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CONTROL OF AN INDUSTRIAL ROBOT BY USING MOBILE

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ABSTRACT

Up to this point of time the system that most of industries using are typical teach pendant robots. Usually, robots are intended, equipped and programmed to accomplish definite tasks, and therefore, non-expert user will not be able to re-program the robot to perform a different task. In industry, this type of robot programming can be justified economically only for production of large lot sizes. However the demand for new and natural human-machine interfaces (HMIs) has been growing in recent years, and the field of robotics has followed this trend.

In this work we developed a robotic system that allows users, especially unskilled programmers, to program and instruct a robot with a high-level of abstraction from the robot language. This is done using motion capture sensors based most natural human machine interface i.e. hand gesture. An input device android based mobile phone (Motorola) was used to recognition the gestures, where the motion data extracted from motion sensors (3-dimensional accelerometer) embedded in the android mobile was used to capture human hand movements and orientation sensor data was used for the activation and deactivation of the system . Mobile application (MATLAB mobile) was used to send sensory data to MATLAB software through Wi-Fi to computer running MATLAB software (R2014a) and calculation of coordinates/position from acceleration data was done in the MATLAB software. Inverse kinematics function of MTIS (MATLAB Toolbox for the Intelitek Scorbot) was used to move the robot according to increment in the coordinates/position vector.

The system was tested for performance and consistency. The performance in terms of accuracy of motion was found to be satisfactory. It also demonstrates human-computer interaction.

I. INTRODUCTION

Programming an industrial robot by the typical teaching method, through the use of the robot teach pendant is a tedious and requires some technical expertise that is a time-consuming task. In industry, this type of robot programming can be justified economically only for production of large lot sizes. Hence, new approaches to robot programming are required.

Generally, robots are designed, prepared and programmed to perform definite tasks, and therefore, an unskilled worker will not be able to re-program the robot to execute a different task.

The goal is to create a methodology that helps users to control and program a robot with a high- level of

abstraction from the robot language. Making a demonstration in terms of high level behaviors (using gestures), the user should be able to demonstrate to the robot what it should do, in an intuitive way.

This is done using motion capture sensors based most natural human machine interface (gesture), an input device android based mobile (Motorola) was used to recognition of gestures, where the motion sensor data extracted from motion sensors (3-dimensional accelerometer) embedded in the android mobile was used to capture human hand behaviors and orientation sensor data was used for the activation and deactivation of the system. Mobile application (MATLAB mobile) was used to send sensory data to MATLAB software through WiFi to computer running MATLAB software (R2014a) and calculation of coordinates or position from acceleration data in the MATLAB software.

II. OBJECTIVES

1. Develop a modular system that allows users, especially non-expert programmers, to program and instruct a robot and with a high-level of abstraction from the robot language by "natural means", using gestures .
2. Eliminate the cable that connects the teach pendant to the robot controller is one of the biggest drawbacks of the equipment
3. To develop a wireless based communication link between mobile device and the PC running MATLAB software.

III. SYSTEM OVERVIEW

Experimental setup consist of a mobile phone for capturing hand movements, a MATLAB mobile application for transferring motion data, a laptop running MATLAB software for controlling robot movement using motion data received from mobile phone and a robot (SCORBOT-ER 4U) with controller as shown in fig. 1.

