MULTI TERRAIN ROBOTIC VEHICLE WITH STEP CLIMBING MECHANISM

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ABSTRACT: In the past few decades demand for Multi Terrain Robot applications have been increased significantly. These robots can be employed for the purpose of security surveillance and rescue purposes in the remote areas. In remote areas the terrain is not uniform and hence stability of the robot becomes a challenging task. In this paper, a new design is proposed for the mobile robot, which aims to perform monitoring task while running on different types of terrain or real time physical environment in balanced way. A six-wheeled multi terrain robot has been developed which has capability to run in rocky and sandy areas, to move on inclined plane and to climb on stairs.

I. INTRODUCTION

In the past few decades demand for Multi Terrain Robot applications have been increased significantly. These robots can be employed for the purpose of security surveillance and rescue purposes in the remote areas. In remote areas the terrain is not uniform and hence stability of the robot becomes a challenging task. In this paper, a new design is proposed for the mobile robot, which aims to perform monitoring task while running on different types of terrain or real time physical environment in balanced way. A six-wheeled multi terrain robot has been developed which has capability to run in rocky and sandy areas, to move on inclined plane and to climb on stairs.

II. ROBOTICS

Robotics is the interdisciplinary branch of engineering and science that includes mechanical engineering, electrical engineering, computer science, and others. Robotics deals with the design, construction, operation, and use of robots, as well as computer systems for their control, sensory feedback, and information processing.

Robots can be autonomous or semi-autonomous and range from humanoids such as Honda's Advanced Step in Innovative Mobility (ASIMO) and TOSY's TOSY Ping Pong Playing Robot (TOPIO) to industrial robots, medical operating robots, patent assist robots, dog therapy robots, collectively programmed swarm robots, UAV drones such as General Atomics MQ-1 Predator, and even microscopic nano robots. By mimicking a lifelike appearance or automating movements, a robot may convey a sense of intelligence or thought of its own.

The branch of technology that deals with the design, construction, operation, and application of robots,as well as computer systems for their control, sensory feedback, and information processing is robotics. These technologies deal with automated machines that can take the place of humans in dangerous environments or manufacturing processes, or resemble humans in appearance, behavior, and/or cognition. Many of today's robots are inspired by nature contributing to the field of bio-inspired robotics. These robots have also created a newer branch of robotics: soft robotics.

From the time of ancient civilization there have been many accounts of user-configurable automated devices and even automata resembling animals and humans, designed primarily as entertainment. As mechanical techniques developed through the Industrial age, there appeared more practical applications such as automated machines, remote-control and wireless remote-control.

The word 'robot' was first used to denote a fictional humanoid in a 1920 play R.U.R. by the Czech writer, Karel Čapek but it was Karel's brother Josef Čapek who was the word's true inventor.[4][5] Electronics evolved into the driving force of development with the advent of the first electronic autonomous robots created by William Grey Walter in Bristol, England in 1948. The first digital and programmable robot was invented by George Devol in 1954 and was named the Unimate. It was sold to General Motors in 1961 where it was used to lift pieces of hot metal from die casting machines at the Inland Fisher Guide Plant in the West Trenton section of Ewing Township, New Jersey.

Robots have replaced humansin performing repetitive and dangerous tasks which humans prefer not to do, or are unable to do because of size limitations, or which take place in extreme environments such as outer space or the bottom of the sea.

There are concerns about the increasing use of robots and their role in society. Robots are blamed for rising unemployment as they replace workers in increasing numbers of functions.[8] The use of robots in military combat raises ethical concerns. The possibilities of robot autonomy and potential repercussions have been addressed in fiction and may be a realistic concern in the future.

III. MECHANISM

The Technical Committee on Mechanisms and Design seeks to bring together researchers with interest in innovative mechanical hardware in robotic systems in order to share knowledge, standardize practices/procedures, and raise the profile of the exciting new work being done in robot mechanisms and design. Additionally, we seek to establish strong ties to the robotics and robotic components industries to facilitate technology transfer, educate researchers on new available technologies, approaches, and standards, and help anchor research approaches to commercial needs and market viability. Relevant topics include, but are not limited to:

- Compliant and variable-stiffness mechanisms
- Design of hardware for open-source dissemination
- Design of robot systems incorporating novel mechanisms
- Materials and fabrication technologies as they relate to novel design and mechanism paradigms
- Mechanism synthesis
- Novel actuator technologies
- Novel transmission technologies
- Parallel mechanisms
- Parameter Selection and Sizing of Actuators

IV. LIST OF COMPONENTS

ELECTRICAL COMPONENTS

- Power Supply(Battery)
- Microcontroller
- Uart
- Lcd
- Zigbee
- Driver Circuit

MECHANICAL COMPONENTS

- Gear motor
- Wheel
- Frame

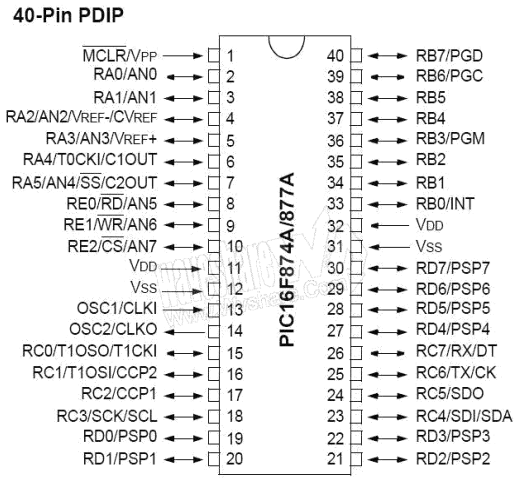
POWER SUPPLY:

