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Wireless Bomb Disposal Robot

[1] Shinde Pushpa.D., [2] Davane Rahul D., [3] Patil Poonam B.
[1,2,3]Department of Electronics and telecommunication
Annasaheb Dange College of Engineering and Technology, Ashta

Abstract—This paper presents the wireless bomb disposal robot which will help to improve defense of our nation from terrorist, suicide bombers and other such activities.The bomb detectors and disposal system works only with the presence of experts. But this way of analyzing takes more time and make risk to life of experts. The Wireless Bomb Disposal Robot uses a control application, at the user end to control the robot remotely using Wireless technology. The bomb technician controls the robot using this application at control site. Input from the user is transmitted over zigbee to the Receiver, where it is received, identified and given to the appropriate module (Robot) to act. The Robot consists of a Base, a robotic Arm and a wireless camera on it. We have used DC motors for the elbow and the gripper of the robotic arm. As we are not risking the life of an bomb expert or any other commando. Hence introducing the safest way for disposing the explosive to save life of common people.

Keywords—Wireless technology; zigbee; robotic arm; bomb disposal.

I. INTRODUCTION

The word robot was derived from Czech word robota which means "a forced laborer" then later a well known Russian science fiction writer Isaac Asimov coined the word robotics. From there on various different developments are being successfully done till date in the field of robotics in the form of manipulators, humanoids ,micro robots etc. as the trend of the industry is moving from the current state of automation to robotization . Thus the robot technology is advancing rapidly.

The robot that we are going to made is a command and control robot. This robot takes commands from the user in the form of control signal sand performs the required action. The central idea behind this robot 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 a safe distance to dispose off a bomb, which he normally has to do with his bare hands.

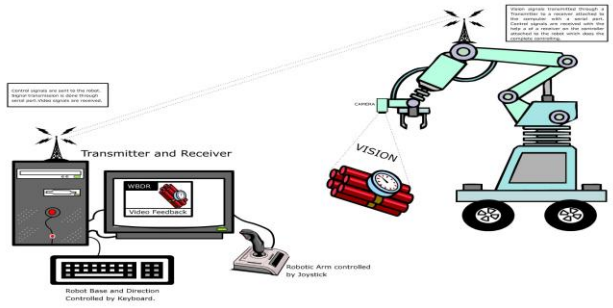

Figure 1: System Context Diagram

Theoretical background of the Project:-

The project has been designed keeping in view the current law and order situation in India and throughout the world. Everyday hundreds of trained personnel are either injured or0 lose their lives while defusing bombs. This can be reviewed by the countless number of news items appearing daily in newspapers around the world.

Although the idea of our project is original, a number of projects with similar functionalities can be found. For Example the British Police have a bomb disposal robot, the Israeli Army has it and it is also being used by bomb disposal squads and a number of states of USA. The main idea of this robot is to provide the bomb disposal squad with safety and security from the risks that they face every day. The bomb disposal squads of Pune have metal detectors and other equipment for bomb detection and disposal, but they have to risk their lives by approaching the bomb or the suspicious packet without any safety and precautions.

Our robot provides an extra layer of protection to the bomb disposal squad by allowing them to check and analyze a suspicious packet before actually approaching it for disposal. Mobile robots reduce or eliminate a bomb technician's time-on-target. A robot takes risk out of potentially deadly scenarios and lets the bomb technician focus on what to do to an explosive device rather than on the immediate danger to life and limb. Even if a robot cannot reach an item for disruption, it can still be used to relay information to aid in tool and procedure selection to moving downrange. In addition, events recorded by a robot's camera can provide evidence for further analysis.

II. System Design

. The block diagram showing the system functionality is shown in figure :

Transmitter side:-

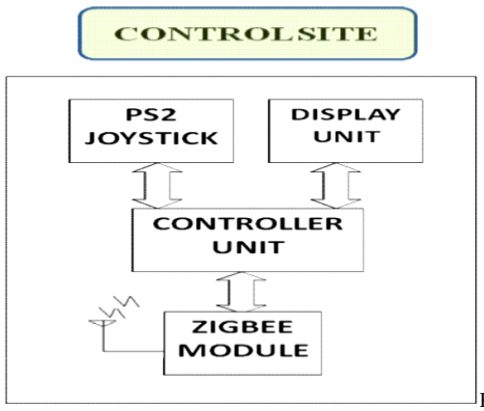

Fig. Transmitter block diagram

Receiver side:-

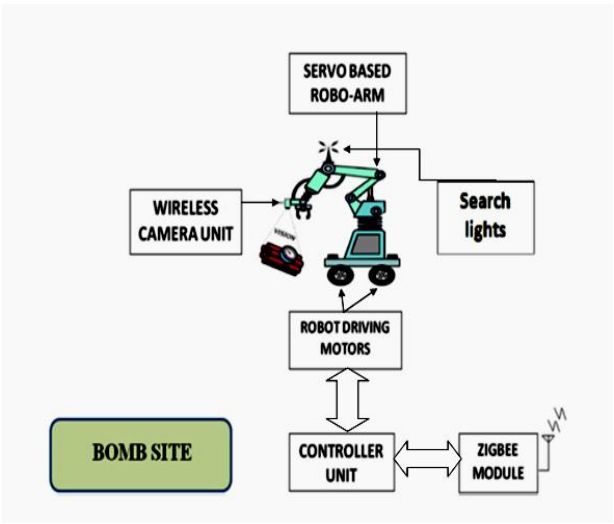

Fig.Receiver block diagram

Figure 1: Block diagram of receiver system

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As per the discussion, system consists of mainly following parts

