VISVESVARAYA TECHNOLOGICAL UNIVERSITY

BELGAUM – 590014

PROJECT REPORT ON

"HAND GESTURE CONTROLLED MOBILE MACHINE ARM"

A Project report submitted to Visvesvaraya Technological University in partial fulfillment of the requirement for the award of degree of Bachelor of Engineering in Mechanical Engineering

Submitted by,

HEMANTH HEGDE	**[4JN09ME027]**
CHANAKYA S.N	**[4JN09ME017]**
SUMANTH PRABHU M.G	**[4JN09ME101]**
DARSHAN KUMAR JAIN	**[4JN09ME019]**

Under the guidance of,

(Mr. M Ramesh)
Lecturer
Dept of Mechanical Engg.
JNNCE
Shimoga

(Dr. S.R. ASHOK)$_{BE,M.tech,Phd}$
Prof., Dept. of Mechanical Engg.
JNNCE
Shimoga

DEPARTMENT OF MECHANICAL ENGINEERING

JAWAHARLAL NEHRU NATIONAL COLLEGE OF ENGINEERING

SHIVAMOGGA – 577204

June 2013

ABSTRACT

Objectives of the project highlighting its importance:-

Our world is changing rapidly & putting more demands on us every day. We are under pressure to be faster, smarter & more connected. Technology is redefining every day. The world is very familiar with the term robotics but not yet implemented to the fullest level. Hence they say there's always scope for improvement and innovation in the field of robotics.

The present day robotic arms can be used for picking, grinding, welding, spinning, cutting etc. There are many gauges of performance & reliability which all have their own associated difficulties. These robotic arms are mostly controlled by microcontroller programming and most often they perform predefined tasks. They will be very particular to certain work. For example:- a robotic arm used for pick and place cannot be used for welding or spray painting.

In this project an attempt has been made to bring more accurate control of robotic arm using HUMAN MACHINE INTERFACE TECHNOLOGY. *Here the work done by the robotic arm is so intuitive that the motion of human arm has been implemented to the robotic arm.* Consider the situation of unmanned ground vehicle (UGV) being operated in military/defence by a remote controller. Here the movement of the machine arm fitted to the UGV is not precise. Hence we are interfacing the hand gesture capturing technology to robotic arm so that it imitates the hand gesture of the man (controller) who wears the *hand movement capturing gadget (HMCG).*

Along with accomplishing the hand gesture controlled machine arm we would also like to make it mobile by fitting it on to a unmanned ground vehicle. So that it finds various applications in industries, military, service areas etc.

The objectives of the proposed work is:-

- **Analyze the complexity and difficulties in controlling in a robotic arm.**
- **Designing of a robotic arm**
- **Designing of hand movement capturing gadget**
- **To make the robotic arm mobile by fitting it into unmanned ground vehicles.**

This project can be divided into 3 main units:

1. **Controlling unit :**

The two main objective of the controlling unit are:

1. Motion sensing

2. Input signal to Microcontroller

The controlling unit mainly refers to the controlling of the robotic arm through a series arrangement of sensors and circuits so as to sense and simultaneously control the movement of the arm.The controlling unit consists of a flexible ribbon which runs all along the human arm till the tip of the fingers and sensors are attached to this ribbon at major joints of the human arm. The sensors used here are BEND SENSORS. The 1^{st} sensor is placed at shoulder. This captures the horizontal movement. 2^{nd} sensor is placed at the elbow. This is to capture the vertical motion of the human arm. 3^{rd} sensor is placed at the wrist. This is for the vertical movement of the wrist. The next 3 sensors are fixed to the 3 fingers: one at thumb, second at fore finger and third at the Middle finger. These three sensors are meant to control the gripper of the mechanical arm. As we are using 6 sensors in the ribbon so maximum of six signals are available to the microcontroller each signal is produced when respective limb or particular sensor is activated by the movement of the hand.

2. **Processing unit :**

The 3 main operation of the processing unit are:

1. Input Data analysis

2. Decision making

3. Control signal generation

The processing unit is the part where the decoding, encoding and the decision making process of the entire system is made. It consists of the microcontroller and its other circuitry. The microcontroller will get input from two different sources

one from sensors in controlling unit and other from the feedback path. The microcontroller receives the sensed data from the sensors through its input ports. This input signal is first decoded and analyzed and then the output is generated according to input fed. The control signals are thus generated and are fed to the operating system through the output ports of the microcontroller. The processing unit also receives feedback signals from the operating unit and makes decisions using the feedback network reducing the error in the operation and increasing the accuracy of the entire system.

3. **Operating unit:**

This is the most important unit of the entire system. The operating system is the mechanically designed robotic arm. The robotic arm consists of three limbs, among which two limbs are actuated by the servomotors and mechanically interconnected to each other. There is another limb to which the two fingered gripper holder is attached. This is the end effecter of the robot. The whole robotic arm assembly is then fitted to an unmanned ground vehicle whose movement is controlled by joy stick.

Expected Outcome of the project :

A machine arm that is intuitively controlled by hand gesture through a hand gesture capturing device which later can be fitted on to an unmanned ground vehicle which makes the robotic arm mobile and the movement of the UGV is controlled by a remote controller. Thus establishing simultaneous movement control of the entire arm assembly and individual limbs of the arm.

Application of the project :

The project finds its application in many areas:-

- In defense and bomb diffusing system where the movement can be effectively controlled.
- In industries for pick and place and material handling.
- In crane operation where the handling of the material can be controlled by hand gestures.
- In domestic house hold purposes, shops and also for physically challenged people.