An Approach to Control Industrial Robots using Android Mobile

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ABSTRACT
Industrial Robots are the backbone of most of the automation systems. There has been a continuous research on these industrial robots to make them more user friendly. In the past decade, various methods had been developed to teach and control these robots more easily and effectively. In spite of all these developments, the Old Teach Pendant Robots are not yet replaced even in top robotic companies. There are many reasons attributed to this. One of the reason is that, the new developments doesn't make great difference in the old system and that the whole cost of the system is still the same. This paper analyses the same and gives a solution that can make a huge difference in the present system. The Solution is an Android mobile. The paper concludes that by exploiting the capabilities of an Android mobile, a highly efficient and user friendly industrial robots can be designed.

Keywords
Android, Accelerometer, Gyroscope, Mobile, Gesture Control

1. INTRODUCTION
Robots are going to be the integral components of any industry in future. There is no field in world which is not focusing on robotics. Robotics was once a separate field. Now each field has robotics as their research interest. All human based works are being replaced by the robots. Industrial robots play a major role in influencing this interest to a great extent. They are one among the early robots which were installed to make things easy. Since their launch in 1980's, till now they have been a topic of high interest. Time and again new developments are made based on the need.

The way these industrial robots are controlled forms the primary objective in any upgrade. In the last decade, new methods were proposed to control these robots more easily.

Wireless Control was the prime objective in most of the proposals. The way of control differed. Control using Accelerometer Sensors seemed desirable in most of them. Some used mobile phones to remotely control these robots. In spite of all these proposals, most of the industries are still using the same teach pendant control. The objective of this work is to analyze the reasons for industries' "No interest in new proposals" and gives a new suggestion on what can bring about a change in the present system.

2. ANALYSES OF PREVIOUS WORKS
The previous works related to robotic arm control can be grouped under three categories.

1) Those which used mobiles phones and Networks to control remotely[4][7](**fig1**)
2) Those which used image processing to capture hand motion and control the robot.[3] [9] (**fig2**)
3) Those which used accelerometers and/or gyros with microcontrollers as wearable gestures.[1] [5] [6](**fig 3**)

The Conceptual diagrams for the previous works and present teach pendant based industrial robots are given below.

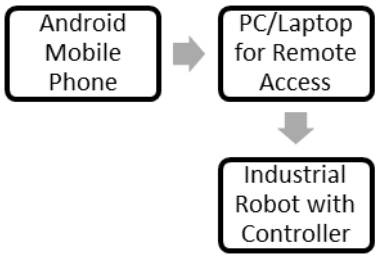

Figure 1 Network Based Control

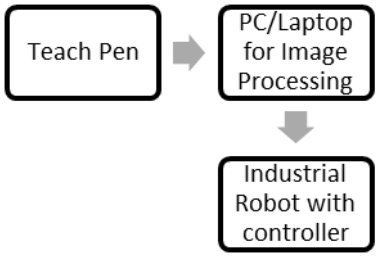

Figure 2 Image Processing Based Control

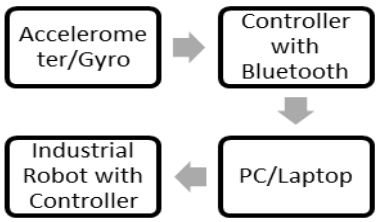

Figure 3 Accelerometer Based Control

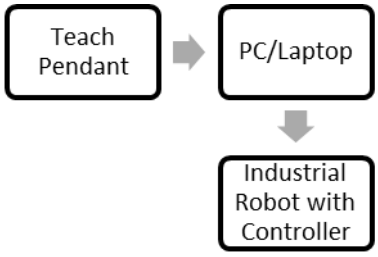

Figure 4 Teach Pendant Based Control

From the conceptual diagrams, the following observations can be made,

1) All the systems needed a PC or a Laptop to process the sensor signals.
2) Only the sensing mechanism changes in them. At the receiver end, they all have the same components.

3. INFERENCES AND OBJECTIVE

Since the overall system, even after new methods of sensing are proposed, doesn't change to a significant level, there won't be reduction cost-wise or in controlling difficulties. This is the primary reason for industries not adopting the new techniques. A Change in the industrial robots won't happen often. It is a long term change and without being satisfied that the change is necessary, the industries won't adopt any.

So "A New change" means a major change in the present system. Since a controller is a necessary part in the system, the only thing that can be eliminated from the present system is the PC/Laptop. The sensing mechanism along with the PC/Laptop can be replaced with an Android Mobile Phone.

4. WHY AN ANDROID MOBILE PHONE?

The PC or the Laptop in the previous works was primarily used for the data acquisition and calculation purposes. With Android phones in hand, acquisition and calculation can be done more easily than ever. Also, since accelerometers and gyros are present by default in the recent Android phones, there is no need of a separate sensing unit. Thus the sensing mechanism and acquisition/calculation is done with a single device eliminating the need for a separate dedicated system.

Another compelling reason for using Android mobile is that, the required Android App can be easily developed and altered as desired, since Android is an open source platform.

5. HOW CAN THIS BE DONE?

The new proposed system consists of only two units – An Android Mobile Phone and An Industrial Robot with Controller.