1) Transmitter(control site)
2) Receiver(bomb site)

1. Controller unit

Its Function is to receive inputs from the sensors and transmit the required data to the master controller. It receives the control signals from master controller and moves the robot. It receives the video signals from the camera encodes it and transmits it to display section at control site. It also generate PWM control signals for the motion of robotics control signals

Zigbee unit. It receives the encoded data from the controller and transmit through zigbee

2.Zigbee module

The xbee modules used as transmitter and receiver to transfer control data from user site to bomb site.

3.Display unit

A display unit is used to display the received video information which is used for robot navigation, bomb detection and disposal too. It is a laptop or any device running HTML software.

4.Robot driving motors

It has 4 high torque DC motors for driving the robot. L293D Motor driver is interfaced with microcontroller to control the robot.

5.Wireless camera unit

It consists of an IP camera with WiFi hotspot connectivity. It may consist of a camera with WiFi router whose IP address is known to us. Also it can be an android smartphone running WiFi livestream software.

6. DC motor based robotic arm

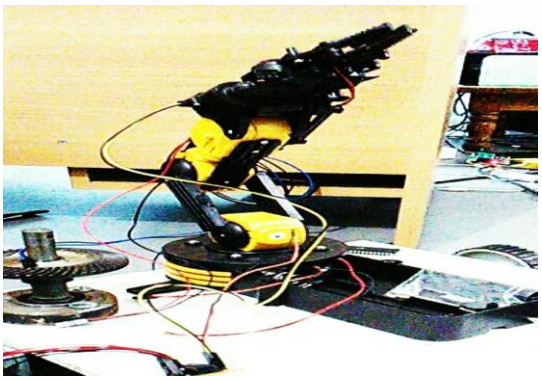

Fig. Robotic arm

III. Overall Circuit Design

3.1] Transmitter circuit diagram:-

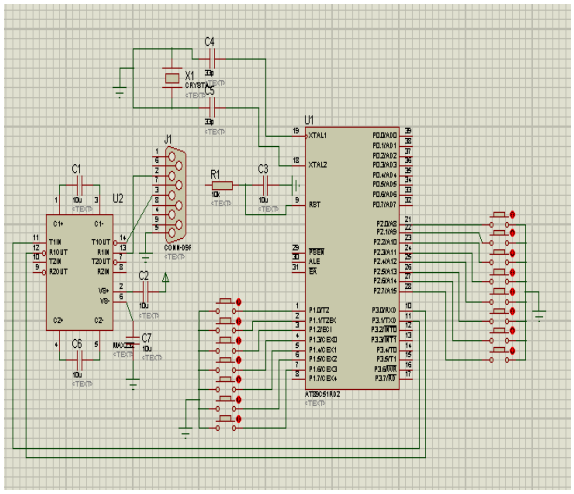

Fig. Transmitter circuit diagram

Pin description:
Transmitter side:

Port 2= Input port (key)
Pin 1.0 to 1.6= Input port

In that transmitter 16 switches are used for do the particular action or motions of the robotic arm. These are act as a sensor. These switches are connected to port 1and port 2 of that micro-controller 89c52. When any switch is pressed the micro-controller pin goes to low. The micro-controller always read continuously the port 1and port 2 pins when any key goes to low micro-controller send particular character serially to RS232. RS 232 sends character to zigbee s2 through DB9 connector. Then Zigbee s2 send these characters to zigbee receiver.. The range of that zigbee s2 is 140m.

3.2] Receiver circuit Diagram:-

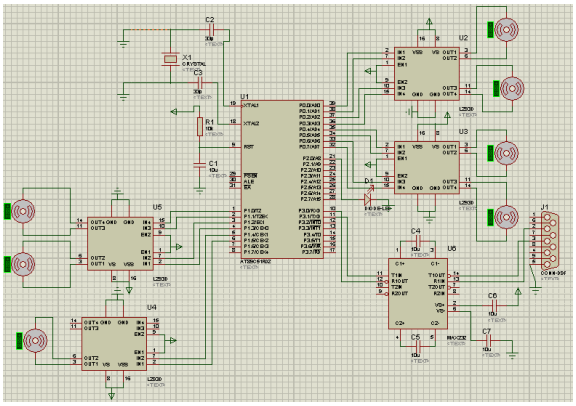

Fig. Reciever circuit diagram

Pin description:
Receiver side:

Port 0= Output port (D.C motor)
Pin 2.1= LED
Pin 1.0 to 1.3=Base motor
Pin 1.4 pin 1.5=Motor.

