GESTURE BASED SMART WALKING ASSISTANCE DEVICE

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Abstract: Traditional Robots have some limitations in context to flexibility, bulkiness and limited functions. Taking the technology to the next level from speech recognitions and wired connections is the technology of hand gesture controlled system. Using a simple I2C chip we can connect chairs using a single remote. This paper presents the Robots are used by the people who cannot walk due to physiological or physical illness, injury or any disability. Recent development promises a wide scope in developing smart Robots. The present article presents a gesture based Robot which controls the Robot using hand movements. The Mems sensor, which is connected to hand, is a 3-axis accelerometer with digital output (I2C) that provides hand gesture detection, converts it into the 6-bit digital values and gives it to the microcontroller.
Keywords: ARM Microcontroller, I2C protocol, Slide Switch, Hand gesture sensor, Motor driver, 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. In today's time, an estimated 1% of the world's population needs a Robot. An increased percentage of elderly and disabled people who want to enhance their personal mobility, for them Robot is the best assistive device. A disabled or an invalid individual (usually the disability of the lower part of the body) can find it convenient to move around and maneuver using the help of a chair constructed on wheels which can either be pushed by another individual or propelled either by physical force or electronically. Such a chair is called as a Robot. Traditional Robots have some limitations in context to flexibility, bulkiness and limited functions [1]. Our approach allows the users to use human gestures of movement like hands and synchronize them with the movement of the Robot so that they can use it with comfort and ease on all kinds of terrains without the hurdle or cardiovascular problems or fatigue. Some existing Robots are fitted with pc for the gesture recognition [2]. But making use of the pc along with the chair makes it bulkier and increases complexity. This complexity is reduced by making use of the Mems accelerometer [3-4], the size of which is very compact and can be placed on the fingertip of the patients. Other existing systems, which make use of the similar kind of sensors are wired, which again increases the complexity of the system. They also limit the long range communication. This complexity is removed by using the RF transmission. The processing speed of this system is made faster by making use of I2C protocol.

II. PROPOSED SYSTEM

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 system comprises of two main parts: The hand gesture is recognized by the sensor, digital output is transmitted to the controller. The data is received at DC Motors which are interfaced to the controller by the motor driver controls the direction of the Robot.

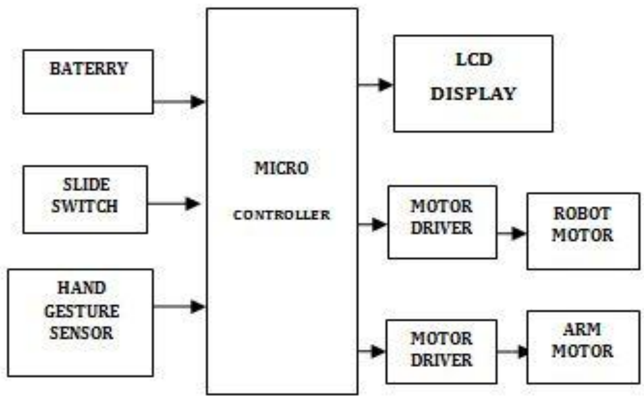

Fig 1: Block diagram

III. HARDWARE SYSTEM

Microcontroller:

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.

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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.
Hand Gesture Sensor:
Micro-Electro-Mechanical Systems(MEMS) is the integration of mechanical elements, sensors, actuators, and electronics on a common silicon substrate through micro fabrication 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 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. 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.

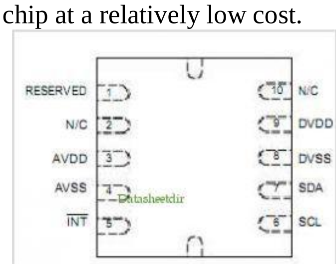

Fig 2: MEMS IC

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: 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.

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: Operation of H-Bridge

IV. METHADOLOGY

In this project Robot is operated using hand gesture and to sense the hand gesture mems accelerometer is being used. Micro Electro Mechanical Systems (MEMS) is the integration of mechanical elements, sensors, actuators, and electronics on a common silicon substrate through micro fabrication technology. An accelerometer is an electromechanical device that measures acceleration forces. MEMS accelerometer is a single chip with small size and low cost. Because of their small size and weight, accelerometers are attached to the fingertips and back of the hand. In this model we are using MMA7660FC accelerometer, which is 3axis accelerometer and gives digital output (I2C) [5]. When the device is switched on, microcontroller (acting as a master) sends the address 0x98 on the I2C bus to look if any slave with the same address

