

Implementation of DTMF and RFID in Robotic Telesurgery



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Abstract — Telesurgery is gaining importance day by day. This helps for enabling long distance surgery which helps to serve the patients in the remote areas. The telerobotic surgical system enables long distance telesurgery, covering the distance between patients and surgeons in remote regions of the world. This prototype have a helper robot which does all the commands instructed by the doctor. This technology is widely used in battlefields, disaster areas and remote areas. The helper robot does the necessary actions by listening to the commands of the doctor. It is used eminently in the situation where doctors cannot reach the accident spot. These robots increases the distance between the doctors and the patients by enabling control through remote ways. Hence lives of the humans can be saved in a effective manner with the help of a robot performing the functions. To attain this system the components used are 8051 microcontroller, LCD, RFID tag and reader, Zigbee, DTMF decoder, PIC and PLACE robot. All the components are interfaced with the microcontroller. Controlling the robot is done by making a call to the particular mobile number. The mobile will be under auto answer mode. After attending the call press the corresponding key to control the robot. In addition with this we use RFID tag and reader for equipments handling. Each equipment have one tag. If any tag is read by the reader corresponding tag number will be sent to the particular monitoring node with help of Zigbee. We have to maintain a database (tag one for knife, tag two for scissor etc) based on the information received by the robot and the control will be done by the doctor.

Keywords — Robotic arm; Telesurgery; DTMF; RFID; Zigbee; disaster areas

I. INTRODUCTION

Researchers are exploring to set suitable ideologies to design a robot which is used to perform surgery. J.L.Meza proposed a paper which exhibits about a fuzzy tuned regulator for the working of robot manipulators. The prototype robotic arm can be used for telesurgery purpose [9]. It can be used to pick and place few surgical tools [5].

Kumar.M proposed a work related to the development of a robot operated and controlled by a mobile phone which is used to perform manipulation tasks.

Use of a mobile phone for robotic control can overcome these limitations. It provides the advantage of robust control, working range as large as the coverage area of the service provider, no interference with other controllers and up to seven controls. Although the appearance and the capabilities of robots vary vastly, all robots share the feature of a mechanical, movable structure under some form of control. The control of robot involves three distinct phases: perception, processing and action. Generally, the preceptors are sensors mounted on the robot, processing is done by the on-board microcontroller, and the task is performed using motors and with actuators. Y.H.Lee demonstrates about design of a grasper which is made up of a flexible material and it is used to pick and place things [6]. In the current scenario the patients has to reach the place of the doctors for performing surgeries. This is a time consuming and life threatening process.

II. MATERIALS AND METHODS

In this system the Doctors can perform surgeries in a remote manner with the help of a telephonic robot. The robot is controlled using DTMF (Dual Tone Multiple Frequency) Technology [1]. This enables them to take a proper decision regarding therapeutic and diagnostic approaches.

III. MODULE DESCRIPTION

The module designed to perform surgeries in remote areas through telephonic robot comprises of the following hardware components. They are listed below

- 8051 MICROCONTROLLER
- Power Supply Unit
- DTMF Section
- Zigbee
- RFID READER AND TAG
- LCD display
- Robotic Grippers

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IV. BLOCK DIAGRAM

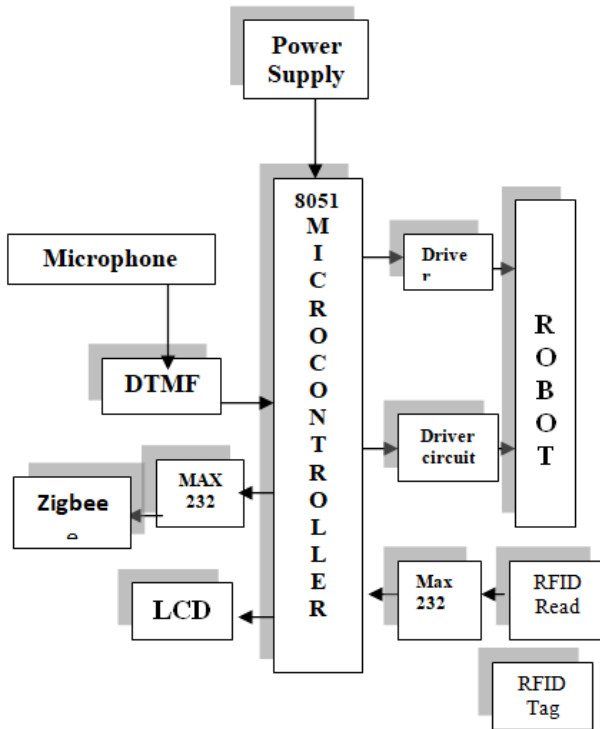


Fig. 1. Block diagram of DTMF and RFID telesurgery.

