Chapter – 1
Introduction

1.1 Introduction

Robotic Arm – A short look into its current state

A Robot is a machine designed to resemble a human being and able to replicate certain human movements and functions automatically.

Robots are currently widely used in large scale industries as robots are much cheaper and are also more efficient to do a single task repeatedly (such as welding in an assembly line or stacking and wrapping a pallet of juice bottles).

Robots have quickly become a necessary spoke in the wheel of our functioning modern society and its importance and we are entirely reliant on these machines in the domain of space exploration.

1.2 Our Project: Servo – Motor Robotic Arm

The Main Objective of our project is to build a scalable Robotic Arm, which can be controlled in a user – friendly manner.

We also have built our Arm in a manner in which a multitude of various sensors and other equipments can be mounted and interfaced with it as per the requirement of the application of its intended use.

Our Prototype is also cost effective and hence can be widely adopted for various applications.

1.3 Our Reasons for Choosing this Topic

We wished to implement this to

i) Understand the working and the concepts behind robotic arms used in industries which manufacture goods which we use on a regular basis.

ii) To develop an easier to control mechanism for robotic arms, so that they can be used even in small scale industries.

iii) we found that this topic will enable us to illustrate our understanding in a varied number of concepts we have learnt and build on them.

1.4 Conclusion

The field of Robotics is fast – paced and ever evolving with the aim of improving the quality of life and standards of living of our society.

Robots in various forms have become an irreplicable part of our strides to be a multiplanetary species and have vastly helped us explore the vast expanse of our beautiful neighbourhood among the stars.

Robots have been used effectively by large scale industries to reduce cost of manufacturing and improve its consistency, small and medium scale industries can also greatly benefit from the use of robots, but for the high costs associated with it.

Chapter – 2

Literature Survey

2.1 Extensive Surveys

a) Controlling robot arm using Kinect

By: Asim turiaqi, Dawoud sader, Ammar ashour, Islam shraim, Dr. Mohammad Dreidy.

Palestine Technical University Khadoori (PTUK)

- This Paper gave us information on the types of Robotics and their application and various forms of control that can be used.

b) Design, Fabrication and Control of an Articulated Robotic Arm

By: Sahil R. Makwana, Divya H. Shah, Kahaan P. Shah

Sardar Patel College of Engineering

- This Paper gave us information on the methods to articulate and design our robotic arm.

2.2 Conclusion

The Survey gave a brief idea of the current methods and techniques used to check for electricity theft and also gave a clear idea on the approach and direction of our Project and that it can be implemented to interface with multiple types of control systems.

Chapter – 3

Design and Components

3.1 Introduction

The implementation of the control mechanism can be split into two parts operating independently to control the arm.

These two parts are:

i) Mirror Arm
ii) Joystick

3.2 Mirror Arm

The Robotic arm is operated by moving a small – scale arm placed besides, the robotic arm mirrors the movements the user does on the mirror arm.

3.2.1 Hardware Unit

The Mirror Arm is made of potentiometers and has 3 Joints.

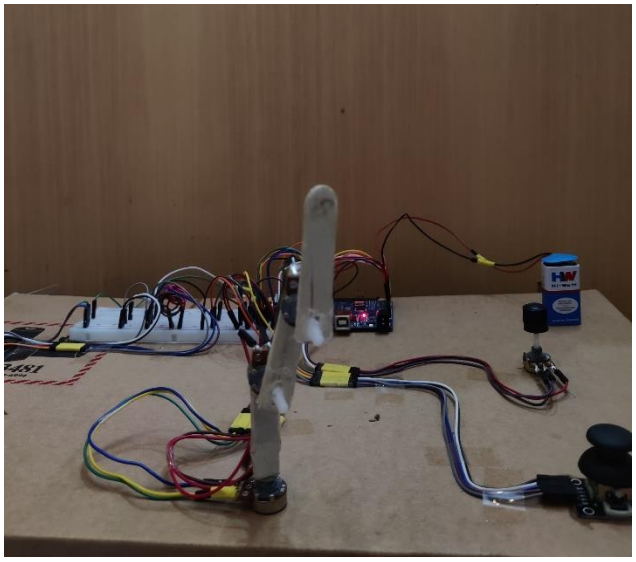

Fig 3.1 – Mirror Arm

The Prime Components of this side of the control mechanism are:

- 10KΩ Potentiometers x3

3.2.2 10KΩ Potentiometer

A potentiometer is a manually adjustable variable resistor with 3 terminals.

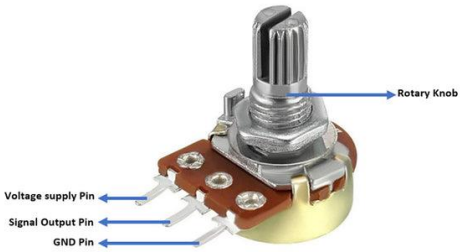

Fig 3.2 – 10KΩ Potentiometer

Two of the terminals are connected to the opposite ends of a resistive element, and the third terminal connects to a sliding contact, called a wiper, moving over the resistive element. The potentiometer essentially functions as a variable resistance divider.

3.3 Joystick

The Robotic Arm is operated by the careful movement of the Joystick.

