

## “Animatronic Hand Using Wireless Module”

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Abstract - *Animatronics is the use of mechatronics to create machines which seem animate rather than robotic. Animatronic figures are most often powered by pneumatics (compressed air), and, in special instances, hydraulics (pressurized oil), or by electrical means. The figures are precisely customized with the exact dimensions and proportions of living creatures. Motion actuators are often used to imitate “muscle” movements, such as limbs to create realistic motions. Also, the figure is covered with body shells and flexible skins made of hard and soft plastic materials. Thus in this project a Animatronic hand is developed using XBEE wireless module and Arduino UNO. As the whole body of the robot would have been of much cost, we only developed a hand which will act as shadow hand. The main aim of this paper is highlight the use of wireless communication and its application by developing Animatronic Hand which can be used in many fields like medical, defense, chemical industries.*

**Keywords-** *Arduino, Servo motors, Flex sensors, Power IC, Programming of the Arduino.*

### 1.INTRODUCTION

#### 1.1 Literature Survey

Wireless animatronic hand is basically a robotic hand which is implemented by using a latest wireless technology. Intension of this product is to help/get involved in many of the industries where human hand is must to complete the required task; but it may harm human skin or bones. Here, instead of using actual human hand, we can replace it by this wireless robotic hand. We may allow this robotic hand to complete the same task so that the risk will be avoided and obviously, required task can be achieved. For example, during bomb diffusing operation in defense field, this Animatronic hand can be mounted on a moving platform

along with a camera to diffuse the bomb from a safer distance without any harm to humanlife . Also this hand can help dumb and deaf people to interact with sign languages. The sign language instructions can be stored in the microcontroller and this hand can easily interact with dumb and deaf people. Also this hand can help paralysis patients who can't move their hand by proving a electronic hand which can work on voice commands of the bearer and enables the user perform various tasks like grab something, switch on something etc. This project intends to implement an affordable electronic product known as wireless animatronic hand based on wireless technology based on Xbee module as well as Arduino-UNO board. Arduino-UNO is a microcontroller board which has on-board microcontroller ATmega-328. It has total 14 pins including analog and digital pins. There are 6 PWM(Pulse Width Modulation) output pins on this board. Also, it has 6 analog inputs, a USB connection, a power jack, a 16 MHz ceramic capacitor, an ICSP header and a reset button. Basically there are two main parts of this project i.e. transmitter (Control glove) and receiver (mechanical-electronic robotic hand). Both parts interact with each other using wireless communication. Control glove mainly consists of flex sensors. There are total five flex sensors placed separately on each finger on the glove. Human hand will control another robotic hand; so that it is called as a control glove. Future efforts would be made to make this hand more flexible, more precise and moveable from one place to another.

#### 1.2 Problem Statement

In present scenario of technology, there are many industries where human hand is a must to complete the required task, but it may harm human skin or bones. So instead of using actual human hand, we can replace it by wireless robotic hand. So this robotic hand can be used to complete the same task so that the risk will be avoided and required task can be achieved.

The objectives of the project is to ensure that the research will fulfill the solution of the problem research. All the objectives are shown below:

- a) To design and develop an Animatronic hand using wireless module (XBEE-S2)
- b) To design and develop the prototype of the human hand which can be a part of human robot and can be used in many applications.

### 1.3 Animatronic Hand

In the field of robotics and industrial equipments, use of proper method of handling the chemicals. equipments etc is very important from safety point of view. Traditional method of handling the chemicals as well as equipments was done normally with the help of bare hands. With the bare arms it is not possible to hold the equipments and chemicals for a large amount of time and due to this there is a matter of safety as well as there is no proper precision. With the new innovations in the field of science i.e. Animatronic hand, we can do all such tough tasks with higher amount of precision and higher amount of safety. So in this project, electronic hand is developed which is controlled via control glove.

The control glove has flex sensors which detects the movements of fingers and accordingly electronic hand perform the required tasks. This animatronic hand is able to be controlled according to the controller's. It is capable of moving at the required degrees of freedom. It can also pick up things upto to minimum desired weight. We can use it as shadow hand of ours which is of various use. With the help of sensors this hand can provide detailed telemetry, which can be exploited to generate innovative manipulation, control systems, or to provide detailed understanding of the external environment.

## 2.METHODOLOGY

### 2.1 Hardware Design and Description:

#### A. Block Diagram:

##### Transmitter

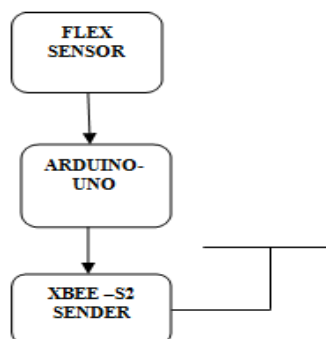


Fig -1: Block Diagram of the Tx end.

