FPGA based Robot used for Defence in India

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Abstract

Many countries of the world are facing a big problem of the terrorism nowadays. Terrorism is of many kinds but the main reason for the resulting violence are not the same. Soldiers of the countries affected by terrorism have increased responsibilities on them to protect citizens. The Indian government faces the same problems as any other government fighting cross border terrorism. There are many uneven grounds on which terrorists operate in India, where it is difficult for the soldiers to reach. One of the solutions to this problem is to develop a robotic system which will help the soldiers to reach those difficult to reach places.

Many techniques have been developed in the robotics, but still they are not very effective to detect terrorist activities. This paper gives an overview of the past few techniques in this field and presents a real–time system by which a robot will follow objects to capture videos and transmit them to a server. This technique is based on the Papillion Spartan3 FPGA in which Android is used by the soldiers for viewing live videos.

Keywords: *Papilio, Spartan3, FPGA, Android*

INTRODUCTION

In the 21st century, the impact of technology, particularly in communication technology with advancing globalization has resulted in movement of people across borders, and this has unfortunately resulted in spread of terrorism too. The increase in

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this movement of people has resulted in many security problems in India and many other countries. The increase in the population and the weaker borders security is very dangerous [1].

Robotic applications are required in today's world and various technologies of robotics must be developed and tested to the end of preventing terrorism. FPGA has the advantage over microcontroller due to its hardware based parallel architecture. Motors are one of the parts of the Robots and controlling them with FPGA is difficult. The application proposed in this paper is wireless using FPGA [1].

The FPGA robot which uses the FPGA as Papilio Spartan3 was developed by the Xilinx. It has I/O of 48 lines, USB with dual channel, JTAG programmer which is integrated, 4 power supplies, and a power connector. External hardware can be added directly using the provided "Wing" slots.

The stepper motors are electric motors that are used in safety applications such as auto, medical devices, and surgical robots which are a very important application. The FPGA is used in digital control for stepper motors [4]. The motor is used for moving the camera in the required direction to capture the video.

The Zigbee is a low data rate, power, and cost wireless networking protocol which is based on the IEEE 802.15.4 standard for wireless personal area networks (WPANs) [1]. It supports the frequency band of 2.4 GHz for worldwide[6][4]. The Zigbee is used to communicate between the server and the robot wirelessly. Zigbee transmitter and receiver was used in this project.

The ultrasonic sensor will move in the direction of right, left and scan the values. If the object is detected, there will be action to follow the object in two ways: automatic and manual.

PROPOSED SYSTEM

The system contains the following main components:

A. Robot Side Unit:

The Robot will have the wireless camera, the ultrasonic sensor which will calculate various values according to which the robot will detect the object. The values then will be saved and it will follow the object once detected. The object is detected by either automatic or manual method.

B. Server side unit:

The real time videos which are taken by the robot are transmitted to the server. The

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videos are saved in the server, and these videos will then be used by the android application. The server will be present in the control room.

C. Android unit:

The android phone of the soldiers will have the application. Each and every soldier will have a username and password. Videos can be sorted according to different regions. The control can be automatic as well as manual.

D. System Overview:

The block diagram shows the proposed system.

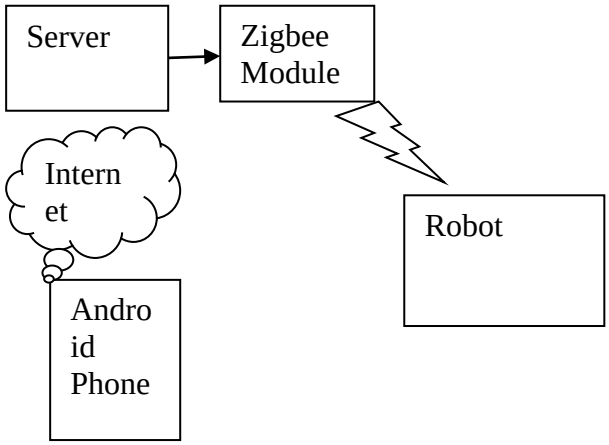


Fig. 1: Block Diagram of Proposed System

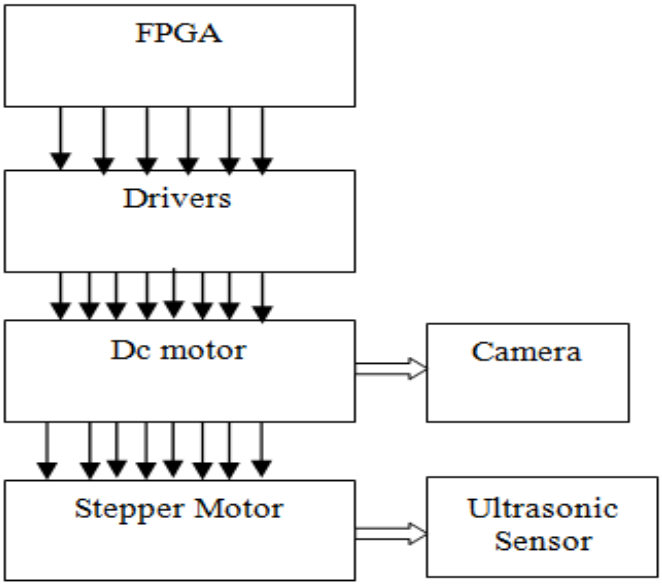


Fig. 2: Robot unit

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Fig.1 shows the overall block diagram of the proposed system. The three units are server side unit, the robot and the android phone. The server and the robot unit communicate with each other through the wireless communication unit Zigbee. The server and the android phone will communicate with each other by the internet connection.

