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ROBOTIC ARM CONTROL THROUGH HUMAN ARM MOVEMENT USING POTENTIOMETER

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ABSTRACT: In today's world there is an increasing need to create artificial arms for different inhuman situations where human interaction is difficult or impossible. They may involve taking readings from an active volcano to diffusing a bomb. In this research paper, some other modes intuitive technique, that is, controlling the complete Robotic Arm by the operators hand movements. We have highlighted the importance and use of robotics applications in developing countries. Our Robotic arm that has five separate movements to grab or release, lift or lower, rotate wrist and pivot sideways controlled servo motors. We conclude our survey by identifying several additional open research issues in robotics and embedded system. As a result, real time and simultaneous movements from simulation to actual environment will be performed.
KEYWORDS: Servo Motors, ATMEGA 328, Micro controller, Arduino, Potentiometer.

I. INTRODUCTION

A Robot is a automatic or virtually intelligent agent that can carry out task robotically or with some supervision, typically with the aid of the remote control. Robot can be autonomous, semi autonomous or remotely controlled. In this practice machine that is guided by means of computer and electronic programming. Controlling robots using wired technology is one of the applications which have creating interest in production line to create more space and flexibility.

This paper is described by design mechanical structure of robotic arms. It also describes the implementation of robotic arm with switching controlled. This Robotic arm is often indicates to move an object from one place to another place. This robot can move freely and work on difficult area not accessible to human.

In the implementation process, the software consists of the commands that control a robot action and provide information regarding required task. When a program is written by means of software, the robot is able to implement command and achieve the particular errands [1]. Programming Robots can we a intricate and difficult process and while it has become easier over the year, the lack of cross platform industries principle has affected the development of software tools for robots compare to automated controls system such as programmable logic controller (PLC) [2]. The controlling of a Robotic arm Using Arduino platform as a first step towards understanding the performance of the system. We worked on a static robot and study the accuracy of the various functions that is it can perform.

The application of robotic field is broadly used in the field of research, laboratory based work, industrial work to automate process and reduce the human errors. Traditionally and currently this arms and machines are controlled either by preloaded (i.e. automatic) or via joystick (i.e. manual). Robot are used with in an increasingly wide variety of task such as for household appliance like vacuuming floor, moving lawns, cleaning drains, building cars, in warfare, and in the task that are too expensive or too dangerous to be performed through a humans such as exploring outer space or at the or at the bottom of the sea[3].

The design process of is clearly explained in the next section with detail information regarding the components used is followed by the implementation and the result and finally end with conclusion. After discussing the whole scenario this research also conclude some importance application of robotics and embedded system for our countries perspective which is very crucial for engineers to find their future code.

Overview of the Arm:

- Degree of freedom : 4
- Payload Capacity : 0.1 kg
- Joint Speed : 0.3 second/ 60 degree
- Hardware Interface : two fingered simulator with potentiometer attached at every joint
- Shoulder Base Pin : no shoulder
- Shoulder Elbow Pitch : 140 degree
- Finger Opening : 120 degree

II. Design of Robotic Arm

The robotic arm is designed using the micro controller that is ATMEGA-328, micro controller using Arduino programming [4]. This work on the principle of interfacing potentiometer and servomotor. The Robot arm has some segments and each segment is tied with Servo motor. The potentiometer and the servo are attached to the body of the robotic arm. The potentiometer converts the mechanical motion into electrical motion. Hence, on the motion of the remote the potentiometer produce the electrical pulses, which Auden root for the Auduino board. The auduino board process the signals received from the potentiometer further more convert them into requisite digital pulse that are then send to the servo motor. This Servo will respond as per the pulse and the movement of the arm occurs. Finally, the micro controller interface all this components specified above.

So the aim of the paper can be briefed as "Designing the system, the sensory part, which can be mounted on the human arm, synthesis the signals and ultimately generate the signals to accurate the Robotic Arm". Hence, to replicate the motion of the human arm.

A Stubby list of it as follow:-

- Arduino Micro controller
- ATMEGA-328
- Potentiometer
- Servo motor

a. ARDUINO Microcontroller:-

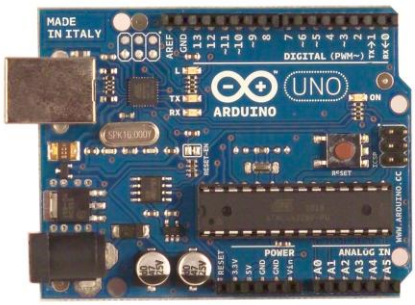


FIG.2.1: Arduino microcontroller

The ARDUINO is a open source, which means Hardware is reasonably priced and development software is free. The ARDUINO programming language is a specified version of C/C++. The ARDUINO is a micro controller board based on the ATMEGA-328. It has 14 input / output pins. 6 analog pins, 16 Hz crystal oscillator, a USB connection a power jack, an ICSP header and reset button[5]. It contains everything needed to support the micro controller, simply connect its to a computer with a USB cable or power it with a AC to DC adapter or battery to get a started. An important feature of the ARDUINO is that you can create a control program on the host PC, download it to the ARDUINO and it will run automatically.