##### Receiver

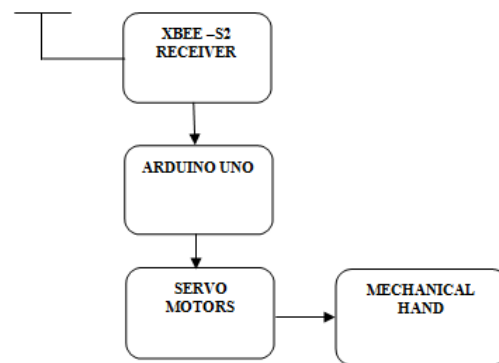


Fig -2: Block Diagram of the Rx end.

#### B. Flex sensor:

These devices are used to measure the bending in the finger by change in the resistance. As the bending angle increases, the resistance increases and this variable resistance is converted into voltage by a voltage divider network and given to ADC for digital conversion.

#### C. Arduino UNO:

Arduino UNO is Atmega-328 based microcontroller board. It is very simple and powerful board with ISP mode. It has total 14 pins including analog and digital pins. There are 6 PWM(Pulse Width Modulation) output pins on this board. Also, it has 6 analog inputs, a USB connection, a power jack, a 16 MHz ceramic capacitor, an ICSP header and a reset button.

#### D. Xbee Wireless Module:

XBEE is a wireless communication module that Digi built to the 802.15.4/Zigbee standards. These modules use the IEEE 802.15.4 networking protocol for fast point-to-multipoint or peer-to-peer networking. They are designed for high-throughput applications requiring low latency and predictable communicating timing,

#### E. HS-55 Microservo Motor:

A rotary actuator that allows for a precise control of velocity, acceleration as well as an angular position is known as a servomotor. Servomotor is a motor suitable for use in a closed loop control system. It includes suitable motor coupled to a sensor to get a position feedback. To handle the finger movements and rotations, micro servo motors are being used in this project.

## 2.2 Software Used

### A. Arduino IDE:

#### 1. Software Download:

Following the instructions on the Getting started section of the Arduino web site, <http://arduino.cc/en/Guide/HomePage>. we at first downloaded the latest version of Arduino, [arduino-1.0.5- windows](#).

#### 2. Software Installation:

Going all the way through the steps to where we saw the pin 13 LED blinking. This is the indication that we had all software and drivers successfully installed and could start exploring with our own programs.

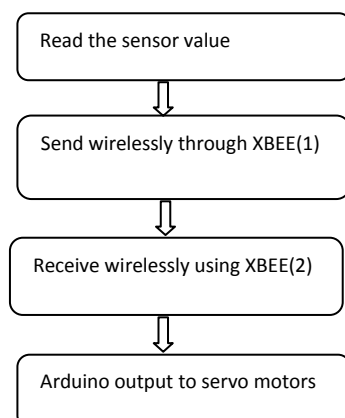
#### 3. Software Execution:

- Connected our Arduino to the computer with the USB cable. We did not need the battery for that time. The green PWR LED will light. If there was already a program burned into the Arduino, it will run.
- Started the Arduino development environment. In Arduino-speak, programs are called "sketches", but here we will just call them programs.
- Then we clicked the Upload button or Ctrl-U to compile the program and load on the Arduino board.

## 2.3 Algorithm

- Start
- Initialize ADC and UART.
- Get the analog output from flex sensors.
- Convert into digital form and send it to Xbee serially.
- Send data wirelessly through XBEE on transmitter side.
- Receive the data wirelessly via XBEE on receiver side.
- Give the output to the servomotors accordingly.
- Stop

## 2.4 Flowchart:



## 3. EXPECTED RESULT

A wireless animatronic hand was first tested with a single finger. It was observed that after bending the single flex sensor at the transmitter side, the corresponding robotic finger moved in the same manner and same angle. Servo motor causes the movement of a robotic finger. With reference to this, all five servo motors moved (or controlled) by five flex sensors on a single control glove. In this way, a wireless communication has been achieved successfully. So, now it is possible that a man can control a robotic hand from a distance wirelessly.

## 4. CONCLUSION

This project presents a wireless animatronic hand which is implemented by using a latest wireless technology. It can be widely used where there are restrictions or a hazard to a human hand. It is basically a futuristic project which will be used to make Humanoid (Human like robots). Future efforts will be made to make this hand movable (from one place to another), more flexible and more precise if possible.

## 5. APPLICATIONS

- For use in Chemical industries for safety point of view to human hand.
- As a part of Humanoid robot to perform various tasks.
- In medical field for physically challenged patients.
- For Military use in bomb diffusing.
- For use in Robots that help deaf and dumb in chatting with sign language.

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