Bomb Disposal Robot Using Arduino

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Abstract: Nowadays bomb disposal and diffusing has become a very critical and hazardous method to human's life, In order to overcome the problem a concept based on wireless bomb disposal robot is proposed. The bomb is disposed using the robot which will be controlled through the wireless control module. The control module consist of a transmitter and the actual Robot consists of the receiver module .The receiver module is interfaced with an ARDUINO UNO R3 board. The Robot functions according to the input given via the transmitter. The control module contains LCD display which is interfaced with a wireless video receiver which receives video signal from the wireless camera. The wireless camera is to be placed in the robot near the arm which houses the center shaft motors used for the actual diffusion purpose so that the video captured can be viewed in the LCD display which is placed in the control module. We have used DC motors for movement of the robotic arm. As we is not risking the life of a bomb squad expert or any other solder or commando hence introducing the safest way for disposing the explosive to save life of common people.

Keywords: ARDUINO UNO; Wireless technology; RF Module; Robotic Arm; Bomb Disposal

1. INTRODUCTION

For many years, humans have been the core motivation for the development of robot system. It surely had many challenges and limitations with the robotic researches that had taken place thus far. Many efforts have been taken for the development of robots to be used as a replacement for humans to do tasks that are a bit critical and risky to human life who have been constantly exposed to methods like bomb disposing, machine cuttings ,etc. Our basic idea is to provide a robot that can be used for bomb diffusion and disposal where it can be controlled from a distance by a bomb disposal expert so that the bomb is carried by the robotic arm by the robot and disposed at a place which is out of the danger zone, away from human population. The robot that we are going to made is a both command and control robot. Commands are taken from the user in the form of control signal sand performs the required action. The idea behind this is to provide a line of defense to a bomb disposal squad against the life threatening risk, faced by them in the event of an explosion. It provides the squad to maintain a safe distance from the bomb to dispose, which he normally has to do with his bare hands [1].

The main technology used here for serial communication with the robot is the Bluetooth technology. Bluetooth technology can be used to share data between two devices considering the range between two devices. The Bluetooth module HC-05 will be connected with the robot and the commands to the robot will be given through the android application [2].This is specially designed bomb detection and disposal robot system with night vision camera to save human life and protect the solders from landmines or bombs. The most important things about these robots also have the capability to perform missions remotely without any danger to human lives. The design of our project encourages developing a robotic vehicle based on RF technology for the remote operation connected with the wireless camera mounted on the robot for monitoring purpose. The robot is contained with 8051 series microcontroller for desired operation and is generally used for spying purposes. The transmitting module consist of the push buttons that send the commands to the receiving module for controlling the movement of robot either to right, left, forward, downward. The receiving module of the robot consists of two motors which are interfaced with the 8051 series of microcontroller to control its movement via motor driver IC.

2. LITERATURE SURVEY

Literature survey includes the architecture of Bluetooth module HC-05 along with L293D motor driver IC.

A. Bluetooth Module HC-05: This Module is an easy to use Bluetooth SPP (Serial Port Protocol) module, designed for the transparent wireless serial connection setup. It also provides switching mode between devices. The Bluetooth module has two devices i) master device ii) slave device. One device connects to the master while the other device connects to the slave. Bluetooth module HC-05 consists of six pins. The six pins are Key, 5V, GND, Tx, Rx, Status in order to have proper communication, the master device must connected to the slave. Once the pairing is done between two devices, the device will ask to enter the password. The password will be either 0000 or 1234. Enter the password and both the devices will be connected to each other [1].