SUMMARY

Microcontroller:	ATMEGA-328
Operating Voltage:	5V

Input Voltage (recommended):	7-12V
Input Voltage (Limits):	6-20V
Digital Input/output Pins:	14(of which 6 provide PWM O/P)
Analog Input Pin:	6
DC Current per I/O Pins:	40mA
DC Current for 3.3V Pins:	50mA
Flash Memory:	32KB of which 0.5KB used by boot loader
SRAM:	2KB
EEPROM:	1KB
Clock Speed:	16MHz

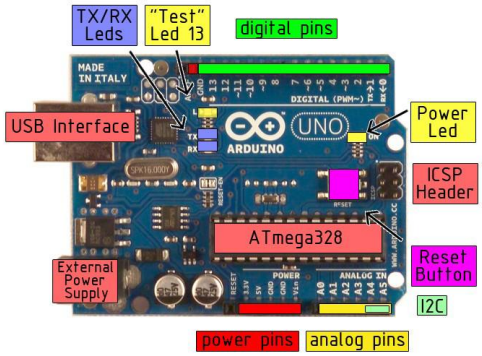


Fig: 2.2: Atmega 328

b. ATMEGA-328:-

The ATMEGA-328 has 32KB of flash memory for storing code. It has also 2KB of SRAM and 1KB of EEPROM. The ATMEGA on the Arduino comes preburned with boot loader that allows you to upload new code to it without the use of an external hardware programmer.

c. POTENTIOMETER

A potentiometer is a simple knob that provides a variable resistance, which we can read into the Arduino board as an analog value. In this example that value controls the rate at which an LED blinks, the potentiometer is a perfect demonstration of a variable voltage divider circuit[6]. The voltage is divided proportionate to the resistance between the middle pin and the ground pin.

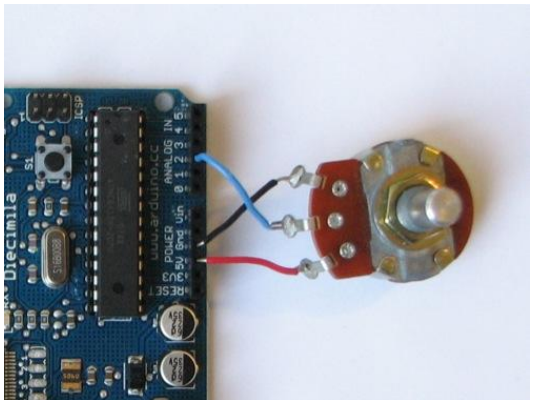


Fig: 2.3: Circuit diagram of potentiometer

We connect three wires to the arduino board, which is as follows:

1. The first goes to ground from one of the outer pins of the potentiometer.
2. The second goes from 5 volts to the other pin of the other outer pin of the potentiometer.
3. The third goes from goes from analog input 2 to the middle pin of the potentiometer.

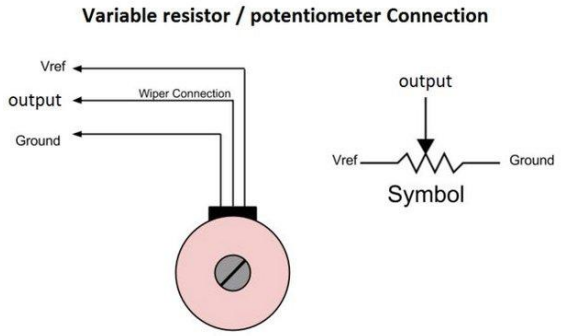


Fig: 2.4: A potentiometer

d. SERVO MOTOR

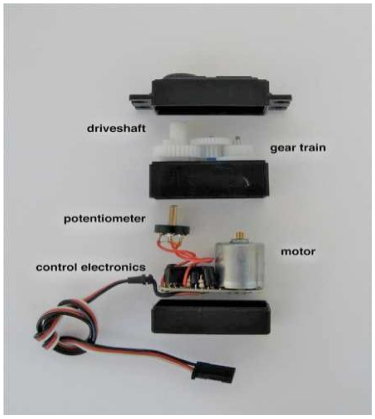
A servo motor has everything built in: a motor, a feedback circuit, and most important, a motor drive. It just needs one power line, ground and one control pin.

Following are the step to connect a servo motor to the Arduino:

1. The servomotor has a female connector with three pins. The darkest or even black one is usually the ground. Connect this to the Arduino GND.
2. Connect power cable that in all standards should be red to 5V on the Arduino.
3. Connect the remaining lines on the servo connector to the digital pin on the Arduino.

Fig: 2.5: A Servo motor

A Servo motor was a taken as a part to show the internal parts. We can see regular DC motor connect to a gear box and a potentiometer that gives the feedback for angle position.