A. 8051Microcontroller

In this project, 8051 microcontroller with 40 pins have been used. The main advantage of 8051 microcontroller is flexibility and faster in execution when compared to other microcontrollers.

B. Power supply unit

The power supply section is the necessary component. It delivers static output regulated power supply for working of a robotic arm. A 0-12V/1 mA transformer is used for this purpose. Overload and short circuit protection is carried out by connecting the main supply with the primary of transformer.

C. DTMF Section

DTMF (dual tone multi frequency) is the automatic signal generated by ordinary telephone's touch notes. This technology is probably known as "Touchtone" technology. When the doctor from one location calls using this technology the helper robot will automatically attend it and it will be performing the actions as the doctor instructs [12].

D. Zigbee

Zigbee is used for transmitting and receiving the data. In this prototype it is used for transmitting information in the controller section and monitoring system.

E. RFID Reader and Tag

A RFID reader is a device which is used as a identifier. It stands for Radio Frequency and Identification system [8]. It consists of a small integrated chip where the tag will be attached to identify objects. RFID technology is used as a identifier tool for the robot to handle the surgical tools. It

will be programmed in such a manner that each tool will be specified with a surgical tool such as scissor, knife, etc [13].

F. LCD display

Light crystal display system is used to view the current status of the robot's action. It also shows the current action mode performed by the robot arm.

G. Robotic Grippers:

Grippers are used basically to pick or grasp. Here it is used to pick and place the surgical tools and it acts as a pick and place robot [6]. This robotic arm is used to perform many actions such as

- Forward motion
- Backward motion
- Arm up
- Arm down
- Arm close
- Arm open
- Stop

These actions will be done when corresponding numbers assigned to such actions are being pressed.

V. RESULTS AND DISCUSSION

Robots used in our project can be used as a helper robot for telesurgery purpose. Doctors will be controlling the robot from a distance. The robots perform actions like forward, backward, right and left turns. Grippers are used to pick and place the surgical tools. Our robot has been programmed in such a way that it can pick components like scissor, knife and cotton. There is also a receiver unit which helps to know about the current status of the patient.



Fig. 2. Schematic model of a robot arm

In our project we have programmed the robot to pick and place few components like cotton, scissor and knife.

The robotic arm motion also plays a major role. It can move in forward, backward, left and right directions. The arm can also move up and down and the gripper can be controlled to grasp any tool. The pick and place robotic system has satisfied the motion sequence of the system intended to manipulate every process with the help of keil and proteus software. Finally the output can also be displayed on pc using hyper terminal and com.

With 8051 microcontroller, the manipulations of the robotic arm pick and place system, work is made easy. It also requires minimal work area compared to hard-wiring system. The accuracy of the robotic arm pick, with the right program installed in the robotic arm pick and place system, also decreases the quantity of human failures. It progressively reduces the number of death cases.

VI. FUTURE DEVELOPMENTS

We recommend the following for future works in our project. A camera can be used in the robotic arm so that doctors will be able to view the components present near the robot. In future it can be designed in such a way that RFID reader would be present in the arm itself so that it will be useful for identifying nearby components. Nonrenewable sources can be replaced by renewable sources so that it reduces power demand.

VII. CONCLUSION

The helper robot designed is used for telesurgery purpose. The doctor will be controlling the robot from a distance. The robot is controlled using DTMF system. The doctor makes a call from distant place and the call is received by DTMF decoder and the robot starts functioning. The robot performs actions like forward, backward, right and left turns. The gripper used in the human hand is used for picking and placing the surgical tool. It consists of RFID reader and tag which is used to identify the components to be picked. A receiver section is also present to view the current status of the robot.

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