The ac voltage, typically 220V rms, is connected to a transformer, which steps that ac voltage down to the level of the desired dc output. A diode rectifier then provides a full-wave rectified voltage that is initially filtered by a simple capacitor filter to produce a dc voltage. This resulting dc voltage usually has some ripple or ac voltage variation.

A regulator circuit removes the ripples and also remains the same dc value even if the input dc voltage varies, or the load connected to the output dc voltage changes. This voltage regulation is usually obtained using one of the popular voltage regulator IC units.

MICROCONTROLLER:

All the functions required on a single chip. A microcontroller differs from a microprocessor, which is a general-purpose chip that is used to create a multi-function computer or device and requires multiple chips to handle various tasks. A microcontroller is meant to be more self-contained and independent, and functions as a tiny, dedicated computer.



They are typically designed using CMOS (complementary metal oxide semiconductor) technology, an efficient fabrication technique that uses less power and is more immune to power spikes than other techniques.

There are also multiple architectures A microcontroller is an integrated chip that is often part of an embedded system. The microcontroller includes a CPU, RAM, ROM, I/O ports, and timers like a standard computer, but because they are designed to execute only a single specific task to control a single system, they are much smaller and simplified so that they can include used, but the predominant architecture is CISC (Complex Instruction Set Computer), which allows the microcontroller to contain multiple control instructions that can be executed with a single macro instruction. Some use a RISC (Reduced Instruction Set Computer) architecture, which implements fewer instructions, but delivers greater simplicity and lower power consumption.

Early controllers were typically built from logic components and were usually quite large. Later, microprocessors were used, and controllers were able to fit onto a circuit board. Microcontrollers now place all of the needed components onto a single chip. Because they control a single function, some complex devices contain multiple microprocessors.

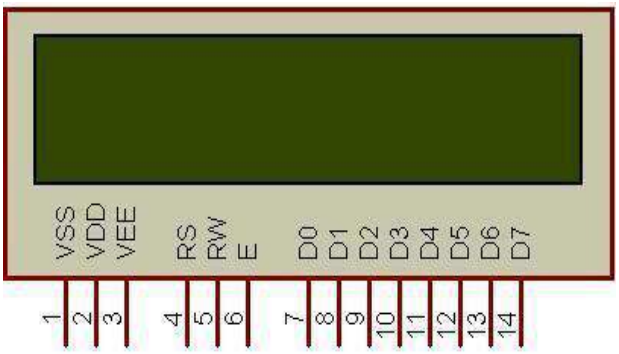
Microcontrollers have become common in many areas, and can be found in home appliances, computer equipment, and instrumentation. They are often used in automobiles, and have many industrial uses as well, and have become a central part of industrial robotics. Because they are usually used to control a single process and execute simple instructions, microcontrollers do not require significant processing power.

UART

The Universal Asynchronous Receiver/Transmitter (UART) controller is the key component of the serial communications subsystem of a computer. UART is also a common integrated feature in most microcontrollers. The UART takes bytes of data and transmits the individual bits in a sequential fashion. At the destination, a second UART re-assembles the bits into complete bytes. Serial transmission of digital information (bits) through a single wire or other medium is much more cost effective than parallel transmission through multiple wires. Communication can be “full duplex” (both send and receive at the same time) or “half duplex” (devices take turns transmitting and receiving).

LCD

The most commonly used Character based LCDs are based on Hitachi's HD44780 controller or other which are compatible with HD44580. In this tutorial, we will discuss about character based LCDs, their interfacing with various microcontrollers, various interfaces (8-bit/4-bit), programming, special stuff and tricks you can do with these simple looking LCDs which can give a new look to your application.

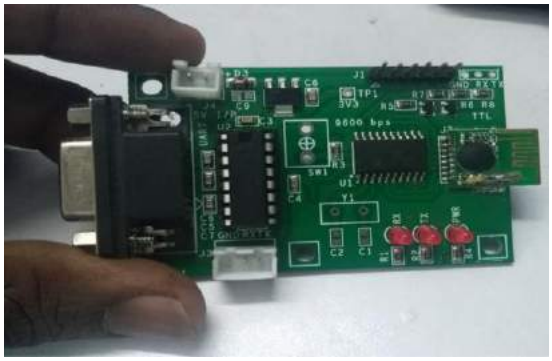


ZIGBEE

ZigBee is a technological standard designed for control and sensor networks. Based on the IEEE 802.15.4 Standard Created by the ZigBee Alliance. It Operates in Personal Area Networks (PAN's) and device-to-device networks Connectivity between small packet devices Control of lights, switches, thermostats, appliances, etc.

