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# "Gesture Actuated Robotic Arm''

**[1] Akshay Pisalkar; [2] Nirbhay Khadse ; [3]Pranay Awathare; [4]Divya Varma & [5] Dhanashree Pimpalkar**

Department Of Electronics& Telecommunication Engineering Datta Meghe Institute Of Engineering, Technology & Research ,Salod,Wardha

alshaypisalkar@gmail.com nirbhaykhadse@gmail.com awatharepranay@gmail.com divyavarma2610@gmail.com dhanashreepimpalkar@gmail.com

## ABSTRACT

*The idea is to change the perception of remote control for actuating manually operated Robotic arm. This project presents a thought and a way to eradicate the bottons, joysticks and replace them with some other more intuitive techniques, that is, controlling the complete Robotic Arm by the operators hand moment or motion or gesture.In this project the completely electronics (without mechanical sensor) way of achiving the above stated goal is discussed. This is achieved by using MEMS-ACCELEROMETER and FLEX SENSOR technology(that is used in smart phones for tilt sensing), showing the diversity of the application of the same technology. It is basically an Accelerometer based system which controls a robotic arms wirelessly using a small and low-cost, 3-axis (DOF's) accelerometer using Zigbee module. The accelerometer are mounted on the operator's hand and according to the gestures postures of the operator hand the motors are provided with the appropriate voltage. This voltage is pre-tested and depending upon the voltage the motars of robotic arm will move to perform the work as operator is doing.*

## INTRODUCTION

Technology has placed a very significant role in improving the quality of life. The increasing population leads to the expectation of new technical innovation to fulfill the new challenges being faced by human being. The main objective of this work is to implement the hand movement gesture, being captured by the sensor called accelerometer. The project is to design and develop the Robotic Arm that is used to move using wireless system by recognizing hand gestures that is controlled by accelerometer sensors for virtual environment & human-machine systems.Here a general method of mapping human motion to the robotic arm domain has been demonstrated the arm movement is reciprocated almost exactly by the robotic arm. Gesture controlled robots are extensively employed in human non verbal communication. This reports an adaptation of this communication gloves for transmitting gestures to control function of robotic arm. In the near future, robots will interact closely with a group of humans in their everyday environment in the field of entertainment, healthcare, nursing. Therefore it is essential to create model for natural and intuitive communication between humans and robots. Furthermore, for initiative gesture-base interaction between humans and robot, the robots should understand the meaning of gesture with respect to society and culture.

