Smart Prosthetic Hand

R. Reenu[1], A. Mouni[2], T. Karthiga[3], S. Kiruba Colin Queen[4], P. Priya Dharshana[5]

[1]*Assistant Professor, Electrical and electronics Engineering Department, Kamaraj college of engineering and Technology*

[2,3,4,5]*Student, Electrical and electronics Engineering Department, Kamaraj college of engineering and Technology*

Abstract - **This paper presents an artificial hand. A system which can mimic the movements of human hand controlled by a human operand which is remote to the robotic hand. Minimum loss and latency of data while transmission. The artificial hand gripper system requires sensors for a smooth and accurate movement. The initial objective is to analyse and develop artificial arm with a strength limit proportional to the weight. Then by the attachment of a wireless system on the prosthetic gripper via nRF24L01 transceiver and receiver. Microcontroller will further use this information to control multiple servo that act as a mechanical hand inside the prosthetic gripper. The Smart prosthetic hand has simple construction and low cost of materials. The main application of this project is for the Military purpose for bomb squad. The use of parallel works can also be accessed with ease. The system will be cheap, user friendly, and an innovative affordable solution for those in need.**

Index Terms - **Arduino UNO, nRF24L01, robotic hand, servo motor, flex sensor.**

I.INTRODUCTION

The term of "robot" comes from the Czechoslovakian word "Robota", that means obligatory work or servitude. It was used firstly in a Czechoslovakian play called "R.U.R".

(Rossum's Universal Robots). The first prosthetic hand was done by a roman general who had his arm cut off and replaced with an iron hand in the 17th century [7]. The prosthetic robot hand that consisted of 3 fingers and 1 thumb is developed by Utah University and MIT in 1986.Movement of the real hand can be precisely classified into 3 parts [1]. They are

1. Movement of four fingers.
2. Movement of thumb.
3. Movement of wrists.

Wireless control of a robotic human hand is operated using flex sensors. The main distinction of the system is that the angle resistance relationship is obtained with the flexible sensor for the detection of the human fingertip angle and that it can be seen what the robot hand is monitoring simultaneously. This device can be used easily in the fields of medicine, industry and defence industry like bomb disposal, private laboratory operations. The system is attractive in terms of cost[5].

In this paper, we designed a robotic hand which is a replica of a human hand. The motions of the human fingers are sensed by flex sensor. We have used Arduino UNO, which is an opensource microcontroller board based on the AT mega 328P microcontroller. The program is developed on PC with Arduino 1.8.13 developed by Arduino.cc.

II.HARDWARE DESCRIPTION AND DESIGN

The prosthetic hand is made by using Foaming sheets. The signal from the flex sensors is fed to the Arduino Uno and to nRF24L01transmitter fixed with the gloves. The flex sensors are used to measure the bend in each finger. Then the corresponding signals are received by nRF24L01 receiver fixed with the prosthetic hand. The arrangement of the prosthetic hand consists of nRF24L01 receiver, DC motor, Arduino UNO. The DC motors are used to move the fingers of the prosthetic hand. They are attached with the fingers with the help of the Strings. To increase the torque of the dc motor gear assembly is used. It is also used to control speed of dc servo motor. The internal circuit consist of potentiometer register and the special purpose IC's. It gives the variation in resistance as flex sensor is bent. This variation in resistance is provided to voltage divider circuit. So, variation in resistance as converted in voltage variation. This voltage is analog

in nature as to convert it into digital ADC present in the controller is used.

