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An Approach to Control a Pneumatic Cylinder Using an Android Application

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Abstract: Manual work is being automated day by day, each and everything which has been automated till today was performed manually in earlier days. Automation has reached each and every field but pneumatic cylinders are still being controlled by humans. This project is to control a simple pneumatic cylinder from a remote place of the earth using an Android phone which is quite common handheld device used by half of the globe. Cylinders are most commonly used as an integral part of Dam valve controls, dancing musical fountains, in factories and more. So here with the help of this project one can control the movement of a piston of a pneumatic cylinder and can check the status of the position.

I. INTRODUCTION

A pneumatic system which can be controlled by an android phone is very useful where the pneumatic cylinder cannot be controlled manually in some hazardous places such as nuclear power plant and other places where a man can't reach. And this is even useful in the places where some cylinders have to be controlled by some specific person in a specific time.Here in this project, my objective is to control a pneumatic cylinder by using the components such as a Bluetooth transceiver, Arduino Uno microcontroller and a simple pneumatic cylinder working system with its finished electric circuit. In certain applications the microcontroller based systems has to be connected with the Bluetooth network which will enable a user to control the system by tapping the phone. Remote control, especially when this no ethernet or Wifi in the outdoor, has been a very profound things in the past. With Arduino and some other related modules. And, it is also quite easy, even for the beginners. All the controlling of the pneumatic systems performed now is carried out using a PLC or other electric circuit boards which are manually controlled.

Existing research has attempted to alleviate antagonistic forces by wrapping a force or impedance layer around the position control loop (e.g. the quadruped Silo4 [1] and hexapod Katharina [2]). The force feedback response is thus modified to respond to positional errors according to Hook's law [1]. This approach of Active Compliance is designed to adapt position control to cope with incomplete and inaccurate environmental and system data. The increased compliance does reduce internal forces but also reduces the ability of the robot to respond to external forces (e.g. Silo4 became unstable on sloping ground [1]).

Electric motor-based actuators are commonly used due to their low weight, size and cost, high power and ease of integration. However, they are difficult to use in force control because of their high stiction and reflected inertia [4].Fluid based actuators such as hydraulics and pneumatics are well suited for force control because controlling fluid pressure controls force. Hydraulic actuators are capable of large forces, however their large weight limits their use to heavy robots e.g. ASV [6]. McKibben artificial muscles are not attractive for control due to their non-linear response, hysteresis and small stroke. Pneumatic cylinders are cheap, light, have a compact footprint and are naturally compliant. However, they can have high stiction, making small forces difficult to attain, and they are low in power density. Also their natural compliance makes position control difficult [6].

Actuators

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Researchers who have used pneumatic cylinders in legged robot designs have pursued control strategies other than force control with poor results. For example STIC [6] and Robot III [3] required physical assistance to walk.

