Wireless Hand Gesture Robot using Accelerometer

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Abstract – *The development of accelerometer based wireless robotic arm is based on wearable accelerometers. The accelerometer is a three axis accelerometer. Accelerometers are used to measure the angular displacement of human hand gesture. This Project represents a simple accelerometer controlled robotic arm using Atmega328 powered embedded system as the core of this robot. The robot does not require training because the robotic arm is fully controlled by the user. This interfacing is done using wireless communication through ZigBee. At the receiver Arm and bot position are controlled as per the user hand gesture .The gesture controlled robot is a basic 4 wheel drive robot with a motor driver and three servo motor which is used for moving the arm. An accelerometer connected to hand for sensing the hand motion and it sends information of the tilt angles to the controller in analog form. This analog signal is directly connected to the ACD of the microcontroller IC. The IC reads this all values and send appropriate control command to the receiver robot through ZigBee. User is able to control motions of the robot by wearing the controller glove and performing predefined gestures. The goal of this system would be to detect hand position in the XY plane and control the speed as well as the direction of the robot according to that.*

*KeyWords:*Arduino,Zigbee,Motordriver-L293D,AVR 328,89C51-Microcontrller, Accelerometer, Wireless camera.

1. INTRODUCTION

We generally find people working in industries under different hazardous condition, these a person suffers with many dangerous diseases like skin cancer, lungs problem and many more. So we finally thought of designing a robot that can copy that instant action of human being under various conditions and situations. So we decided to design a robot that will be driving itself according to position of user which stands in front of it. It does what user desires to do. It makes copy of it's all movement of the user standing in front of it. Hardware required is very small, and hence low cost and small in size programming and control an industrial robot through the use of the robot teach pendant is still a tedious and time-consuming task that requires technical expertise. Therefore, new and more intuitive ways for robot programming and control are required. The goal is to develop methodologies that help users to control and program a robot, with a high-level of abstraction from the robot specific language. Making a robotic demonstration in terms of high-level behaviors (using gestures, speech, manual/human guidance, from visual observation of human performance, etc.), the user can demonstrate to the robot what it should do In the robotics field, several research efforts have been directed towards recognizing human gestures, recurring to vision-based systems motion capture sensors or using finger gesture recognition systems based on active tracking mechanisms.

Accelerometer-based gesture recognition has become increasingly popular over the last decade. The low-moderate cost and relative small size of the accelerometers make it an effective tool to detect and recognize human body gestures. Several studies have been conducted on the recognition of gestures from acceleration data.

1.1 Accelerometer :

An accelerometer is an electromechanical device which measures acceleration. A movingbody possesses an inertia which tends to resist change in velocity. It is this resistance to change In velocity that is the source of the force exerted by the moving body .Accelerometers is available that can measure acceleration in one, two, or three orthogonal axes. They are typically used in one of three modes:

1. As an inertial measurement of velocity and position;
2. As a sensor of inclination, tilt, or orientation in 2 or 3 dimensions, as referenced from the acceleration of gravity
3. As a vibration or impact (shock) sensor.

Accelerometers a device that measures proper acceleration. The proper acceleration measured by an accelerometer is not necessarily the coordinate acceleration (rate of change of Velocity). Instead, the accelerometer sees the acceleration associated with the phenomenon of weight experienced by any test mass at rest in the frame of reference of the accelerometer device. For example, an accelerometer at rest on the surface of the earth will measure an acceleration g=9.81 m/s2 straight upwards, due to its weight. By contrast, accelerometers in free fall or at rest in outer space will measure zero. Another term for the type of acceleration that accelerometers can measure is g-force acceleration. Accelerometers have multiple applications in industry and science. Highly sensitive accelerometers are components of inertial navigation systems for aircraft and missiles. accelerometers are used to detect and monitor vibration in rotating machinery. Accelerometers are used in tablet computers and digital cameras so that images on screens are always displayed Upright. Single and multi-axis models

of accelerometer are available to detect magnitude and direction of the proper acceleration (or g-force), as a vector quantity, and can be used to sense orientation (because direction of weight changes), coordinate acceleration (so long as it produces G-force or a change in g-force), vibration, shock, and falling in a resistive medium (a case where the proper acceleration changes, since it starts at zero, then increases). Micro machined19 accelerometers are increasingly present in portable electronic devices and video game controllers, to detect the position of the device or provide for game input.
How do accelerometers work?