3.3.1 Hardware Unit

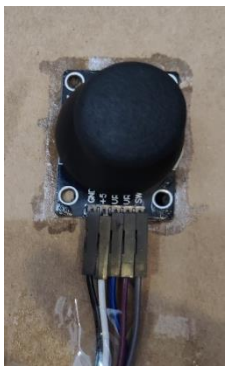

Fig 3.3 – Joystick

A Joystick Module consists of two Potentiometer, each for one axis (X and Y). Both potentiometers are independent to move in their particular direction.

SW (Switch) pin is connected to a push button internally. The change in the resistance is used to determine the movement with respect to both X & Y axes.

3.4 Servo – Robotic Arm

3.4.1 Hardware Unit

The Servo Motor Arm is Made up of servo – motors and has 3 joints.

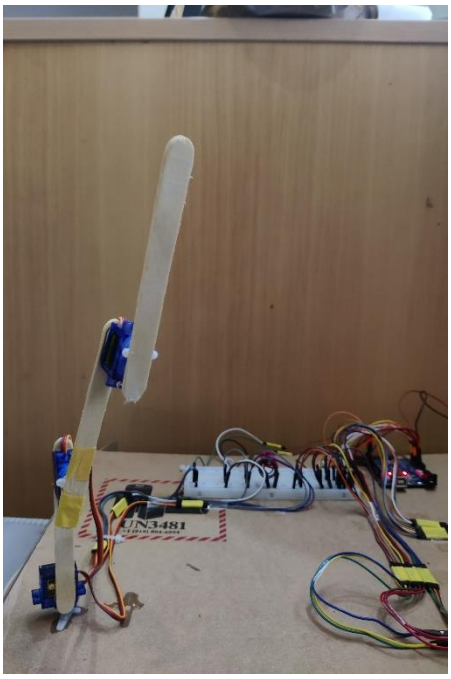

Fig 3.4 – Robotic Arm

The Servo Robotic Arm is the Arm which is being controlled and can be used to perform tasks.

It Consists of:

- SG – 90 Servo – Motor x3

Fig 3.5 – Servo Motor

A servo motor is a rotary actuator which allows to precisely control the angular position. It comprises of a motor coupled to a sensor which gives position feedback. It also requires a servo – drive to complete the system. The servo – drive uses the feedback sensor to precisely control the rotary position of the motor.

3.5 Additional Components

- An Arduino Uno is used to Program and control the system.

3.5.1 Arduino Uno

Arduino is an open-source platform for development of electronics and other related projects.

Fig.3.6 – Arduino Uno

Arduino consists of a physical programmable circuit board and an IDE (Integrated Development Environment), which is running on a fork of C++ which supports the C language library. Arduino provides a standard form factor board that breaks out the functions of the micro-controller into an array of pins, thereby making it more accessible.

- A Potentiometer is used as a switch to change the mode of control from Mirror Arm to Joystick
- A 9V Battery is used as a power source that can supply a steady voltage is used to control and power the system.

Fig 3.7 – 9V Battery

- A 16X2 LCD Display is used to Display the current Mode of Operation.

Fig 3.8 – 16X2 LCD Display

- A bread Board is used to tie the System together.

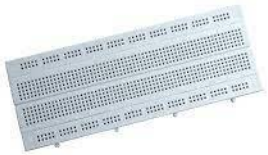

Fig 3.9 – Breadboard

3.6 Conclusion

The above Points give an overview of the components used in our project, and their working principles.

Chapter – 4

Methodology

4.1 Introduction

This chapter gives the overview of the methodology that was used to implement our project.

4.2 Schematic Diagram of System

Fig 4.1 – Schematic Diagram of System

4.2 General Arduino Code Flowchart

4.3 Working

4.5 Target Applications

- Welding Applications
- Material Handling
- Painting
- Drilling
- Water – Jet Spray
- Thermal Spray
- Drilling
- Soldering

4.6 Conclusion

The Above Schematic Diagrams and the Working gives a detailed overview of how the system actually works and how the arm is controlled using both the Joystick and the Mirror Arm.

Chapter – 5

Result and Analysis

5.1 Introduction

The prototype setup consists of the mirror arm, joystick and the servo – robotic arm.

Fig 5.1- Shows the setup of the Entire Prototype

5.2 Conclusion

All the Hardware components were tested and their working verified.

The Output Given by the Hardware were in accordance to the input provided and the expected Output was received.

Chapter – 6

Conclusion

6.1 Conclusion

We have successfully developed a robotic arm which can be controlled by both a Joystick and a mirror arm. This system can be used to perform various applications.

6.2 Advantages

- Easy to integrate

- Cost effective

- Multiple Control Methods

- 3 Degrees of Freedom

6.3 Scope of Future Improvements

i) Built-in vision in the Arm – A built in camera will enable the use of the Arm even in situations where the operator cannot maintain line of sight.

ii) Wireless Control of the Arm can add more flexibility to its deployment.

References

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iv) ROBOT ARM CONTROL WITH ARDUINO by Aimn Mohamed Ahmed Ghiet MECHANICAL AND AERONAUTICAL ENGINEERING: https://www.researchgate.net/publication/317277584_ROBOT_ARM_CONTROL_WITH_ARDUINO