Hand Motion Controlled Robotic Arm

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Abstract - Wireless operations are important in many industries particularly in hazardous or hazardous areas. In some industries it is important to handle few jobs with very high temperature which in these cases wireless operations are more productive by human hand. With the support of Arduino and wireless sensor networks, this paper focuses on the design of hand gesture powered robotic arm using microcontrollers. For control purposes the programming methods are used to send correct control signals to devices or circuits. With different types of microprocessors and microcontrollers, this can be accomplished. Simulations are being performed, and with the above specifications, the hardware prototype was successfully implemented.

Keywords **—Robot, Hand Gesture, RF Transmitter & Receiver, Accelerometer and Arduino.**

I. INTRODUCTION

Automation plays a vital role in today's life. Robotic arm is called a robot manipulator that can execute different functions as performed by human arm. Most organizations using a robot for multiple functions whereby Robot arm, either called as robot manipulator, was an important aspect of every robot must be specifically regulated focusing on the request. It is possible to use robot manipulators in manufacturing or any technology for functions such as welding, trimming, picking, respectively. Such a robotic arm has the benefit how it can operate in a dangerous environment that cannot be reached by humans. Most robot specifications are customized to demand. There are various ways of preventing robotic arm such as Voice Controlled, Keypad Control, Gesture Control, and so on.

A device applied it composed of sender & receiver. This system provides manual gesture control of a robotic arm. This system includes RF receiver that is interfaced with the 8051 microcontroller that regulates the driver IC responsible for regulating arm movement. The transmitter circuit consists of an accelerometer sensor which is connected to the Atmega microcontroller. The transmitter circuit sends an instruction to a receiver circuit. This instruction suggests whether all the robotic arm is to be moved forwards or backwards, and whether the instructions suggest that somehow the item has to be grasped or released.

II. RELATED WORK

Entire design is split through dual parts, one being the transmitter portion while the other is the receiver portion. The circuit description as well as the transmission model will be shown in the diagram, and the transmitter segment includes with an Arduino Uno, one 3-axis accelerometer and one RF transmitter board. The circuit diagram of the receiver microcontroller as well as the receiver model will be shown in the estimate.

The receiver segment includes a number of RF receiver module, one IC motor driver, two engines. Below, dual different 5-volt power supply is connected to both parts. At last, the Arduino Uno recognizes that analog output values, i.e. the x-axis and the y-axis values, from in the 3-axis accelerometer and transforms the analog charge to both the corresponding digital value. The virtual values are absorbed by stretch of the imagination of both the compatibility of the Arduino and send to a RF transmitter which would be gained by implies of the receiver and is analysed on the receiver prevent which drives the motor on a specific route. The device shifts positions where the user's head is angled, respectively.

III. BLOCK DIAGRAM

The block diagram was shown in Fig.1 below. This contains for dual sections which have been integrated by wireless transmission control systems. The RF Module can serve as a transmitter and receiver control configuration.

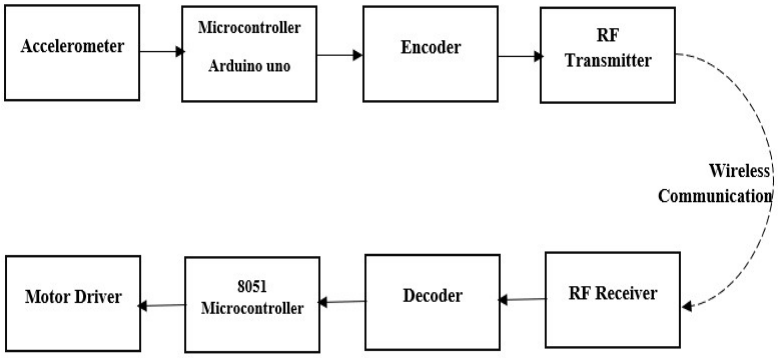

Figure 1. Block diagram of Hand Motion Controlled Robotic Arm

A first portion comprises of gloves with a Li-ion battery, a microcontroller and a monitor. The final part includes of the pump, the microcontroller as well as the robotic arm within which the physical activity takes place.

IV. RF MODULE

Wireless connectivity between both the transmission and the receiver parts is accomplished by using RF modules. This program uses a 433 MHz transmission and receiver combination.

4.1 Transmitter

The transmitter device runs at a bandwidth of 433MHz. The VCC pin is attached to the positive terminal throughout the connection.

