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A Novel Idea on Semi-Automated Operation Theatre Assistance for Doctors Based on Robotic Technology

P.Mohan Kumar[1], S.Sriram[2]
[1]*Department of Biomedical Engineering, PSNA College of Engineering and Technology*
[2]*Department of Biomedical Engineering, PSNA College of Engineering and Technology*

----------**ABSTRACT**----------
The idea of this article is to develop a robotic assistant for handling surgical instruments in Operation Theatres. Hence it is possible to minimize human intervention in turn the risk of contamination and the probability of human error. The robotic system principally has three functional parts : locomotion controlled by Bluetooth from an android device; rotatory array of medical instruments governed by a stepper motor that functions over a voice input and a robotic arm made of Gripper motor controlled remotely.

Keywords: *Operation theater, Robotic assistant, locomotion, voice recognition,Bluetooth, android..*

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I. INTRODUCTION

Operation theatres are highly hygienic to carry out effective surgeries in hospitals. Nowadays, there is a lot of need for automation in surgery. In order to increase the effective handling of surgical instrument and also to ensure the accuracy of manipulating the instruments, plenty of research activities are eagerly carried by the scientists.

In order to avoid the confusion while giving command to the expert system using voice recognition, the proposed system is designed for one user voice among a group of members and also this facility ensures us the secured usage. In our case, Doctor has the authority to control the system by configuring his/her voice to the corresponding operation. Unless or otherwise the system configured to a unique voice, system cannot be controlled.

II. METHODOLOGY

2.1 Atmel8051 Micro Controller (AT89C51)

The AT89C51 is a low-power, high-performance CMOS 8-bit microcomputer with 4Kb of Flash programmable and erasable read only memory (PEROM). The device is manufactured using Atmel's high-density nonvolatile memory technology and is compatible with the industry-standard MCS-51 instruction set and pin out. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional nonvolatile memory programmer. By combining a versatile 8-bit CPU with Flash on a monolithic chip, the Atmel AT89C51 is a powerful microcomputer which provides a highly-flexible and cost-effective solution to many embedded control applications with the following features Fully Static Operation (0 Hz to 24 MHz), Three-level Program Memory Lock, 128 x 8-bit Internal RAM, 32 Programmable I/O Lines, Two 16-bit Timer/Counters, Six Interrupt Sources, Programmable Serial Channel, Low-power Idle and Power-down Modes.

2.2 Voice Recognition Module with 4 bit Data Out

This module can store 15 pieces of voice instruction. Those 15 pieces are divided into 3 groups, with 5 in one group. First we should record the voice instructions group by group. After that, we should import one group by serial command before it could recognize the 5 voice instructions within that group. If we need to implement instructions in other groups, we should import the group first.This module is speaker independent with features like Voltage: 4.55.5V, Current: <40mA, Digital Interface: 5V TTL level UART interface, Analog Interface: 3.5mm mono-channel and microphone connector with microphone pin interface of Size: 30mm x 47.5mm

2.3 Gripper (Servo Electric Gripper)

Choosing the proper gripper is essential to ensuring successful automation applications. The servo-electric gripper appears more and more in industrial settings due to the fact that it is easy to control. Electronic motors control the movement of the gripper jaws. These grippers are highly flexible and allow for different material tolerances when handling parts. Servo-electric grippers are also cost effective because they are clean and have no air lines.