III.METHODOLOGY
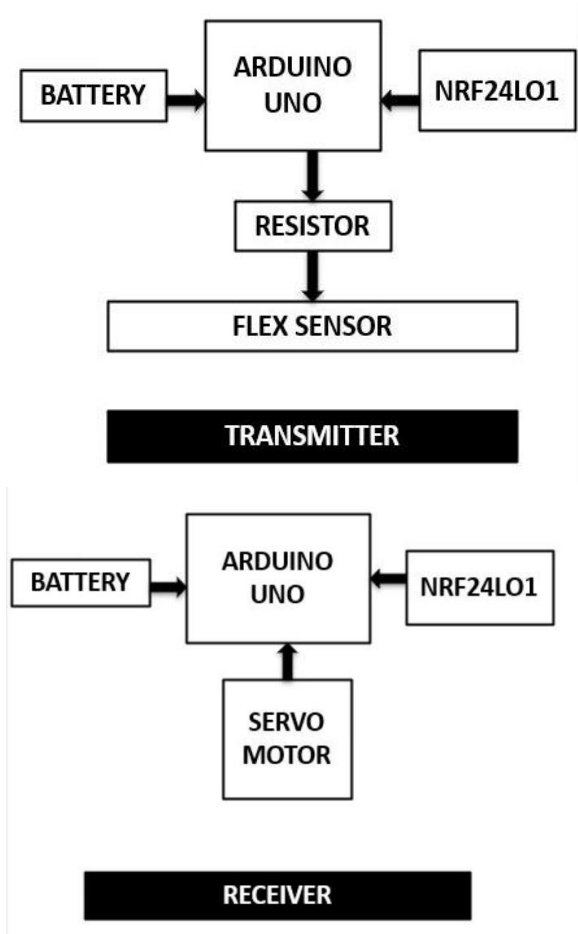
The ARDUINO UNO microcontroller is based on pre-programmed with a boot loader that simplifies uploading of programs to the on-chip flash memory. Some serial Arduino boards contain a level shifter circuit to convert between RS-232 logic levels and transistor–transistor logic (TTL) level signals. The transmitter part consists of gloves. The receiver part consists of the prosthetic hand made of foaming sheets. In the transmitter part, the signals from the flex sensors are fed to the Arduino Uno through a 10k ohm resistor and to the nRF24L01 transmitter. The Arduino is connected to 9v battery. The nRF24L01 receiver in the receiver part receives the signal from the transmitter and feds the signal to the Arduino UNO connected with 9v battery. The signals from the Arduino helps the DC motor which is used in the movement of the fingers.

IV. RESULT AND DISCUSSION

The main intention of our project is to help in the application of the military purpose, cleaning of sewage system, chemical laboratory, etc. Therefore, we designed the smart prosthetic hand, to avoid accidents. For these, we have studied hardware required i.e., Arduino Uno microcontroller, flex sensor, nRF24L01 transmitter and receiver which is very useful. Our project has been shown below:
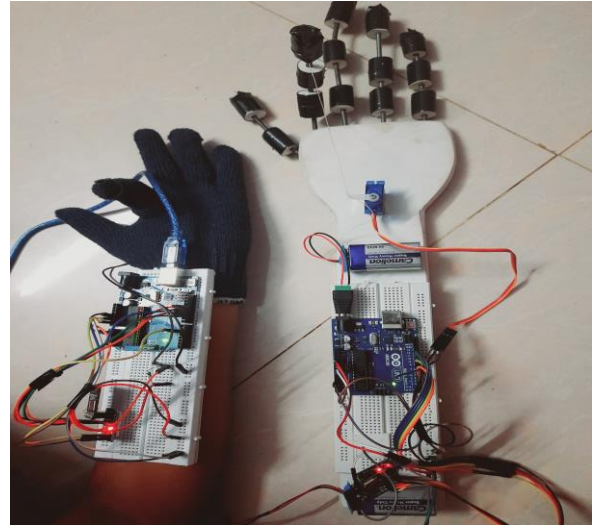
This smart prosthetic hand is practically used for parallel works which are helpful in military purpose, cleaning and other parallel works. Since our proposed work is less in cost, anyone can easily buy this smart prosthetic hand. This proposed work can efficiently reduce the death caused by asphyxia (deficient supply of oxygen to the body) by cleaning sewage, during bomb defusal. The system will be cheap, user friendly, and an innovative affordable solution for those in need.

V.CONCLUSION AND FUTURE SCOPE

Simple prosthetics have the potential to make a measurable impact in an amputee's daily life. Construction and assembly of the hand calls for a short list of materials and tools that are easy to access. [8] With the availability of this technology, amputees have the necessary tools to manufacture their own personalized prosthetics that will improve their quality of life. The objective of this project consisted of the creation of an inexpensive smart prosthetic hand powered by Arduino that could perform several gestures. This system can be used for further research in the military, medical and industrial setup where

real-time, precise hand actuation is a necessity [6]. The operation of mechanical finger movement in respects of all joints and object detection, grasping and releasing various types of objects are tested. A good repeatability for every task performed is observed. Finger movement is arbitrary and tested the same. [6] In future the weight capacity of the hand will be improved in order to hold and grab the object as like human hand [8]. This smart prosthetic hand would serve to create a product that could revolutionize the prosthetics industry.

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