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## BLOCK DIAGRAM

### Transmitter

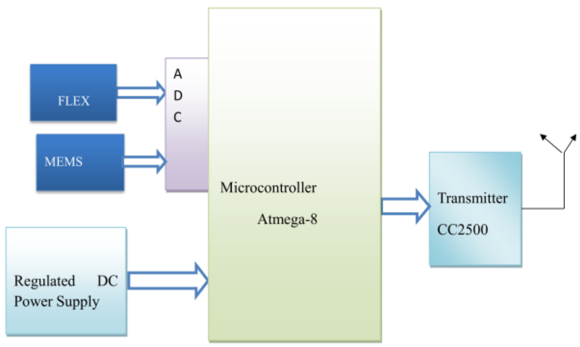


**Fig. 1: Block Diagram of Transmitter**

### Receiver

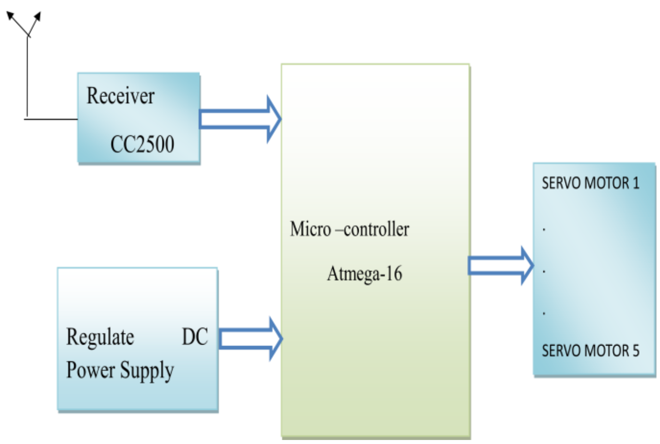


**Fig. 2: Block Diagram of Receiver**

### 3.2 Description

## Description

- MEMS SENSOR: It is a Micro-Electromechanical System. It is a sensor which is used to detect the motion of operator's hand. In this project, there are two MEMS sensors are in used. One for detecting the motion for Forward, Backward, Left and Right direction whereas other is used for detecting the motion for Pick Up and Pick Down movement of robotic arm [1].
- FLEX SENSOR: The Flex Sensor patented technology is based on resistive carbon elements. As a variable printed resistor, the Flex Sensor achieves great form-factor on a thin flexible substrate. When the substrate is bent, the sensor produces a resistance output correlated to the bend radius—the smaller the radius, the higher the resistance value.
- REGULATED DC POWER SUPPLY: In this project, there is 12V DC power supply is used but the microcontroller Atmega 8 is works on 5V supply hence to get that here regulate DC power supply is used.
- MICROCONTROLLER ATMEGA 8 AND ATMEGA 16: Atmega 8 is a 28 pin IC whereas Atmega 16 is a 40 pin IC. They work on the 5V power supply. The maximum operating frequency of these Atmega 8 and Atmega 16 IC is 16 M Hz. These IC have inbuilt ADC circuit.
- C2500 TRANSECEIVER MODULE: It is a wireless transmitter and receiver circuit which is used to transmit the data over 30 feet distance. The operating frequency of CC2500 is 2.4 GHz**.** It works in the voltage range of 1.8V – 3.6V. It is an 8 pin module. It has high sensitivity and low current consumption.
- SERVO MOTORS: The function, or task, of a servo can be described as follows. A command signal which is issued from the user's interface panel comes into the servo's "positioning controller". The positioning controller is the device which stores information about various jobs or tasks. It has been programmed to activate the motor/load, i.e. change speed/ position. It is a system of devices for controlling some item (load). The item (load) which is controlled (regulated) can be controlled in any manner, i.e. position, direction, speed. The speed or position is controlled in relation to a reference (command signal), as long as the proper feedback device (error detection device) is used. The feedback and command signals are compared, and the

corrections made. Thus, the definition of a servo system is, that it consists of several devices which control or regulate speed/ position of a load[3].

## CIRCUIT DIAGRAM

### Transmitter

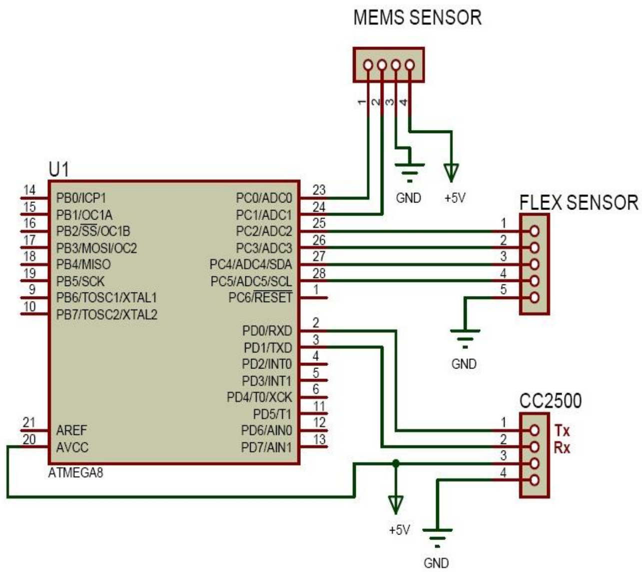


**Fig 3: Circuit Diagram of Transmitter**

### Description:

This is the circuit diagram of transmitter. In this circuit we use the Atmega 8 which is 28 pin IC and it works on the 5V supply. We have to use MEMS sensor and flex sensor. The MEMS sensor are connected to the Port C and the remaining pins of the both MEMS sensor i.e. pin 3 is connected to the +5V supply and pin 4 is connected to the ground. The flex sensor containing five pins out of that four pins are connected to the port C and the remaining one pin is ground. The next is the CC2500 Module. It is a transreceiver module. It can transmit as well as receive the data. It can be work on 2.4 GHz and its range is 30 feet. The TxD pin of the CC2500 Module is connected to the RxD pin of the IC and vice-versa. The pin 3 is connected to +5V supply and the pin 4 is connected to the ground.