There are many different ways to make an accelerometer! Some accelerometers use the piezoelectric effect - they contain microscopic crystal structures that get stressed by accelerative forces, which causes a voltage to be generated. Another way to do it is by sensing changes in capacitance. If you have two microstructures next to each other, they have a certain capacitance Between them. If an accelerative force moves one of the structures, then the capacitance will change.[1]
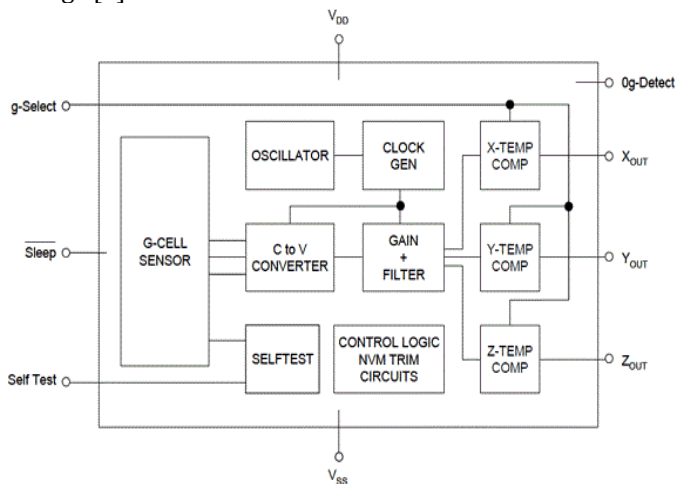

Figure-1: Block diagram of accelerometer

1.2 Zigbee

Figure-1.2: Zigbee

ZigBee networks are secured by 128 bit symmetric encryption keys. In home automation applications, transmission distances range from 10 to 100 meters line-of-sight, depending on power output and environmental characteristics.

ZigBee is targeted at the applications that require a low data rate, long battery life. It operates over same 2.4GHz frequency range as Wi-Fi and Bluetooth. Unlike those technologies though ZigBee transmits at much lower data rates, it's made for sending simple commands such as turning on a TV, rotating left etc. or small bits of data. Thanks to the low data rates, ZigBee tends to use far less power than other networking technologies. ZigBee standard utilizes mesh networking, which allows ZigBee devices to automatically connect with and transmit data through one another without having to go through a central gateway like a router. ZigBee uses IEEE 802.15.4 standard to allow wireless PAN (Personal Area Network) in home. It uses digital radio waves to transfer information between electric devices. It uses transistors in its electronic devices. The electronic devices communicate from a central computer that sends and receives data. It is more reliable, supports larger network and is more fully featured than other networking technologies.
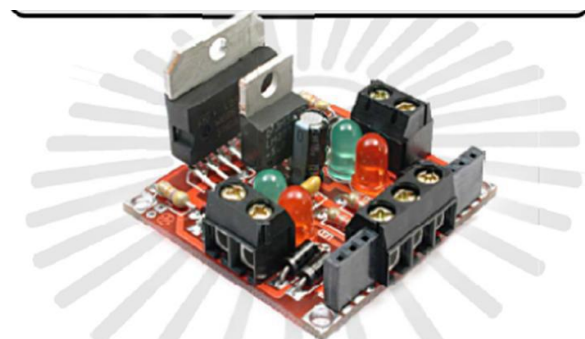
1.3 Motor driver