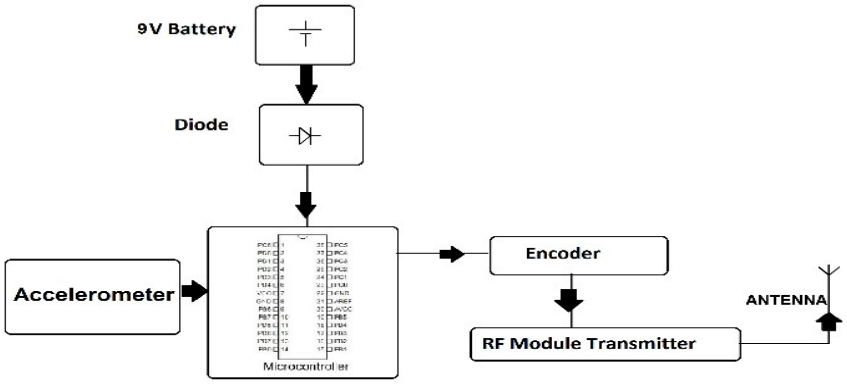

Figure 2.1. Transmitter Circuit of Hand Motion Controlled Robotic Arm

The data pin is attached to a HT12E (Encoder) that is sent or if we can tell the encrypted information. This next pin is GND, which is attached to the ground controller. Now and the last pin ANT is attached as an antenna to a short cable.

4.2 Receiver

The RF receiver interface must obtain the data transmitted by the motion system. It also functions like a transmitter module-Connect the positive VCC pin to the 5-volt connector. Link the ground pin to the ground terminal. The data pin would then be attached to the HT12D (Decoder) pin. And we'll get the 4-bit decrypted files.

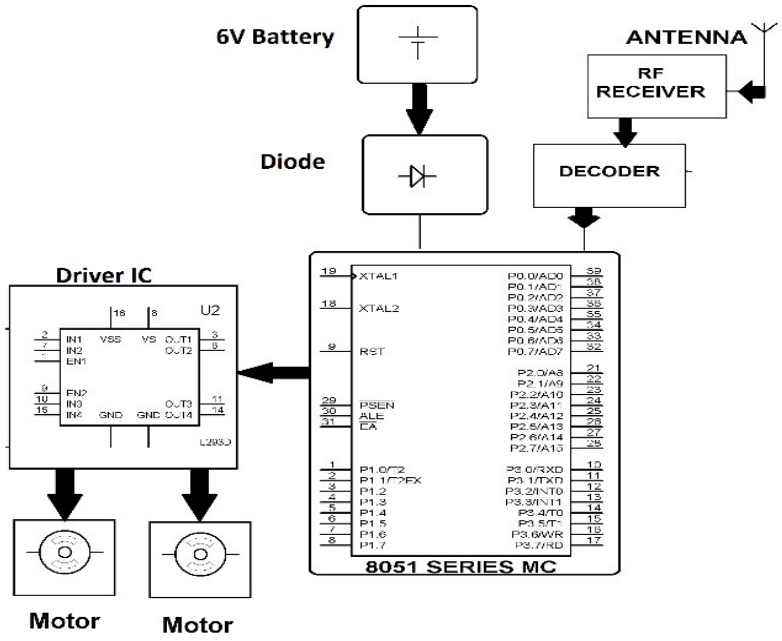

Figure 2.2. Receiver Circuit of Hand Motion Controlled Robotic Arm

V. TYPE OF COMPONENTS

5.1 *Arduino*

Arduino Uno is an ATmega328 is the powered microcontroller board with 14 optical I / O and 6 analog connectors. It is where you want to assist the microcontroller. The Arduino Uno ATmega328 provides UART TTL-serial connectivity and is usable on physical pins such as TX (1) and RX (0). The Arduino app has a serial console which allows easy details. There are dual LEDs on the wall, such as RX & TX, which could flash so when the information is sent via the USB. Arduino Uno may detect the atmosphere after receiving signals from such a number of sensors and can influence its environment by manipulating lighting, motors and other actuators.

5.2 *Accelerometer*

This Accelerometer module is based totally on the popular ADXL335 three-axis analog accelerometer IC, which reads X, Y and Z acceleration as analog voltages. Through increasing the amount of force due to gravity, the accelerometer will calculate the degree at which the Earth is inclined. Through detecting the sum of rapid acceleration, the accelerator will figure out how quickly and at what manner the system is going. The accelerometer is a really simple controller to the Arduino Micro-controller utilizing 3 analog input pins which can be used with almost all other micro-controllers, such as PIC or AVR.