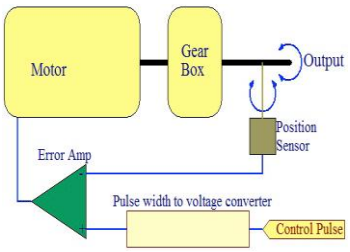


Fig: 2.6: internal part

III. IMPLEMENTATION PROCESS

The Arduino Duemilanove can be powered via the USB connection or with an external power supply [6] and the power source is selected automatically. External (non-USB) power can come from either an AC-to-DC adapter (wall-wart) or battery. The adapter can be connected by plugging a 2.1mm center-positive plug into the board's power jack. Leads from a battery can be inserted in the Gnd and Vin pin headers of the POWER connector[7]. The board can operate on an external supply of 6 to 20 volts. If supplied with less than 7V, however, the 5V pin may supply less than five volts and the board may be unstable. If using more than 12V, the voltage regulator may overheat and damage the board. Therefore, the recommended range is 7 to 12 volts.

a. ATmega328 Microcontroller

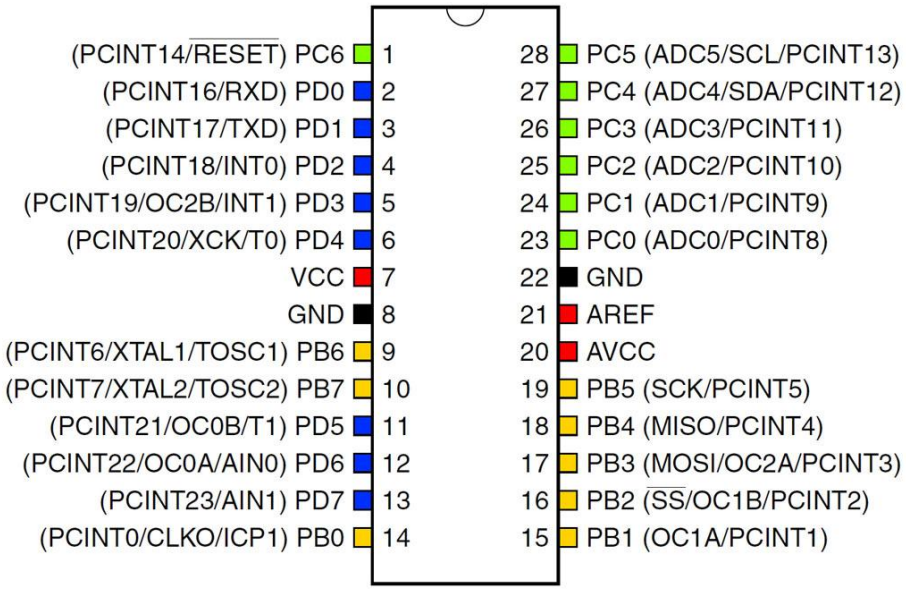


Fig: 3.1: Complete Circuit Block Diagram

Here in the diagram, each of the 14 digital pins on the Duemilanove can be used as an input or output, using the command lines „pin Mode ()", „digital Write()", and „digitalRead()" as functions. They operate at 5 volts. Each pin can provide or receive a maximum of 40 mA and has an internal pull-up resistor (disconnected by default) of 20-50 k Ohms. In addition, some pins have specialized functions. There is a built-in LED connected to digital pin 13. When the pin is "HIGH" value, the LED is on, when the pin is "LOW", it is off. The Duemilanove has six analog inputs, each of which provides 10 bits of resolution (i.e. 1024 different values).

b. LED:

LED is connected to a digital pin and its number may vary from board type to board type. To make your life easier, we have a constant that is specified in every board descriptor file. This constant is *LED_BUILTIN* and allows you to control the built-in LED easily. Here is the correspondence between the constant and the digital pin.

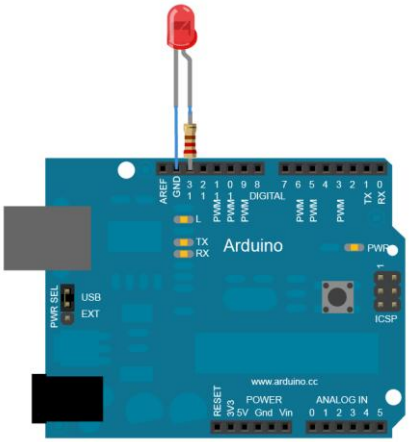


Fig: 3.2: LED

c. APPLICATION:

There are many applications of robotics arm some of them are as follows:

- Painting
- Soldering
- Access unevenly placed parts
- Pick and place
- Third hand

IV. CONCLUSION

This paper has undergone various aspects to design a robotic arm based on the ARDUINO MICROCONTROLLER considering various aspects of it, and the basics of machine designing are observed that are explained clearly. The objective of this project has been archival which was developing the hardware and software for a sensor controlled robotic arm. From the observation that have been made it clearly shows that it's movement is pierces , accrete and is easily to control and user friendly to use. The robotic arm has been developed successfully as the movement of the robotic can be controlled preseisly. The robotic arm method is expected to overcome the problem such as picking object that away from the user, pick and place hazardous object in very fast and easy manner.

V. FUTURE WORK

The Robotic arm is designed is such in such a way that to is able to lift objects of medium size or we can say weight. In future it is extended to some extent, more advance tools and material in a way that it's capacity increases to lift more heavier weights or more large size objects which are applicable in warfront and used as a rescuer at several places where there is need such as military, industrial area and so on.

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