Figure 1: HC-05 Bluetooth Module

B. L293X Motor Driver IC: The L293Xis designed to provide bidirectional drive currents of up to 600-mA at voltages from 4.5 V to 36 V. To drive inductive loads such as relays, solenoids, DC and bipolar stepping motors, as well as other high-current/high-voltage loads in positive-supply applications can be obtained by both the devices 1,2 EN and drivers 3 and 4 enabled by3,4 EN. The outputs are active and in phase with their inputs when the input is high. When the enable input is low, those drivers are disabled, and their outputs are off and in the high-impedance state. A full-H (or bridge) reversible drive suitable for solenoid or motor applications [3] with the proper data inputs formed by each pair of drivers
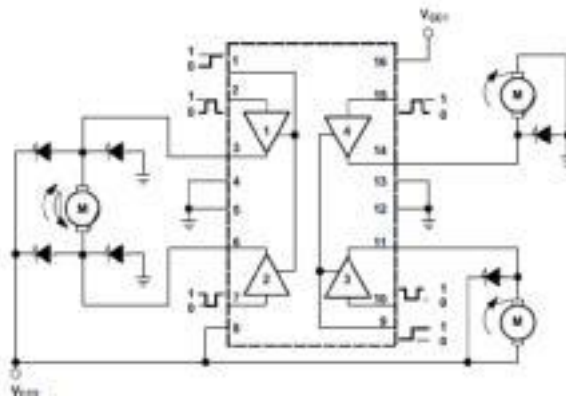

Figure 3: Functional Diagram Of L293X[7]

C. Arduino UNO: It contains everything needed to support the microcontroller along with14 digital input/output pins; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started. It differs from all preceding boards because in that it does not use the FTDI USB-to-serial driver chip. It contains everything needed to support the micro controller. We either need to connect it to a computer using a USB cable or power it with an AC-to-DC (7-12v) adapter. Arduino had used the Atmel Atmega AVR series of chips, specifically the ATmega8, ATmega168, ATmega328, ATmega1280, and ATmega 2560[4].
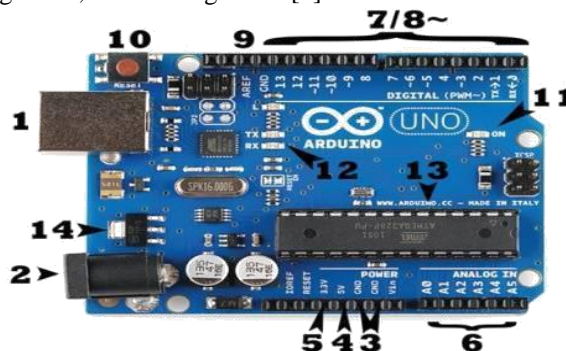

Figure 4: Arduino Uno Module

D. DC Motor: Electric machines are means of converting energy. Motors take electrical energy into mechanical energy. Electric motor is used to power hundreds of devices we use in everyday life. The DC motors are connected with the L293D IC through pins 3 and 6 and other motor through pins 11 and 14. The input pins are connected with the Arduino board. Implementation of connection of Arduino with L923D along with the motor interfacing for driving the robot [1] is simulated by proteus shown in the figure.

3.   BLOCK DIAGRAM

In this robot there are two sections; one is transmission section and another one is receiver section.

3.1. Block Diagram of Transmitter Section: The figure 5 show the block diagram of transmitter section which consists of switches, encoders, RF-Module, Camera, and monitor/screen.

1.Power Supply: Arduino Uno board, battery, motor driver requires 12V power supply connected with BATTERY, RF RECEIVER, LED indicators, sensors and control circuit operates with DC 5V. AC ripples reducer circuit provides to obtain pure DC from pulsating DC.

2. RF Frequency Modules: There are various types of RF modules available in market like 315MHz, 433MHz, 668MHz from free frequency band, having maximum communication distance is 250 mtrs and we can use them.
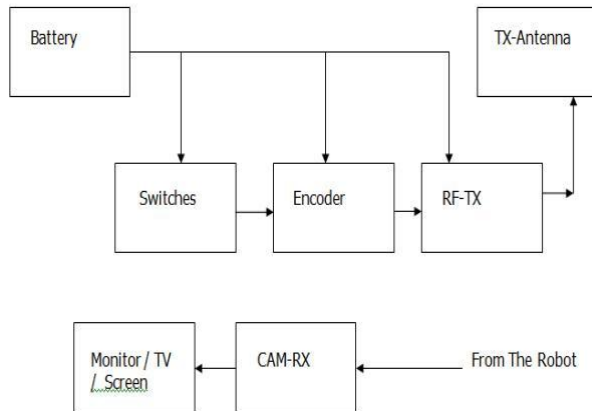

Figure 5: Block Diagram of Transmitter Section

3. Parallel to Series Encoder**:** Input is 4-bit parallel BCD number (connected with switches). It cannot transmit over long distance directly, hence converted to serial using parallel to serial encoder circuit. The serially converted 4-bit BCD is transmitted by using radio frequency module. It can transmit data up to 250 meter in open space.

