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Development of a Robotic Arm for Dangerous (Explode) Object Disposal

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ABSTRACT: The Embedded Technology is now in its prime and the wealth of Knowledge available is mind-blowing. Embedded System is a combination of hardware and software. Embedded technology plays a major role in integrating the various functions associated with it. This needs to tie up the various sources of the Department in a closed loop system. This proposal greatly reduces the manpower, saves time and operates efficiently without human interference. This project puts forth the first step in achieving the desired target. With the advent in technology, the existing systems are developed to have in built intelligence.

KEYWORDS: Robotic Arm, Remote Control, Mechatronic, Microcontroller.

I.INTRODUCTION

Various forms of threats, technological accidents, especially in the chemical industry and military complexes which cause major damages to humans, assets and environment, draw attention to development of new technological means to eliminate danger without the risk for human life. This determines the equipment logistic for the protection and rescue system. In line with this, the article presents the development of a robotized system for detection of chemical, biological, radiological and nuclear threats (CBRN), and for detection and neutralization of improvised explosive devices (CIED). In addition, a prototype model of a robotic vehicle is constructed. Reconnaissance, terrain and of great importance so that the operators and technicians have at their disposal an option of multiple analysis of a problem. The basic feature of using a robotized machine is the replacement of EOD and CBRN technicians in various life-threatening situations. Citizens' trust is of greatest and crucial importance for providing safety in such extraordinary situations. In order to meet the strict tactical and technical requirements, the robotized system comprises the stealth platform, working tools, a control console, a manipulator arm for complex actions, a CBRN detector, an additional EOD robot for terrain scouting and sample taking, an unmanned reconnaissance aircraft and a mobile command center. The prototype model of a robotic vehicle shows that the project is both technically and economically feasible on the basis of a tracked machine with battery propulsion, the Ultra Low Profile dozer. Existing resources and experience in development of specialized machines are significant for the development of a robotized system.[1]

Robots can also be found in military applications. A service robot is a robot which operates semi or fully autonomously to perform services useful to the wellbeing of humans and equipment, excluding manufacturing operations. Industrial robots usually consist of a jointed arm (multi-linked manipulator) and an end effector that is attached to a fixed surface (Charles, Aaron and Eduardo, 2007). Modular robots are new breeds of robots that are designed to increase the utilization of the robots by modularizing the robots.[2] In this paper a robotic arm was developed using a 89c51 microcontroller, programmed with Keil software with the use of a monitoring camera controlled by a remote controller.

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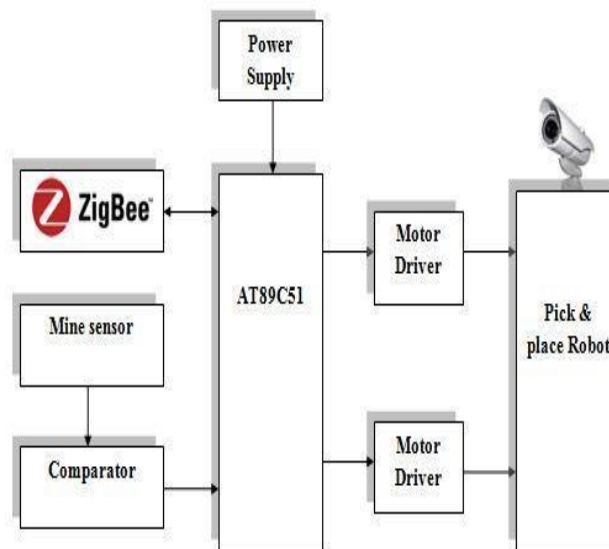
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II.WORKING PRINCIPLE

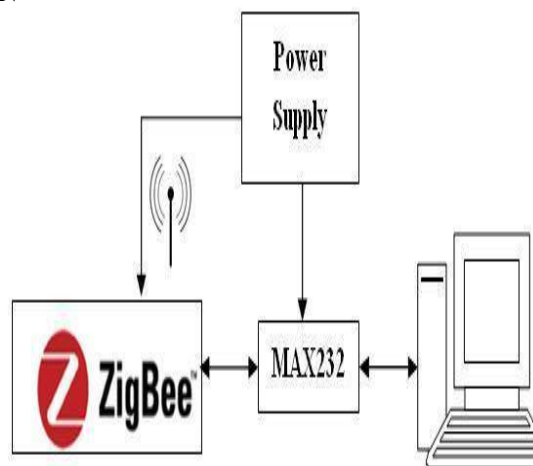
This robot having the pick and place arm for pick explode things. In the proposed system, interfacing the pick and place robot with 89c51 microcontroller through the driver circuit. The robot navigation and operations should be controlled by Zigbee technology. CCTV camera used to get visual of robot navigation area. The pick and place operations and navigations controlled by the commands given from pc. We can control the camera from remote area using Zigbee.[3]

