DESIGN AND IMPLEMENTATION OF HAND GESTURE BASED ROBOTIC- ARM CONTROL SYSTEM

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Abstract: We present a novel system to achieve coordinated task-based control on a dual-arm industrial robot for the general tasks of visual servoing and bimanual hybrid motion/force control. The industrial robot, consisting of a rotating torso and two seven degree-of-freedom arms, performs autonomous vision- based target alignment of both arms with the aid of fiducial markers, two-handed grasping and force control, and robust object manipulation in a tele-robotic framework. Industrial robots traditionally are preprogrammed with teach pendants to perform simple repetitive tasks without any sensor feedback. This work was motivated by demonstrating that industrial robots can also perform advanced, sensor based tasks such as visual servoing, force-feedback control, and tele-operation. Industrial robots are typically limited by the long delay between command and action, but with careful tuning, we show that these sensor-based methods are still feasible even with off-the-shelf sensors.

***Keywords**: controller, MEMS sensor, motors.*

I. INTRODUCTION

Robot is very useful for mankind in doing uncertain tasks and there are different way of approaches to control the robot like voice or wireless communications but none of them will be useful in providing friendly environment for disabled person so we propose a system in which robot can be operated through gesture. In proposed system accelerometer sensor is attached to the user hand or head depending upon the hand gestures or head movements the robot will be controlled the robot is provided with arm structure which can be helpful in picking the things. The main purpose of this project is to design a hand-glove robot which is controlled according to the movement of hand.

II. HARDWARE SYSTEM

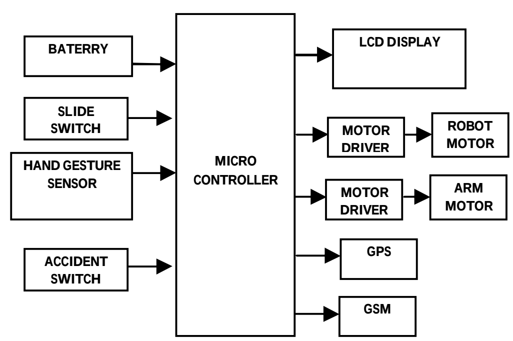

Fig 1: Block diagram

The aim at incorporating the modern ways of wheel chair dynamics and control and at the same time making it cost effective, so that it is affordable to the common masses. The goal of this research is to develop a wheelchair system which controls its movement by the mere bending of a person’s fingers. Special type of sensor known as ‘MEMS-sensor’ is embedded in order to achieve the desired goal. In this research a prototype of an affordable and technologically advanced robot is to be designed and developed. This is to aid the communication of severely disabled people and enhance the maneuvering of the vehicle with the use of hand movements.

The proposed prototype will be communicating between the controller and the plant and it will also replace the traditional joystick by the implementation of user hand glove control. The MEMS sensor can sense the movement and the sensor output is given to the controller. The controller sends the signals and according to the signals the motor is running which changes the robot movements.

III. METHODOLOGY

Micro controller: This section forms the control unit of the whole project. This section basically consists of a Microcontroller with its associated circuitry like Crystal with capacitors, Reset circuitry, Pull up resistors (if needed) and so on. The Microcontroller forms the heart of the project because it controls the devices being interfaced and communicates with the devices according to the program being written.

ARM7TDMI: ARM is the abbreviation of Advanced RISC Machines, it is the name of a class of processors, and is the name of a kind technology too. The RISC instruction set, and related decode mechanism are much simpler than those of Complex Instruction Set Computer (CISC) designs.

Liquid-crystal display (**LCD**) is a flat panel display, electronic visual display that uses the light modulation properties of liquid crystals. Liquid crystals do not emit light directly. LCDs are available to display arbitrary images or fixed images which can be displayed or hidden, such as preset words, digits, and 7-segment displays as in a digital clock.

MEMS:

Micro-Electro-Mechanical Systems (MEMS) is the integration of mechanical elements, sensors, actuators, and electronics on a common silicon substrate through microfabrication technology. While the electronics are fabricated using integrated circuit (IC) process sequences (e.g., CMOS, Bipolar, or BICMOS processes), the micromechanical components are fabricated using compatible "micromachining" processes that selectively etch away parts of the silicon wafer or add new structural layers to form the mechanical and electromechanical devices. MEMS promises to revolutionize nearly every product category by bringing together silicon-based microelectronics with micromachining technology, making possible the realization of complete systems-on-a-chip. MEMS is an enabling technology allowing the development of smart products, augmenting the computational ability of microelectronics with the perception and control capabilities of micro sensors and micro actuators and expanding the space of possible designs and applications.

Microelectronic integrated circuits can be thought of as the "brains" of a system and MEMS augments this decision-making capability with "eyes" and "arms", to allow micro systems to sense and control the environment. Sensors gather information from the environment through measuring mechanical, thermal, biological, chemical, optical, and magnetic phenomena. The electronics then process the information derived from the sensors and through some decision making capability direct the actuators to respond by moving, positioning, regulating, pumping, and filtering, thereby controlling the environment for some desired outcome or purpose.

Because MEMS devices are manufactured using batch fabrication techniques similar to those used for integrated circuits, unprecedented levels of functionality, reliability, and sophistication can be placed on a small silicon chip at a relatively low cost.