4. Camera RX: camera receiver is used to receive transmitted video by camera on robot. The receiver requires 9V DC and can be connected to TV directly. For monitor TV tuner card required to convert the video signals in to monitor.

3.2. Block Diagram of Receiver Section: The figure 6 shows the block diagram of Receiver section which consists of main processor Arduino uno, Bomb Detector, Wireless camera, Motor Drivers.

1.   RF Receiver: We require same frequency receiver module as used in transmitter remote (it can be 433MHz/ 315MHz/668MHz). The received signal is decoded by RF module itself and gives serial output for the serial to parallel decoder circuit. This circuit can decode serial data in to parallel format (original format as in transmitter).
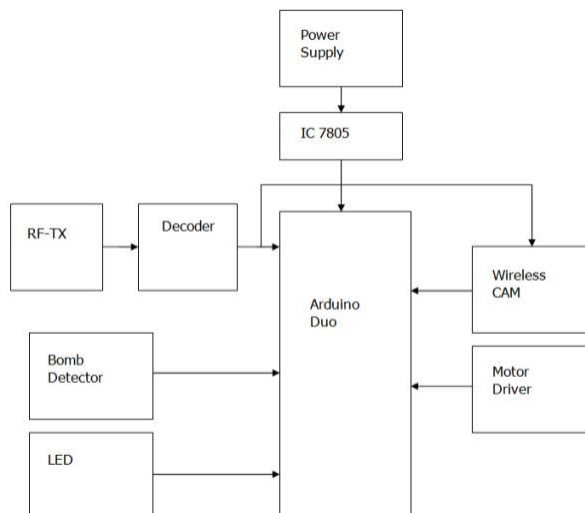

Figure 6: Block Diagram of Receiver Section

2.   Motor Driver**:** Arduino board/ Microcontroller have very low current output. It cannot drive current consuming sources, like motor hence separate motor driver circuit required.

3.   Sensor: Here we are using metal detector which operates with metal detection from maximum 3-4 inch distance, connected with analog input pins of Arduino Uno board, according to programming Arduino peeps the buzzer. For RF received signal robot operate forward, reverse, left turn, right turn movements according to programming conditions.

4.   Wireless Camera: A wireless video camera that supports night vision as well for better surveillance is used, the camera module supports a video transmitter as well and the receiver module is interfaced with the control module using a LCD display and the live video feedback from this camera is received by tuning the receiver to the particular frequency and the LCD is connected to the receiver module from the AV port in the receiver and thus live feedback can be viewed by the bomb disposal expert in the LCD display.
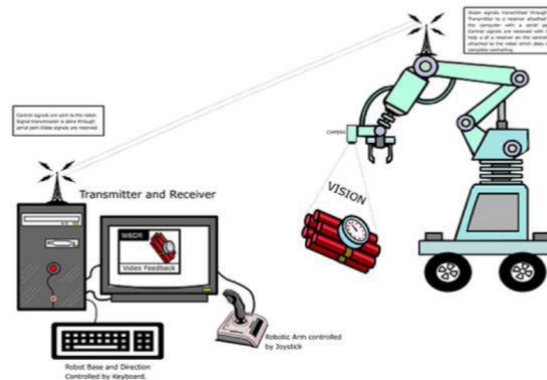

Figure 7: Proposed Robot Design

4. APPLICATIONS

There are number of applications of this robot. It can be used in:

1.   Military operations.
2.   Surveillance along border.
3.   Search and Rescue Operation.

CONCLUSION

The primary need for our paper would be accuracy. We have been able to view the things accurately that are currently happening in the surrounding area. Our design has not caused any sort of disturbances. The robot will move depending on the motor direction based upon the input we give through command by remote section unit. It display the current operation is going on as example left robot, near to object, clear up. With the help of the camera we are able to view the things that are happening in the surrounding area where the robot is hidden. By keeping the circuit easy and simple, most users will be able to use it easily. By using this technology we can detect the bomb as early as possible and beings dismantle it easily so that we can easily save the life of the human.

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