BLOCK DIAGRAM



Block diagram of the Robotic arm for dangerous object disposal

TRANSMITTER SECTION



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NUMBER OF UNITS (MODULES):

- Power Supply Unit
- Microcontroller Unit.
- Display unit
- Communication Unit.
- Software Unit

Power Supply Unit:

The supply of 5V DC is given to the system which is converted from 230V AC supply. Firstly, the step down transformer will be used here for converting the 230V AC into 12V AC. The microcontroller will support only the DC supply, so the AC supply will be converted into DC using the bridge rectifier. The output of the rectifier will have ripples so we are using the 2200uf capacitor for filtering those ripples. The output from the filter is given to the 7805 voltage regulator which will convert the 12V DC into 5V DC.[4] The output from the regulator will be filtered using the 1000uf capacitor, so the pure 5V DC is getting as the output from the power supply unit. Here we are using the PIC microcontroller which will be capable of getting the supply of 5V DC so we have to convert the 230V AC supply into 5V DC supply.[5]

Microcontroller Unit:

The microcontroller unit is used to get the input from the zigbee and sensor depending on the input it give command to the robot using driver circuit.

Keil Software makes C compilers, macro assemblers, real-time kernels, debuggers, simulators, integrated environments, and evaluation boards for the 8051, 251, ARM, and XC16x/C16x/ST10 microcontroller families. Keil Software is pleased to announce simulation support for the Atmel AT91 ARM family of microcontrollers. The Keil μ Vision Debugger simulates the complete ARM instruction-set as well as the on-chip peripherals for each device in the AT91 ARM/Thumb microcontroller family. The integrated simulator provides complete peripheral simulation.

Display Unit:

The display unit is mainly is mainly achieved by the 16X2 LCD. A liquid crystal display (LCD) is a flat panel display, electronic visual display, or video display that uses the light modulating properties of liquid crystals (LCs). LCs do not emit light directly. In this project LCD is used to display sensor value

Communication Unit.

In our project Zigbee is the communication unit is used to transmit the command from the control section to robot section.[6]

Software Unit:

Software is used to compile the coding of the desired application for the corresponding embedded system.[7]

KEIL software

Keil Software is the leading vendor for 8/16-bit development tools (ranked at first position in the 2004 Embedded Market Study of the Embedded Systems and EE Times magazine). Keil Software is represented world-wide in more than 40 countries. Since the market introduction in 1988, the Keil C51 Compiler is the de facto industry standard and supports more than 500 current 8051 device variants.[8] Now, Keil Software offers development tools for ARM.

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GIVEN INPUT AND EXPECTED OUTPUT

Power Supply Unit:

Given Input:

230V, 5A, 50 Hz AC Supply

Expected Output:

12V, 500mA- 1A, DC Voltage

Microcontroller Unit:

8051 Microcontroller:

Given Input:

The zigbee out put and the sensor output is the input of the controller[9]

Expected Output:

Movement of robot depend on the controller input

Display Unit:

LCD:

Given Input:

The text from the microcontroller indicating the device status is given as input to the LCD.[10]

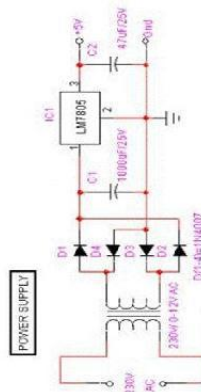
Expected Output:

The received text is displayed on the LCD

BLOCK DIAGRAM DISCIPTION

Power Supply

This section describes how to generate +5V DC power supply



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successful working of the project. A 0-12V/1 mA transformer is used for this purpose.[11] The primary of this transformer is connected in to main supply through on/off switch& fuse for protecting from overload and short circuit protection. The secondary is connected to the diodes to convert 12V AC to 12V DC voltage. And filtered by the capacitors, which is further regulated to +5v, by using IC 7805.