The signal which is transmitted from zigbee s2 transmitter receives by using Zigbee s2 receive. This signal is forwarded to RS232 through DB9 connector. RS232 send signals to microcontroller. Robotic arm connect to microcontroller's port 0 and port 1.Depending upon received serial character microcontroller gives output to L293D IC which is used to drive the motor.

We use 5 motor in robotic arm for doing the different function or motion. Each motor operates as forward and reverse direction is depend on the switch. 4 motors used for robot vehicle chassis movement: forward, backward,left,right movement.

We use night vision camera for video feedback.

IV. TRANSMITTER AND RECIEVER MODULES

Transmitter and receiver modules are as shown in fig. When we press any particular key in that switch matrix then that signal goes towards the IC 89C52. In that IC all that switches is connected to the port 1 and port 2 of that IC 89C52.The micro-controller always read continuously the port 1and port 2 pins when any key goes to low micro-controller send particular character through Zigbee. At receiver side micro controller IC read that particular character as per the given in that program and give the output by using the port 0 and port 1 of that micro-

controller IC to robotic arm.. We get video display on screen or laptop.

Transmitter:-

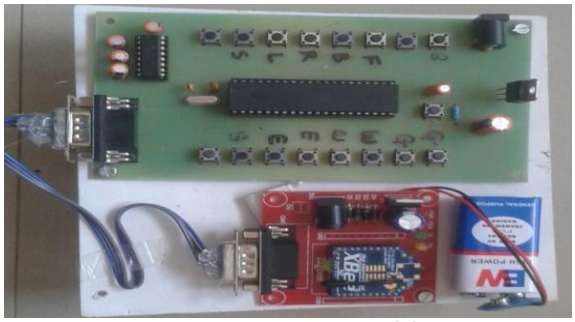

Fig.Transmitter module

Receiver:-

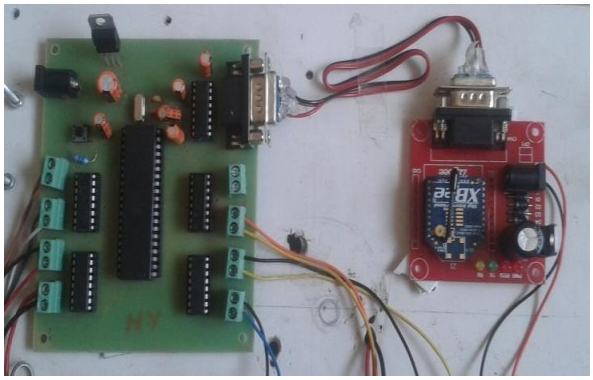

Fig.Receiver module

OUTPUT RESULT:-

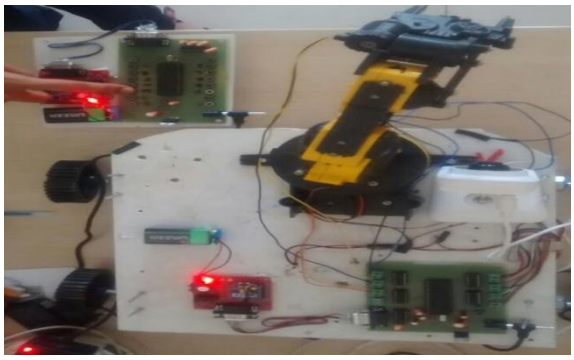

Fig. Output result

V. APPLICATIONS

We have designed it as an assistant robot to the bomb disposal squad but there are a number of other applications of this robot. It can be used by:

- Police: In hostage situations
- Military: For reconnaissance missions
- Fire: To provide video feedback of the site for analysis
- Nuclear: For handling hazardous or radioactive materials.

VI. CONCLUSION

The Wireless Bomb Disposal Robot has been designed in such a way that it can cater to the needs of the bomb disposal squad, the military, the police and also for the Personnel who handle radioactive materials. It has countless applications and can be used in different environments and scenarios. For instance, at one place it can be used by the bomb disposal squad, while at another instance it can be used for handling mines. While another application can be to provide up to date information in a hostage situation.

VII. FUTURE SCOPE

1. Step climbing mechanism :-

Step climbing mechanism is used for using the staircase which will help the user to move from one floor to other floor

2. Wireless video transmission :-

Wireless video transmission is used to keep the user away from the bomb site and control it from a safe distance.

3. Vision sensing technique:-

The camera is mounted above the Robot and is able to pan and tilt. Its image is displayed on a screen so that users can select a feature with a pointing device.

4. Removable Gripper/Multi-Gripper Robotic Arm:-

The gripper attached to the robotic arm is fixed at the moment that is, it will only work with the specific shaped of objects. Placing a gripper that can be removed and replaced by another gripper can solve this problem or a multi gripper robotic arm can be developed with more than 2 types of grippers for different type of materials and for different shaped of the objects.

5. Artificial Intelligence

At present the robot does not have the capability to make decisions on its own that is there is no built in artificial intelligence in it. Therefore the robots working are

based purely on the decisions made by the end user of the robotic control application. Therefore Artificial Intelligence may be provided to the robot for making the process of decision-making much quicker and reliable

6. Night Vision Camera

. For night mode or places where light is low a night vision camera can be mounted on the robot instead of a standard camera, which will increase the visibility in case of no light at all.

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