2.4 Working

2.4.1 Locomotion controlled by Bluetooth from an android device

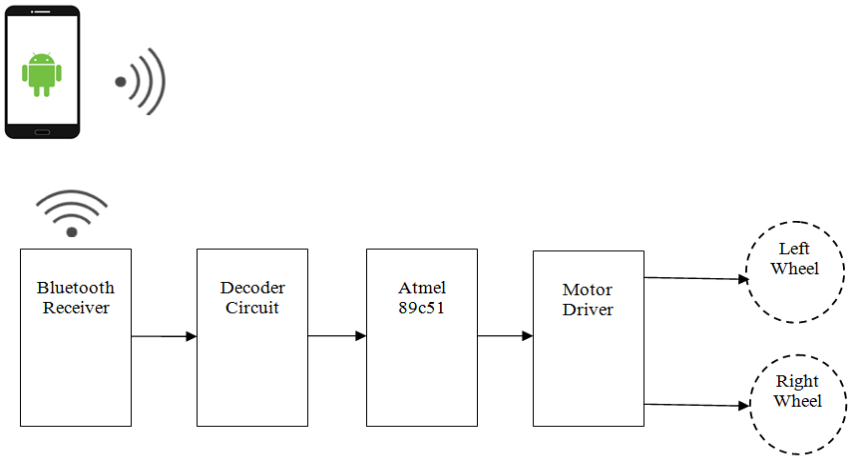

Fig 1 Block diagram of locomotion circuit

The idea is proposed to control a robotic vehicle using an android application. Bluetooth device is interfaced to the control unit of the system for sensing the signals transmitted by the android application. This data is conveyed to the control unit which moves the system in desired directions. An Atmel 89C51 microcontroller is used here as control device.

Remote operation is achieved by any smart-phone/Tablet etc., with Android OS, upon a GUI (Graphical User Interface) based touch screen operation. Transmitting end uses an android application through which commands are transmitted. At the receiver end, these commands are used for navigating the robot forward and backward, and turning left and-right. The movement is achieved by two DC motors that are interfaced to the microcontroller. The program on the microcontroller refers to the serial data from the Android device to generate respective output data to operate the motors through a motor driver IC.

2.4.2 Rotatory array of medical instruments governed by a DC motor that functions over a voice input

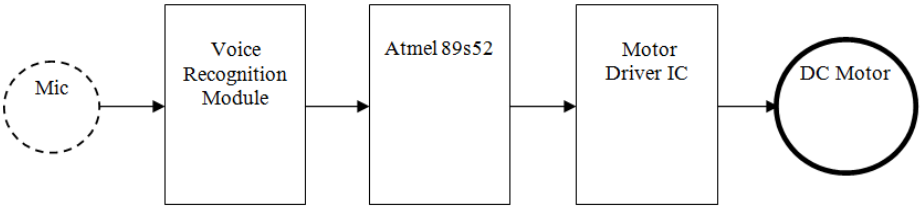

Fig 2 Block diagram of DC motor control circuit

A circular array of OT equipment with predefined positions. Voice input from the surgeon is manipulated by the Voice Recognition System to give its respective output to the DC motor via microcontroller, which rotates the circular table to the instrument requested among the available six instruments. Expected accuracy in the Voice Recognition module is 80-90%.

2.4.3 Arm control mechanism

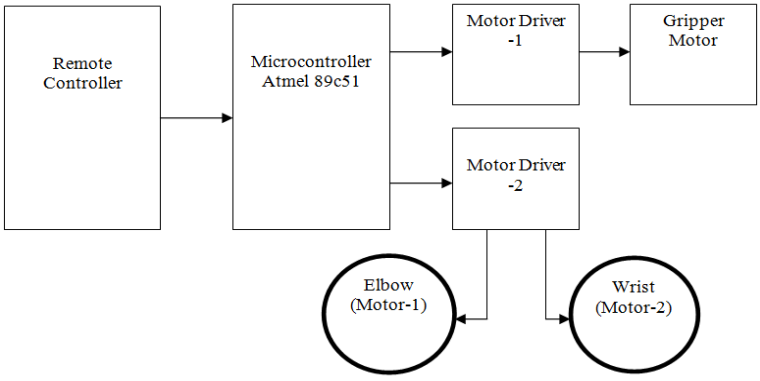

Fig 3 Block diagram of arm control circuit

The manual operation of a Robotic Arm: The operation of the Gripper motor is concerned with the acquisition and delivery of the instrument requested for in the hands of the Surgeon. A pair of DC Motors takes responsibility of Arm motion

III. RESULT & CONCLUSION

In this paper, we aim to devise a semi-automated instrument capable of handling 4 medical instruments. But its capacity can be improved to handling a higher number of instruments. This system can further be developed by adding more features like camera for navigation purposes. The actual instrument is to have no sharp corner and is to be made of appropriate material that can be sterilized like any other instrument in the CSSD Department of the hospital.

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