The ADXL335 is a lightweight, thin, low voltage, full 3-axis accelerometer with transmitter-conditioned voltage outputs. It's got 6 sticks. There are three pins for the X, Y, Z axis. Initial power supply pin (VCC), second ground pin (GND) and last self-testing pin (ST). This works on the 3.3V of the Arduino Uno frame. The X and Y axis pins are attached to the A0 and A1 pins of the Arduino Uno module, together. It can calculate the constant momentum of gravity through tilting sensing systems as well as the dynamic momentum arising from rotation, impact or movement and provide the respective analog values by X, Y, Z axis pins. The ADXL335 is offered in a compact, small-profile, 4 mm x 4 mm x 1.45 mm, 16-lead, plastic sided frame chip scale box.

5.3 *Motor Driver*

The L298 Driver is a high voltage, high current dual complete bridge driver designed to meet regular TTL logic and power resistive loads such as relays, solenoids, DC and stepper motors. Two control inputs are given to activate or uninstall the system separately from the input signals. The emission of the lowest transistors from each bridge are linked to each other and the equivalent outer termination could be used to link the actual sensing resistor. Given its size, it is commonly used for the robotic systems to drive DC motors.

5.4 *DC Motor*

The DC motor is being used to transform direct current to linear motion. The mechanical movement may be either brushless motor or regular. The function of the DC motor is founded on the principle that even the conductor feels a mechanical force whenever a new conductor is put in a magnetic field. The pace of the DC motor can be regulated either by increasing the voltage added to the armature or by adjusting the field current.

5.5 *8051 Microcontroller*

The primary aim of the 8051 microcontroller DC interface is to control the movement of the electric motor. The DC motor is an electrical mechanism with a spinning part called a rotor to be operated. Imagine, for instance, a DC motor which pace or path of DC motor rotation can be regulated using programming techniques that can be accomplished by an 8051-microcontroller device. So, in this post, let us explore the connection between the DC motor and the 8051 microcontrollers.

5.6 *Battery*

A battery is a device made up of one or more electrochemical batteries. The aim of the battery was to provide 12 volts for the application of DC motors. The Arduino Nano could be operated by a Mini-B USB connection, a 6-20V uncontrolled additional power connection (pin 30) or a 5V managed additional power connection (pin 27). The power system is automatically activated from maximum voltage supply.

VI. EXPERIMENTAL SETUP

The accompanying Fig.3 illustrates an experimental setup consisting of a transmitter, i.e. a glove placed on a human hand with a sensor and receiver that is a robot manipulator head.

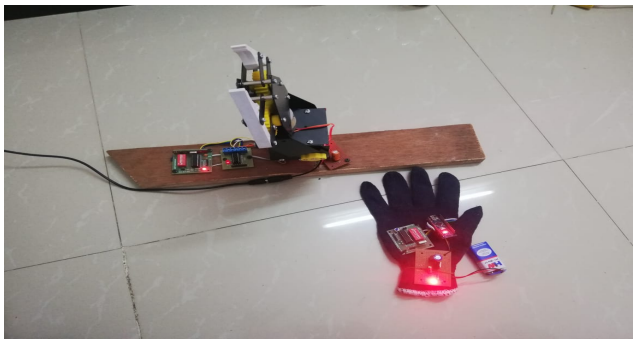

Figure 3. Experimental setup of Hand Motion Controlled Robotic Arm

VII. CONCLUSIONS

Human hand to control the robotic arm was designed in this work. The transmitter part can be measuring the hand motion by the way of X, Y, and Z axis in accelerometer. And it transmits the signal to receiver. In receiver end to receive the signal by RF module and to decode a signal to Motor driver could control the robotic arm. A form of hand motion technology can be used when people are unable to support themselves in challenging or rough conditions. Manipulating a computer, in real time, by hand gestures, is a innovative technique and has a

multitude of uses.Swelling of robotic operation to residential consumers and businesses in the years to come will involve these approaches widely.The solution has tremendous potential as long as it is more refined, because its time complexity is low, with the aid of improved hardware requirements.The usage of a more effective wireless networking strategy and a monitor on a robotic device would significantly enhance the efficiency of the machine and could be integrated into potential research.

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