Figure-1. 3:Motor driver

The L293 is an integrated monolithic circuit in a 15-lead Multiwatt and power SO20 packages. It is a high voltage, high current dual full-bridge driver designed to accept standard TTL logic levels and drive inductive loads such as relays, solenoids, DC and stepping motors. Two enable inputs are provided to enable or disable the device independently of the input signals. The emitters of the lower transistors of each bridge are connected together and the corresponding external terminal can be used for the connection of an external sensing resistor. An additional supply input is provided so that the logic works at a lower voltage.
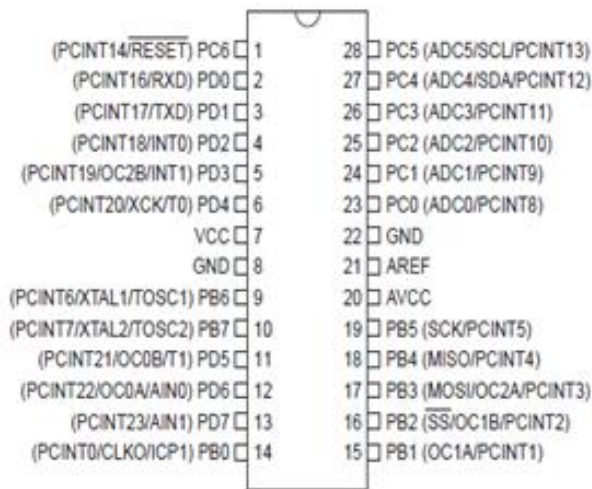
1.4AVR Arduino

Figure 1.4 Pin diagram of Arduino

The Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.. You can tinker with your UNO without worrying too much about doing something wrong, worst case scenario you can replace the chip for a few dollars and start over again.

"Uno" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0. The Uno board and version 1.0 of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases. The Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform; for an extensive list of current, past or outdated boards see the Arduino index of boards.

2. WORKING

A Gesture Controlled robot is a kind of robot which can be controlled by your hand gestures not by old buttons. You just need to wear a small transmitting device in your hand which included an acceleration meter. This will transmit an appropriate command to the robot so that it can do whatever we want. The transmitting device included a ADC for analog to digital conversion and an encoder IC which is use to encode the four bit data and then it will transmit by an RF Transmitter module. At the receiving end an RF Receiver module receivers the encoded data and decode it by and decoder . This data is then processed by a arduino controller and finally our motor driver to control the motor's. The robot moves

according to accelerometer direction i.e. left, right, forward, backward.

The temperature sensor LM 35 is interfaced with Arduino controller it senses temperature in area where robot moves & sends back to operator

Result

The robot moves in 4 direction as per hand gesture.
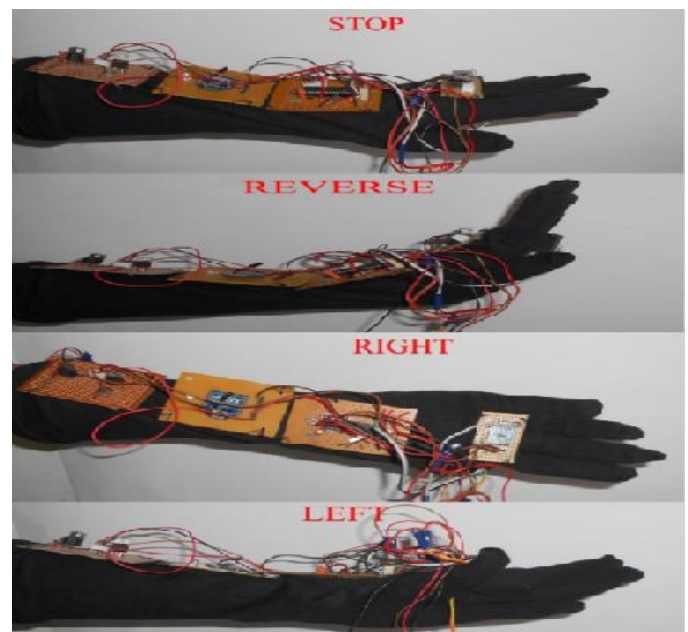
3. CONCLUSIONS

In this project accelerometer is used. The new approach is interfacing of LM 35 for temperature sensing. The robot moves in different directions.It is applicable for area where human is unable to reach like mines ,military applications.

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