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exists or not. Now the MMA7660 accelerometer (acting as slave) sends the acknowledgement of its presence back to the controller. On receiving the positive acknowledgement, microcontroller initializes the registers of the sensor. After the initialization of the sensor registers microcontroller start calling the data stored in the sensor memory one by one. Data which is called is stored in two temporary registers Rd (0) and Rd (1) so that routine functioning of the controller is not disturbed. The data stored in temporary registers is then sent to the controller for further processing. The value for x direction is initialized at port 1. The value at port 1 is then stored in accumulator register. Now the digital output received from the transmitter is compared one by one with the value of accumulator. If the value is equal to 13 then the motor connected at port 2 using motor driver performs stop function and the value motor driver is 0000. If it is not equal to 13 then the value of accumulator is compared to next output and so on.

V. EXPERIMENTAL RESULTS

Transmitter and Receiver module are Switched On. The desired mode i.e. Robot Mode or Robot Arm mode must be selected by using the Mode switch. Transmitter module has Accelerometer MEMS Sensor which will be placed on the hand and according to the hand movements the Robot will move if it is in Robot Mode. The same way the Robot ARM will move if the Robot Arm Mode is selected.

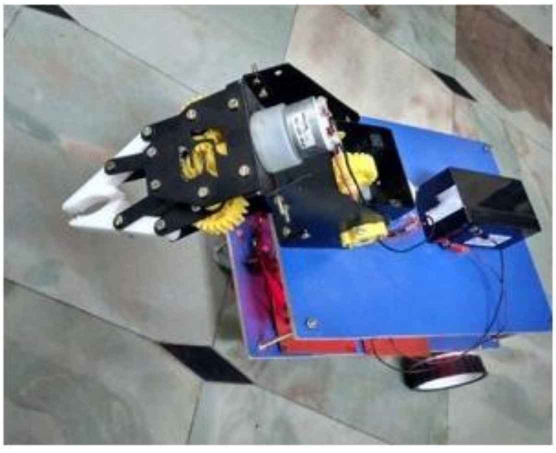

Fig 4: Receiver (Robot)

Robot Movements:

MEMS Accelerometer Sensor placed on hand, according to the hand movement Robot moves in four directions.

Fig 5: MEMS used to move Robot in Forward direction

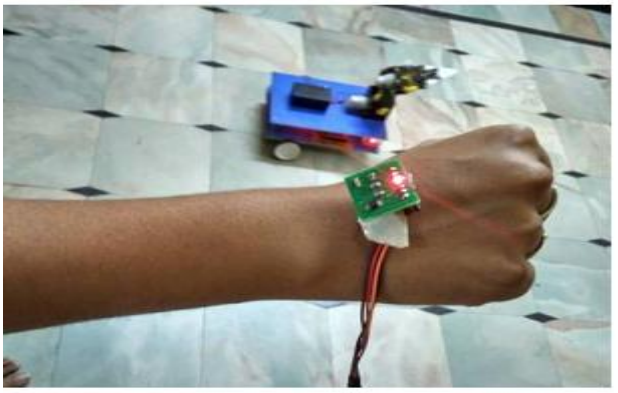

Fig 6: MEMS used to move Robot in Backward Direction

Fig 7: MEMS used to move Robot in Left Direction

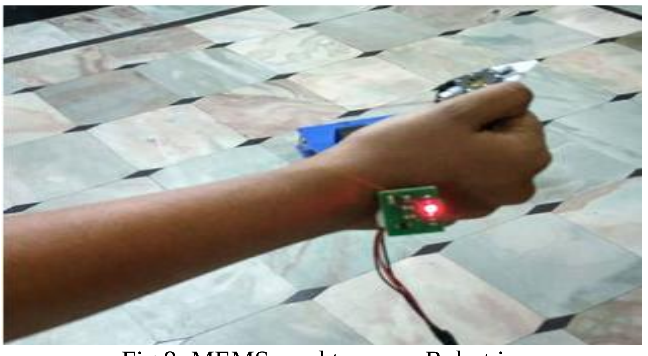

Fig 8: MEMS used to move Robot in Right direction

Robot ARM Movements

MEMS Accelerometer Sensor placed on hand, according to the hand movement Robot ARM moves in two directions and ARM Jaws opens and closes.