### Receiver

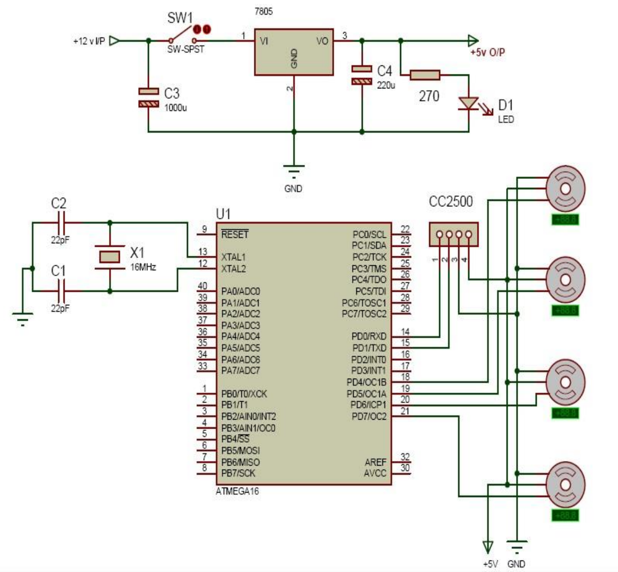


**Fig 4: Circuit Diagram of Receiver**

### Description:

This is the circuit diagram of the receiver. In this circuit we use Atmega 16 which is 40 pin IC. In the receiver side we use Atmega 16 because in the receiver side there are more connection than the transmitter side and we also require more memory space for the programming so that we use the Atmega 16 in the receiver side. We connect four servo motors containing three pins out of that one pin is connected to the port D and remaining two pins are +5V and ground. Here we also use CC2500 Module for transmitting and receiving purpose.

**Power supply**

This is the power supply circuit. We apply a 12V input supply but in our circuit the Atmega 8/16 IC works on the +5V supply so that we use the 7805 voltage regulator IC which can convert the 12V supply to the 5V. We can also use the capacitors for the filtering purpose and there is one LED for the indication.

## WORKING AREA DETAILS

**1) Software**

**1.1 PCB Artist**

PCB Artist is just of many PCB layout software tools available to use, but for understanding of one layout tool easily transfer to any PCB design tool. PCB Artist is a free software tool and can be downloaded for free at www.4pcb.com.

**1.2 Atmel Studio 6.0**

Atmel Studio 6 is the integrated development platform (IDP) for developing and debugging Atmel Arm Cortex-M and Atmel AVR microcontroller (MCU) based applications Atmega Studio 6 IDP gives you a seamless and easy-to-use environment to write , build and debug your applications written in C/C++ or assembly code.

**2) Hardware**

**2.1 CC2500 Module**

It is a transreceiver module. It can transmit as well as receive the data. It can be work on 2.4 GHz and its range is 30 feet.

**2.2 Atmega 8, 16**

The Atmega 8 which is 28 pin IC and it works on the 5V supply & we used it on transmitter side.. Atmega 16 which is 40 pin IC. In the receiver side we use Atmega 16 because it has more memory space in it.

**2.3 SENSORS**

MEMS sensor is a Micro-Electromechanical System. It is a sensor which is used to detect the motion of operator's hand. In this project, there are two MEMS sensors are in used. One for detecting the motion for Forward, Backward, Left and Right direction whereas other is used for detecting the motion for pick up and pick down movement of robotic arm.The Flex Sensor patented technology is based on resistive carbon elements. As a variable printed resistor, the Flex Sensor achieves great form-factor on a thin flexible substrate. When the substrate is bent, the sensor produces a resistance output correlated to the bend radius—the smaller the radius, the higher the resistance value.

**2.4 Voltage Regulator IC (7805)**

It is a voltage regulator integrated circuit. It is a member of 78xx series of fixed linear voltage regulator ICs. 7805 provides +5V regulated power supply.

## ADVANTAGES

- It allows interactivity in real-time with virtual objects
- Can be applied in remote rural areas so as to carry out operations.
- Can be used in military areas where highly skilled doctors may not be present.
- In application like bomb disposal the human life is not at risk.

## APPLICATIONS

- Gesture controlled robotic arm can help in the applications like bomb disposal without risking the human life.
- It can work in remote areas.
- It can also be used in pick and place applications.

## FUTURE SCENARIO

- Research is going on sixth sense technology to control the robotic arm. This, if achieved will be of great help to the physically handicapped.

## CONCLUSION

It provides a better way to control a robotic arm using accelerometer which is more intuitive and easy to work, besides offering the possibility to control a robotic arm by other wireless means. Using this system a non experience a controller can easily control robotic arm quickly and in a natural way. Also, many applications which require precise control and work like human beings can be easily implemented using this approach. The application that was mentioned is successfully fulfilled. And it provides more flexible control mechanism.

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