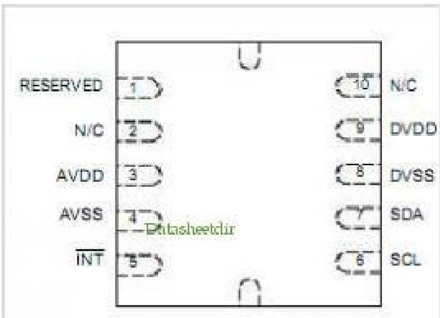

Fig 2: MEMS IC

DC Motor:

A DC motor relies on the fact that like magnet poles repels and unlike magnetic poles attracts each other. A coil of wire with a current running through it generates an electromagnetic field aligned with the center of the coil. By switching the current on or off in a coil its magnetic field can be switched on or off or by switching the direction of the current in the coil the direction of the generated magnetic field can be switched 180°.

Fig 3: DC Motor

Motor driver:

DC motors are typically controlled by using a transistor configuration called an "H-bridge". This consists of a minimum of four mechanical or solid-state switches, such as two NPN and two PNP transistors. One NPN and one PNP transistor are activated at a time. Both NPN and PNP transistors can be activated to cause a short across the motor terminals, which can be useful for slowing down the motor from the back EMF it creates. H-bridge. Sometimes called a "full bridge" the H-bridge is so named because it has four switching elements at the "corners" of the H and the motor forms the cross bar. The switches are turned on in pairs, either high left and lower right, or lower left and high right, but never both switches on the same "side" of the bridge. If both switches on one side of a bridge are turned on it creates a short circuit between the battery plus and battery minus terminals. If the bridge is sufficiently powerful it will absorb that load and your batteries will simply drain quickly. Usually however the switches in question melt.

High Side Left	High Side Right	Low Side Left	Low Side Right	Quadrant Description
On	Off	Off	On	Forward Running
Off	On	On	Off	Backward Running
On	On	Off	Off	Braking
Off	Off	On	On	Braking

Table 1: operation of H-Bridge

GSM:

Global System for Mobile Communication (GSM) is a set of ETSI standards specifying the infrastructure for a digital cellular service.

The network is structured into a number of discrete sections:

- Base Station Subsystem – the base stations and their controllers explained
- Network and Switching Subsystem – the part of the network most similar to a fixed network, sometimes just called the "core network"
- GPRS Core Network – the optional part which allows packet-based Internet connections
- Operations support system (OSS) – network maintenance

SM was intended to be a secure wireless system. It has considered the user authentication using a pre-shared key and challenge-response, and over-the-air encryption. However, GSM is vulnerable to different class of attacks, each of them aiming a different part of the network.

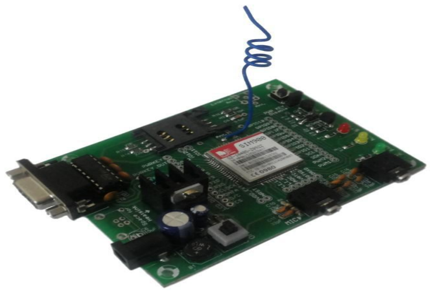

Fig 4: GSM Module

GPS:

Global Positioning System (GPS) technology is changing the way we work and play. You can use GPS technology when you are driving, flying, fishing, sailing, hiking, running, biking, working, or exploring. With a GPS receiver, you have an amazing amount of information at your fingertips. Here are just a few examples of how you can use GPS technology.
GPS technology requires the following three segments.

- Space segment.
- Control segment.
- User segment

Space Segment

At least 24 GPS satellites orbit the earth twice a day in a specific pattern. They travel at approximately 7,000 miles per hour about 12,000 miles above the earth's surface. These satellites are spaced so that a GPS receiver anywhere in the world can receive signals from at least four of them.

Control Segment

The control segment is responsible for constantly monitoring satellite health, signal integrity, and orbital configuration from the ground control segment includes the following sections: Master control station, Monitor stations, and Ground antennas.

User Segment

The GPS user segment consists of your GPS receiver. Your receiver collects and processes signals from the GPS satellites that are in view and then uses that information to determine and display your location, speed, time, and so forth. Your GPS receiver does not transmit any information back to the satellites.

The following points provide a summary of the technology at work:

- The control segment constantly monitors the GPS constellation and uploads information to satellites to provide maximum user accuracy
- Your GPS receiver collects information from the GPS satellites that are in view.
- Your GPS receiver accounts for errors. For more information, refer to the Sources of Errors.
- Your GPS receiver determines your current location, velocity, and time.
- Your GPS receiver can calculate other information, such as bearing, track, trip distance, and distance to destination, sunrise and sunset time so forth.
- Your GPS receiver displays the applicable information on the screen.

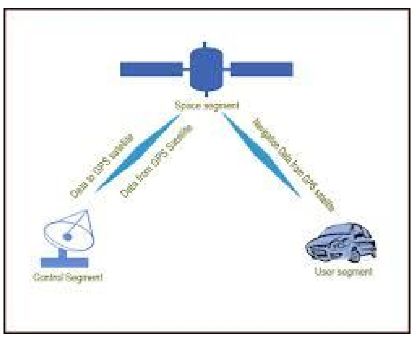

Fig 5: GPS Working

IV. CONCLUSION

The proposed prototype will be communicating between the controller and the plant and it will also replace the traditional joystick by the implementation of user hand glove control. Thus by using this project to an effective and efficient control for the people with disabilities was designed.

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