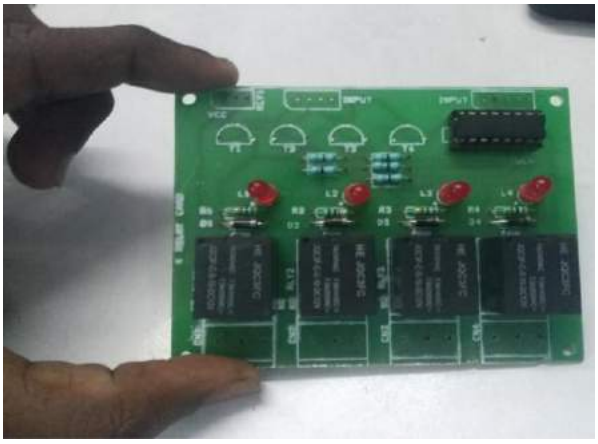
Development started 1998, when many engineers realized that WiFi and Bluetooth were going to be unsuitable for many applications. IEEE 802.15.4 standard was completed in May 2003. Organization defining global standards for reliable, cost-effective, low power wireless applications.

A consortium of end users and solution providers, primarily responsible for the development of the 802.15.4 standard. Developing applications and network capability utilizing the 802.15.4 packet delivery mechanism.



DRIVER CIRCUIT

The ULN2003 is a monolithic high voltage and high current Darlington transistor arrays. It consists of seven NPN Darlington pairs that feature high-voltage outputs with common-cathode clamp diode for switching inductive loads. The collector-current rating of a single Darlington pair is 500mA.



GEAR

A **gear** or **cogwheel** is a rotating machine part having cut teeth, or cogs, which mesh with another toothed part to transmit torque. Geared devices can change the speed, torque, and direction of a power source. The gears in a transmission are analogous to the wheels in a crossed, belt pulley system. An advantage of gears is that the teeth of a gear prevent slippage.

MOTOR

An electric motor is an electrical machine that converts electrical energy into mechanical energy.

The reverse of this is the conversion of mechanical energy into electrical energy and is done by an electric generator.

In normal motoring mode, most electric motors operate through the interaction between an electric motor's magnetic field and winding currents to generate force within the motor. In certain applications, such as in the transportation industry with traction motors, electric motors can operate in both motoring and generating or braking modes to also produce electrical energy from mechanical energy.

Found in applications as diverse as industrial fans, blowers and pumps, machine tools, household appliances, power tools, and disk drives, electric motors can be powered by direct current (DC) sources, such as from batteries, motor vehicles or rectifiers, or by alternating current (AC) sources, such as from the power grid, inverters or generators. Small motors may be found in electric watches.

General-purpose motors with highly standardized dimensions and characteristics provide convenient mechanical power for industrial use. The largest of electric motors are used for ship propulsion, pipeline compression and pumped-storage applications with ratings reaching 100 megawatts. Electric motors may be classified by electric power source type, internal construction, application, type of motion output, and so on.

Electric motors are used to produce linear or rotary force (torque), and should be distinguished from devices such as magnetic solenoids and loudspeakers that convert electricity into motion but do not generate usable mechanical powers, which are respectively referred to as actuators and transducers.

WORKING PRINCIPLE

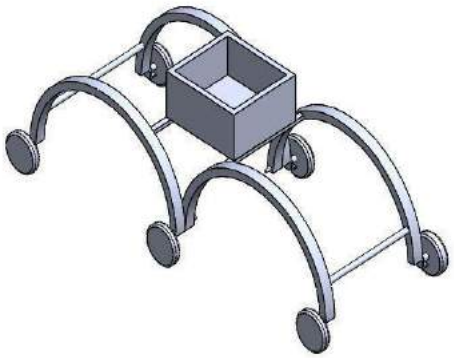
In the past few decades demand for Multi Terrain Robot applications have been increased significantly. These robots can be employed for the purpose of security surveillance and rescue purposes in the remote areas. In remote areas the terrain is not uniform and hence stability of the robot becomes a challenging task. A new design is proposed for the mobile robot, which aims to perform monitoring task while running on different types of terrain or real time physical environment in balanced way. A six-wheeled multi terrain robot has been developed which has capability to run in rocky and sandy areas, to move on inclined plane and to climb on stairs.

DESIGN AND DRAFTING

Step climbing robot is designed to withstand a load capacity of 5kg and it is coupled with a motor 100rpm.

It is drafted with a software module as follows

MODEL OF STEP CLIMBING ROBOT



ADVANTAGES

- Low cost
- Low power consumption
- Low data rate
- Relatively short transmission range
- Scalability
- Reliability
- Flexible protocol design suitable for many applications

CONCLUSION

In the proposed system we are introducing a six wheeled multi terrain robot which has the capability to run in rocky and sandy areas. The robot consists of two sections. They are the control section and the robot section. The control section consists of a ZIGBEE trans-receiver connected to the PC. The commands are given through the PC and it is received on the other side through ZIGBEE. Then according to the command the robot will move forward, reverse, right and left. The robot can be used for the research and surveillance purpose.

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