ZIGBEE

Zigbee is a specification for a suite of high level communication protocols using small, low-power digital radios based on an IEEE 802 standard for personal area networks. [12]Zigbee devices are often used in mesh network form to transmit data over longer distances, passing data

through intermediate devices to reach more distant ones.

Metal sensor

A metal detector is an electronic instrument which detects the presence of metal nearby. Metal detectors are useful for finding metal inclusions hidden within objects, or metal objects buried underground. They often consist of a handheld unit with a sensor probe which can be swept over the ground or other objects. If the sensor comes near a piece of metal this is indicated by a changing tone in earphones, or a needle moving on an indicator.[13]

LCD

A liquid crystal display (LCD) is a flat panel display, electronic visual display, or video display that uses the light modulating properties of liquid crystals (LCs). LCs does not emit light directly.[14]LCD is used to display the results of the system operation such as sensed values, motor status etc....

DRIVER CIRCUIT

The ULN2003 is a monolithic high voltage and high current Darlington transistor arrays. It consists of seven NPN darlington pairs that features high-voltage outputs with common-cathode clamp diode for switching inductive loads. The collector-current rating of a single Darlington pair is 500mA. The darlington pairs may be paralleled for higher current capability. [15]Applications include relay drivers, hammer drivers, lamp drivers, display drivers (LED gas discharge), line drivers, and logic buffers.

The ULN2003 has a 2.7kΩ series base resistor for each Darlington pair for operation directly with TTL or 5V CMOS devices.

Higher load current capability. The ULx2823A/LW and ULx2824A/

LW will withstand 95 V in the OFF state.

These Darlington arrays are furnished in 18-pin dual in-line plastic packages (suffix „A“) or 18-lead small-outline plastic packages (suffix „LW“). All devices are pinned with outputs opposite inputs to facilitate ease of circuit board layout.

The ULN2003 series input resistors selected for operation directly with 5 V TTL or CMOS. These devices will handle numerous interface needs particularly those beyond the capabilities of standard logic buffers. The ULN2003 have series input resistors for operation directly from 6 V to 15 V CMOS or PMOS logic outputs. The ULN 2003 is the

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standard Darlington arrays. The outputs are capable of sinking 500mA and will withstand at least 50 V in the OFF state.

KEIL SOFTWARE

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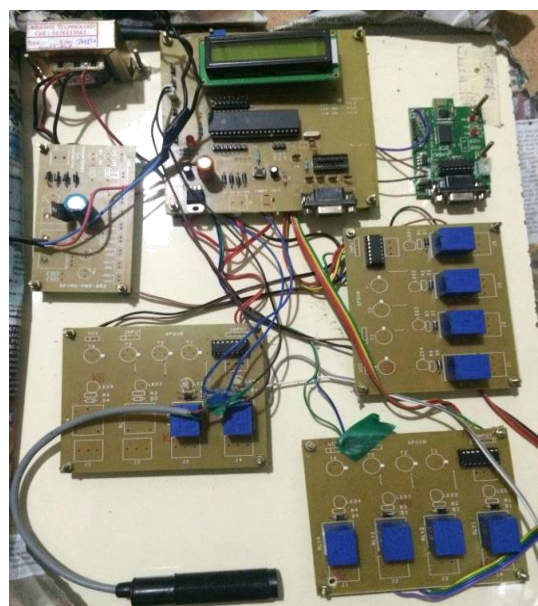
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Keil Software is pleased to announce simulation support for the Atmel AT91 ARM family of microcontrollers. The Keil μ Vision Debugger simulates the complete ARM instruction-set as well as the on-chip peripherals for each device in the AT91 ARM/Thumb microcontroller family. The integrated simulator provides complete peripheral simulation. Other new features in the μ Vision Debugger include:[17]

- An integrated Software Logic Analyzer that measures I/O signals as well as program variables and helps developers create complex signal processing algorithms.
- An Execution Profiler that measures time spent in each function, source line, and assembler instruction. Now developers can find exactly where programs spend the most time.



The ROBOTIC ARM



THE MAIN CIRCUIT BOARD

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OBJECT DISPOSAL ROBOT

III.CONCLUSION

There is no effective system in this method. So we have to improve the system efficient. Hence we are going to propose an advanced wireless controlled explode disposal system. So it's very useful for surveillance and monitoring function.

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