Fig.2 shows the robot unit which has the Papilio Spartan3 FPGA which is connected to the drivers present for the movement of the robot. The drivers will be connected to the D.C motor and the movement will be accordingly. The ultrasonic sensor are present which will take the values during the movement of the robot. When the object is detected, this info is transmitted by the server or the soldiers through the android application. The action will be both automatic and manual.

RESULTS

The proposed system has the android application design for the soldiers as the snap shots show.

First window:

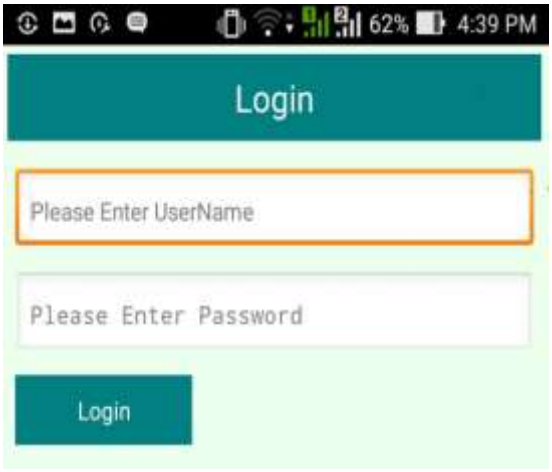


Fig 3: First window of the application

In the first screen, we have the login window. Each soldier will have his own username and password.

Second window:



Fig4. Second window of the application

In the next region, the region where the soldiers are present is meant for selection.

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Third window:

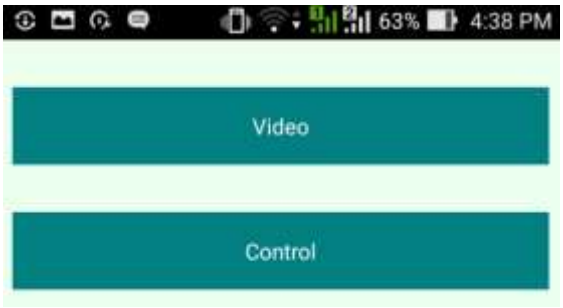


Fig 5: Third window of the application

The selection of the regions is done by the soldiers, after which the robot that belongs to the selected region will be able to see the video captured by the robot. If required, action can be taken by the soldiers.

Fourth window:

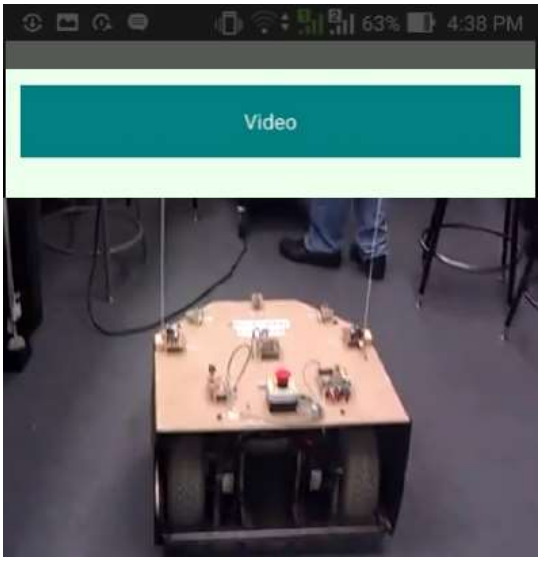


Fig 6: Fourth window of the application

The forth window gives the video which is taken by the robot when the video option is selected. The Robot will give the video which was captured by the robot.

iii.Fifth window:

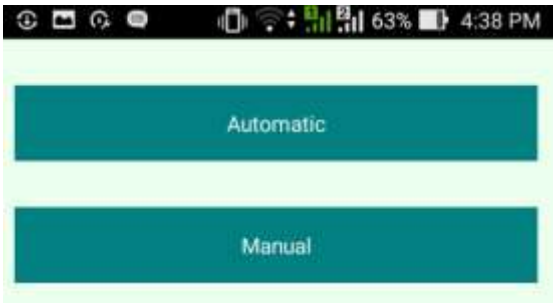


Fig 7: Fifth window of the application

The controlling action can be done in two ways that is the robot will follow the object which the robot will detect. The manual once selected will give you option of direction: left or right.

CONCLUSION

In this paper, an easy way to look after the areas where soldiers cannot reach is proposed. The working of the robot and the detection of the object and following the object is done in two ways. This makes this system a better option for ensuring security. The Papilio Spartan3 FPGA developed by the Xilinx gives these results. This android application if developed for the soldiers would be an easy way to keep a watch on all the regions where the soldiers cannot reach. This application can also be used to control action.

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