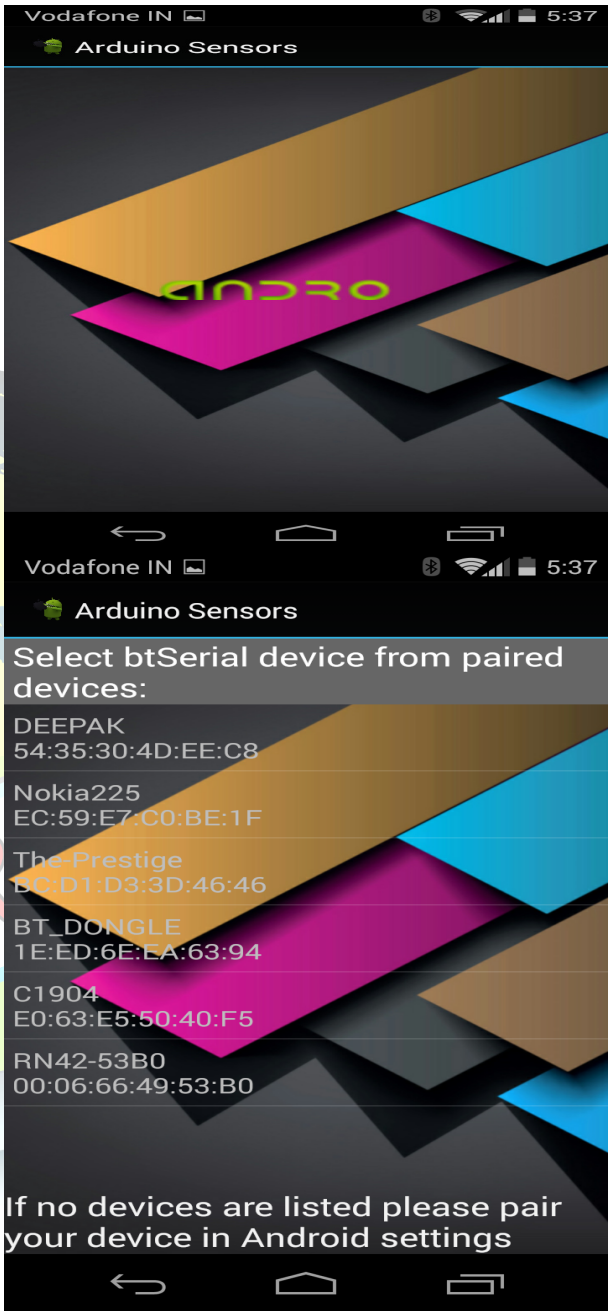
II. METHODOLOGY

The process of controlling a pneumatic system using an android phone can be explained as.

- Process initiation at user end
- Input processing and signal transmitting
- Signal reception, analysis and re-processing
- Processed signals to electrical impulses

Process initiation at user end

Everything starts here, where the screen of an android phone is touched and that input is taken.



Input processing and signal transmitting

The input transmitted using Bluetooth dongle

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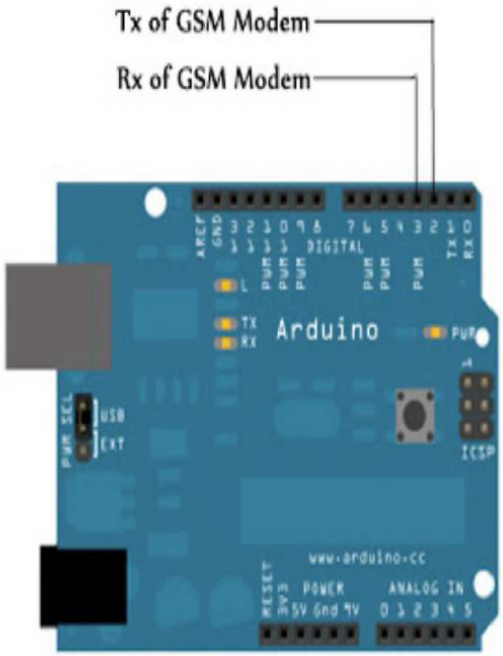
Signal reception, analysis and re-processing

The signals which are received by the modem are further processed and passed to the Arduino Uno board



Processed signals to electrical impulses

Movement of the Pneumatic cylinder piston which is controlled by the solenoid is controlled by the electrical impulses produced by the electric circuit.

Reception and display updating

On changing in the position of the cylinder's piston, the display in the hand held device of the user has to be updated.

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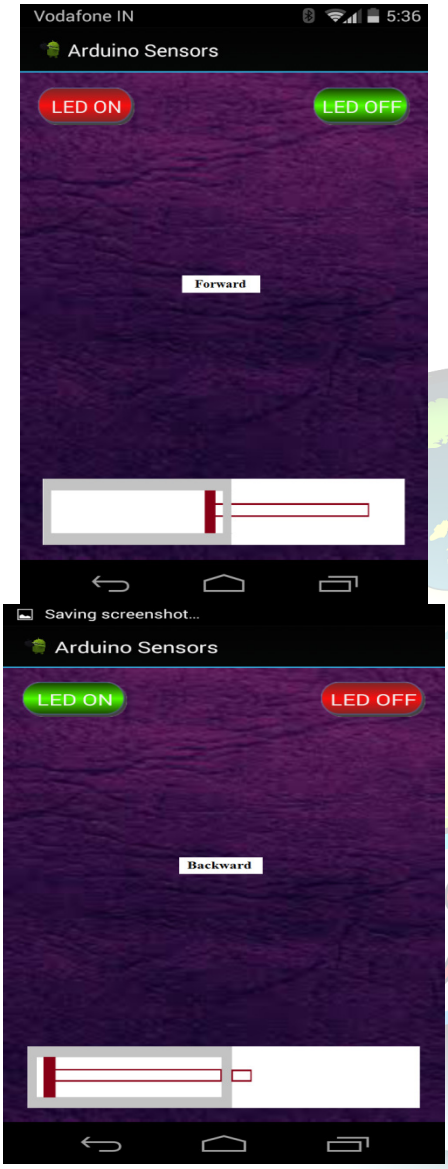

III. Results And Discussion

- A developed android application with process indications.
- A Bluetooth interfaced Arduino Uno board.

IV. Conclusion And Future Work

With the help of Android application we will be able to control pneumatic cylinder. As a further improvement the control of pneumatic cylinder can be done by Bluetooth technology.

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