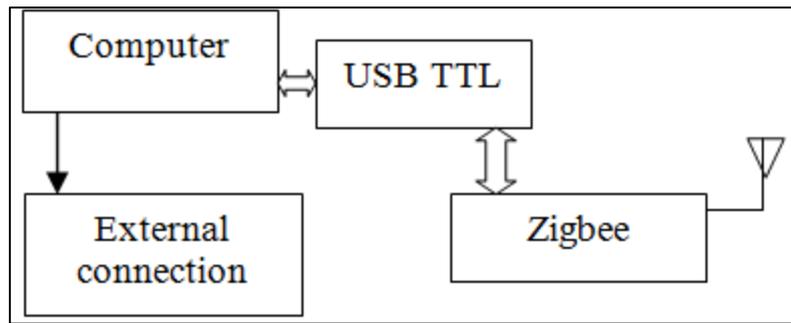


Fig. 1: Block Diagram of Transmitter

B. Microcontroller

Microcontrollers are used in automation systems, and devices such as Automobile Engine Control Systems, Implantable Medical Devices, Remote Control Appliances, Power Tools, and Other Embedded Systems. The size of the circuit is reduced as microcontroller is used instead of a unit that consists of separate Microprocessor, Memory, and Input/output devices, thereby making it economically efficient. By using Microcontrollers, it makes it economical to digitally control more devices and processes. The controller here used is of 8051 family. The code is written in Embedded C and will be burned or programmed into the code memory by a programmer. This unit requires +5VDC for it to operate properly.

C. LCD 16x2

LCD (Liquid Crystal Display) screen is an Electronic Display Module and is used for wide range of Applications. A 16x2 LCD display is basic Module and is very commonly used in various Devices and Circuits. These Modules are preferred over Seven Segments and other Multi Segment LEDs. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters and so on. A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD, each character is displayed in 5x7 pixel matrix. This LCD has two Registers, namely, Command and Data.

D. DC Motor

DC Geared Motors are used of 10/30/45 RPM. The voltage required to drive the motors are 12VDC and current is nearly 200mA. The purpose of gears is used to provide more torque. This unit requires +12VDC for its proper operation.

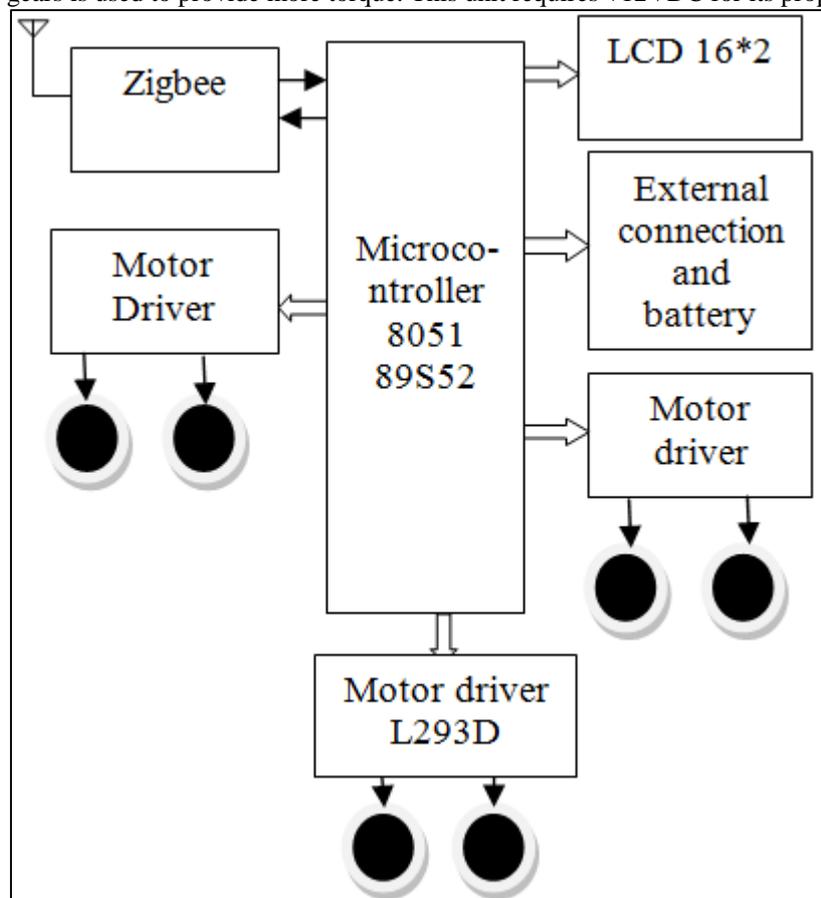


Fig. 2: Block Diagram of Receiver

E. DC Motor Driver

This unit is H-Bridge driver encapsulated in a single IC. L293D IC is used for DC motor driving. L293D can drive up to 4 DC Motors in Unidirectional Mode and 2 DC Motors in Bidirectional Mode. It can sink up to 600mA per Channel. The job of this unit is to drive the connected Motors in desired direction when Microcontroller sends signal to their respective channels. This unit requires +12VDC for its proper operation.

F. ADC 8-bit

These Microcontrollers convert various analog parameters coming from transducers. It is one of the most important units in Embedded System. The job of this section is to convert analog input signals (voltages) into its equivalent digital (decimal) value. Here 8-bit ADC is used which has digital range from 0-255. As ADC has 8 channels it can be used for multiple sensors. This unit will be connected with Microcontroller with 8-bit Data lines, 3-bit Address lines and some control lines. Clock pulses are required for its internal operation which is given by 555 timer section. This unit requires +5VDC for its proper operation.

IV. ADVANTAGES

- 1) Can be controlled through various Medium like Computer controlled, Mobile controlled, etc
- 2) Walking like motion,
- 3) Multiple Style Crawling,
- 4) Special C-Shaped legs,
- 5) Can move in all Directions viz. Forward, Backward, Right and Left.
- 6) Can overcome obstacles like stones.

V. LIMITATIONS

- 1) Power Supply is off board.
- 2) Wait is more due to heavy motors.
- 3) The casing is not of high strength.
- 4) Speed of movement is slow.
- 5) Gets heated easily.
- 6) No water proofing is there.

VI. FUTURE MODIFICATIONS

There is always a chance to improve the System as Research & Development is an endless process. Our system is no exception to this phenomenon. The following improvements can be done...

- 1) On board power supply can be used.
- 2) We can increase its speed for fast operations.
- 3) Waterproofing can be done.
- 4) Range of the system can be increased by using high power transmitters.
- 5) More Parameters can be integrated.
- 6) The system can be enclosed in waterproof casing.
- 7) Autonomous Navigation can also be added for better area viewing.
- 8) High quality motors can be used.
- 9) Solar based Power Supply can be used.
- 10) It can be mounted and worked on charged batteries.

VII. CONCLUSION

In today's changing era there is a need in advancement of technology in order to obtain information about certain threats in our neighbourhood that may cause casualties for human lives. In order to prevent collateral damage, Crawling Bot helps in spying purpose. The aspects of Digital Electronics Circuit can be learnt which will give more knowledge of designing microcontroller based system and it also provides help in developing the Embedded Software. Various Software Development Strategies and programming techniques can be learnt for PC based applications.

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