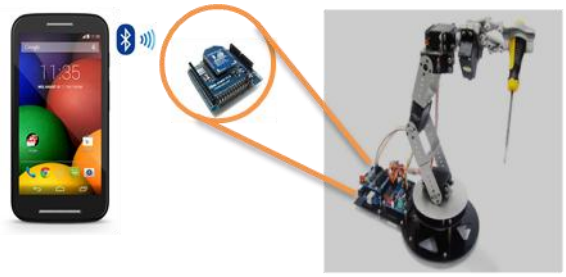

Figure 5

An Android application is developed which can acquire the accelerometer and gyro values from the mobile phone and transmit over Bluetooth channel. Not all the axis values are acquired. X-axis and Y-axis values are acquired from accelerometer and Z-axis readings are acquired from the gyroscope.

On the robotic Arm end, a Microcontroller along with a Bluetooth module is present. The accelerometer and gyroscope values are received using Bluetooth module and sent to the Microcontroller serially. This data is analyzed and correspondingly the servos are controlled.

6. SIMULATION

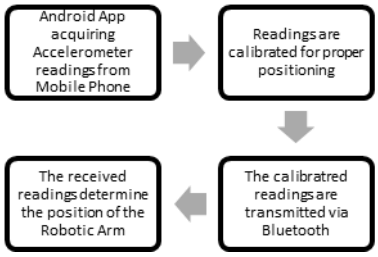

Figure 6 Block Diagram of the Proposed System

The sequence of operations in the proposed system is shown above. The Simulation of the proposed model is done using Blender. The 3D model of 3 DOF robotic arm is shown below.

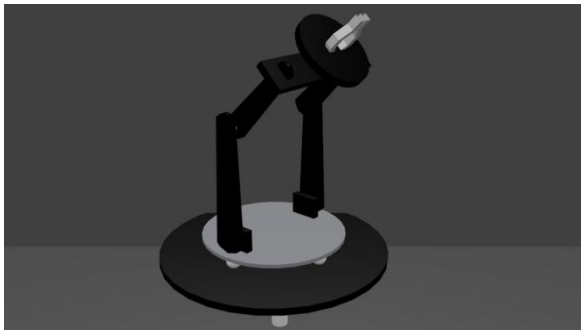

Figure 7

Since Blender is built upon PYTHON, it is easy to get serial data from Bluetooth and manipulate it using python code.

PySerial is a python plug-in which can be used to get the data serially from any serial device and also to send out serial data.

For simulation, we use an already available android app called "Sensoduino"(**fig 8**) which can send out accelerometer and gyro readings from the mobile phone via Bluetooth. A view of the APP is shown below.

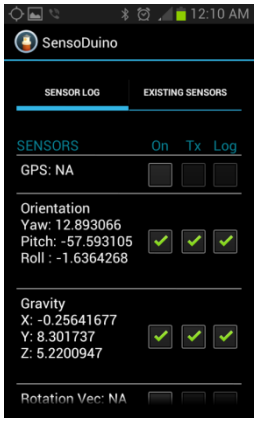

Figure 8

The Accelerometer and gyro readings will be in the range from 1 to 10. Each axis gives out different readings in this

range. These readings are then calibrated and provided to three servos of the arm on Blender.

7. CONCLUSION

With the growing interest in robotics, this way of controlling the robots will help industrialists to use the robots in a more efficient way. The fact that the use of android is spreading in all directions, make this way desirable to most of the people.

8. FUTURE WORK

Industrial Robots have become intelligent. By adding Artificial Intelligent techniques, these robots can be made to work autonomously with just a click from the mobiles. The fact that android apps are open to all, a common controlling platform can be developed which can control any kind of industrial robot in the world.

9. REFERENCES

[1] Pedro Neto, J.NorbertoPires, A.Paulo Moreira "*Accelerometer Based Control of an Industrial Robotic Arm*"The 18th IEEE International Symposium onRobot and Human Interactive Communication ,Toyama, Japan, Sept. 27-Oct. 2, 2009

[2] S. Waldherr, R. Romero, and S. Thrun, "*A gesture based interface forhuman-robot interaction*" in Autonomous Robots, vol. 9, no.2, pp.151-173, Springer, 2000.

[3] Love Aggarwal, Varnika Gaur, PuneetVerma "*Design and Implementation of a Wireless Gesture Controlled Robotic Arm with Vision*"International Journal of Computer Applications (0975 – 8887) Volume 79 – No 13, October 2013

[4] Peter Papcun, MatejČopik ,JánJadlovsky "*Remote control of Mitsubishi industrial robot*" 12th Scientific Conference of Young Researchers – FEI TU of Košice, 2012

[5] N.Nandhini, SU.Suganthi " *Wireless Control of a Robotic Arm Using Inertial Sensor*" International Journal of Engineering and Advanced Technology (IJEAT) ISSN: 2249 – 8958, Volume-2, Issue-4, April 2013

[6] K.Brahmani, K.S.Roy , Mahaboob Ali "*Arm 7 Based Robotic Arm Control By Electronic Gesture Recognition Unit Using Mems*" International Journal of Engineering Trends and Technology (IJETT) - Volume4Issue4- April 2013

[7] NeerparajRai, PalzorGyatsoBhutia, UditPradhan "*Remote Learning: Android Operated Educational Robot Arm With 6 DOF*"Proceedings of Eleventh IRF International Conference, 17th August 2014, Chennai, India, ISBN: 978-93-84209-47-6

[8] Dr. Bindu A Thomas, Stafford Michahial, Shreeraksha.P, Vijayashri B Nagvi, Suresh M "*Industry Based Automatic Robotic Arm*"International Journal of Engineering and Innovative Technology (IJEIT) Volume 2, Issue 11, May 2013

[9] Hsien-I Lin * and Yu-Hsiang Lin "*A Novel Teaching System for Industrial Robots*"Sensors 2014, 14, SSN 1424-822