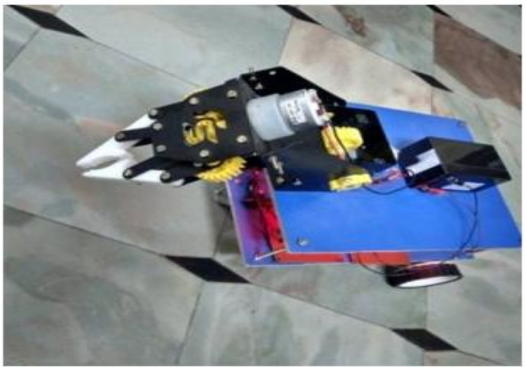

Fig 9: MEMS used to move the Robot Arm downward direction

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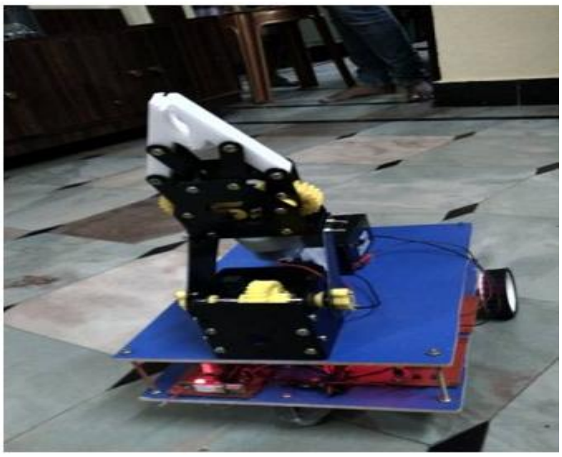

Fig 10: MEMS used to move the Robot Arm upward direction

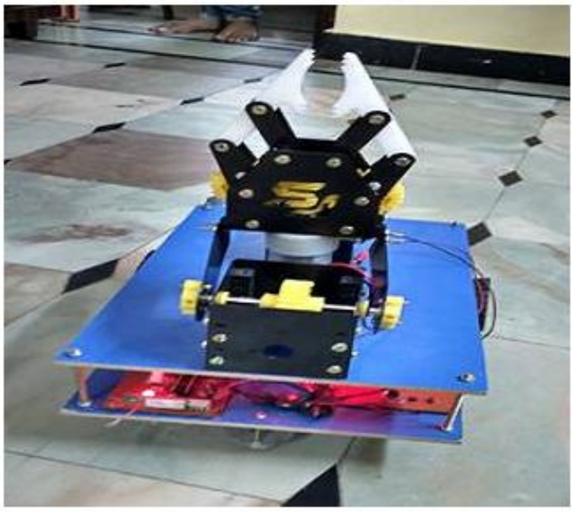

Fig 11: MEMS used to close the Robot Arm Jaw

VI. CONCLUSION

In our arrangement of motion controlled robots, we have just considered a predetermined number of signals. Our calculation can be stretched out in various approaches to perceive a more extensive arrangement of motions. The motion acknowledgment bit of our calculation is excessively basic, this strategy would require, making it impossible to be utilized as a part of testing working conditions. This kind of control could enhance efficiency, decrease the impacts of dull movements, and enhance security. Progressed mechanical arms that are outlined like the human hand itself can undoubtedly controlled utilizing hand signals as it were. The mechanical arm will copy the development of the controller. Progressed mechanical arms like these can perform unpredictable and perilous errands easily.

REFERENCE

[1] Amundson JS, Amundson SG, “A joystick controlled wheelchair”, Biomed Sci Instrum.1991; 27:131-3.
[2] 2007 4th international conference on Electrical and Electronics Engineering (ICEEE 2007) Mexico City, Mexico. September 5-7, 2007.
[3] http://mafija.fmf.unilj.si/seminar/files/2007_2008/MEMS accelerometers-koncna.pdf
[4] http://en.wikipedia.org/wiki/Accelerometer.
[5] http://www.robot-electronics.co.uk/acatalog/I2C_Tutorial.html
[6] K. Sudheer,et al, International Journal of Research in Computer and Communication technology, IJRCCT, ISSN2278-5841, Vol 1, Issue 6, November 2012.
[7] O.Mirabella, M.Brischetto, G.Mastroeni “MEMS based gesture recognition”, proc.HSI P.599–604, May 2010.
[8] http://www.analog.com/en/content/over_five_motion_senses/fca.html,1995-2012
[9] J. Z. Yi, Y.K. Tan Z.R. Ang, “Microcontroller Based Voice- Activated Powered Wheelchair Control”, ACM publishers, 2007.
[10] Munro, Jay. "Watch What You Say PC Magazine Online. March 10, 1998.
[11] http://www.freescale.com/files/sensors/doc/data_sheet/MMA7660FC.pdf.

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