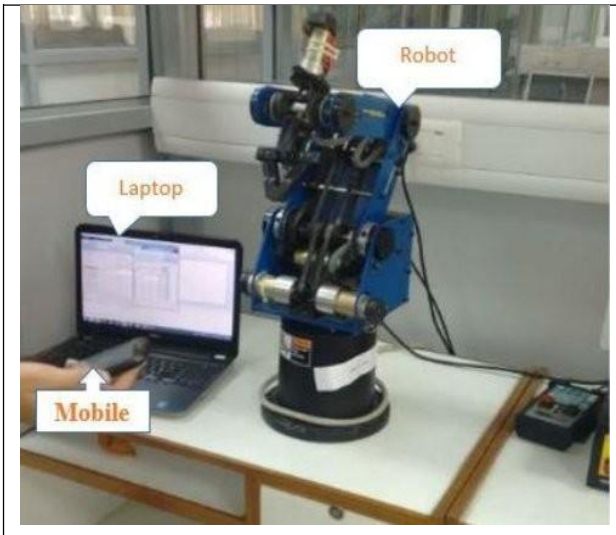

Fig. 1: Complete robotic

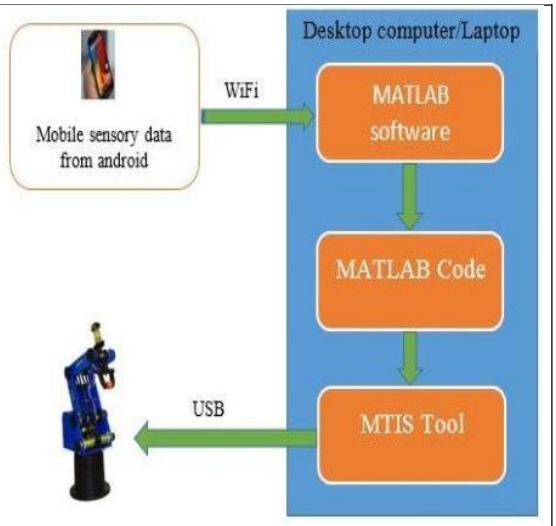

Fig.2: Overview of the whole system

It can be seen that the whole system consists of hardware – a smartphone, a Computer and robot as well as software - MATLAB software, a mobile phone app and MTIS tool, for transferring sensory data from mobile

to MATLAB software and send command to robot through MTIS tool. Overview of the whole system shown in fig. 2.

IV. METHODOLOGY

1. Setting up WiFi connection between laptop and android mobile running MATLAB mobile and MATLAB software and make positive roll of the mobile to send sensory data from mobile to MATLAB.
2. Retrieve and process the raw acceleration data in the MATLAB software to calculate coordinates/position (displacement) for XYZ axes.
3. Input the processed accelerometer data input to inverse kinematic (ScorDeltaCartMove) function of the MTIS (MATLAB Toolbox for the Intelitek Scorbot). MTIS move the robot TCP (Tool Center Point) according to the increment in the coordinates/position with respect to timestamps.

V. SYSTEM FUNCTIONALITY

The complete system functionality flow chart shown in fig. 3 .

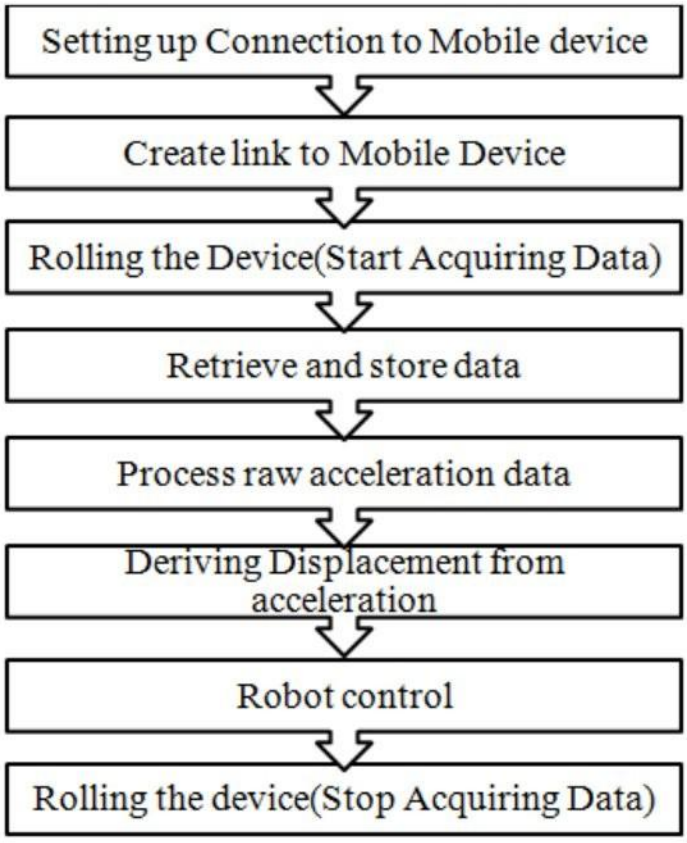

Fig.3. System Functionality Flow Chart 6.0.Results and

VI. CONCLUSION

To assess the performance of the system, different practical tests were performed. These tests include move the robotic arm along three axis separately and move robotic arm along the three axes simultaneously. The results found were very promising, showing that an untrained user can generate a robot program for a specific task, quickly and in a natural way.

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