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Flex Sensor Based Wireless Robot Glove Controlled Robot

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Abstract— A wired glove is an input device for human–computer interaction worn like a glove. Sensors play an important role in the field of robotics as they help to determine the current state of the system. Various sensor technologies are used to capture physical data such as bending of fingers. Robotic applications demand sensors with high degrees of repeatability, precision, and reliability. The pick and place operation of robotic arm can be efficiently controlled using flex sensors and micro controller programming. This work is based on the educational concepts of mechanical engineering and electronics engineering.

Keywords—Flex sensor; Accelerometer; Microcontroller; Transmitter; Resistance.

I. INTRODUCTION

The concept of a data glove has been traditionally accepted in the field of engineering. Engineers continue to develop prototypes that use innovative sensor technologies and architectures to achieve the goal of gesture identification. The combination of medical science and engineering has made the task like difficult surgery by robotic arm simpler. To identify the motion of human limbs, different sensors can be used. Many companies have designed units, which can integrate accelerometers, gyroscopes and can be attached to human limbs. These units can be worn for video game character modeling [1], virtual reality [2,3], activity recognition [4]. A sensor is a device that can measure some attribute of motion, being one of the three primitives of robotics (besides planning and control), sensing plays an important role in robotic paradigms. Robotic arm manipulators can have different configurations and kinematic constraints. Few of these constraints can be effectively mapped from the human arm domain to the robot's restricted joint space. In this paper a general method of mapping human motions to the robotic arm domain has been demonstrated. The arm moment is reciprocated almost exactly by the robotic arm. The author has designed a robot which is controlled wirelessly with the help of hand gestures which rather than controlling it manually through a conventional remote controller. The Robot moves and acts in the manner depending on the gestures made by the fingers and hand from a distance.

II. RELATED WORK

An exciting description of inertial sensors and some innovative application of sensors have been explained in [1]. [2] gives an examination of the impact of individual sensor on the performance of a navigation system. [5] gives the design of a controller which is capable of controlling an anthropomorphic robotic arm through a LAN or via the Internet. [6] provides a review of relevant mobile robot positioning technologies like Odometry, Inertial Navigation, Magnetic Com-passes, GPS Model Matching etc. Pick and place operation by controlling the speed and position using FPGA has been discussed in [7]. But the important contribution of present work is that any human arm moments can be mapped onto the robotic arm with good precision. Further the flexibility of micro controller programming makes the task easier.

III. PROJECT DESCRIPTION

A. Transmitter

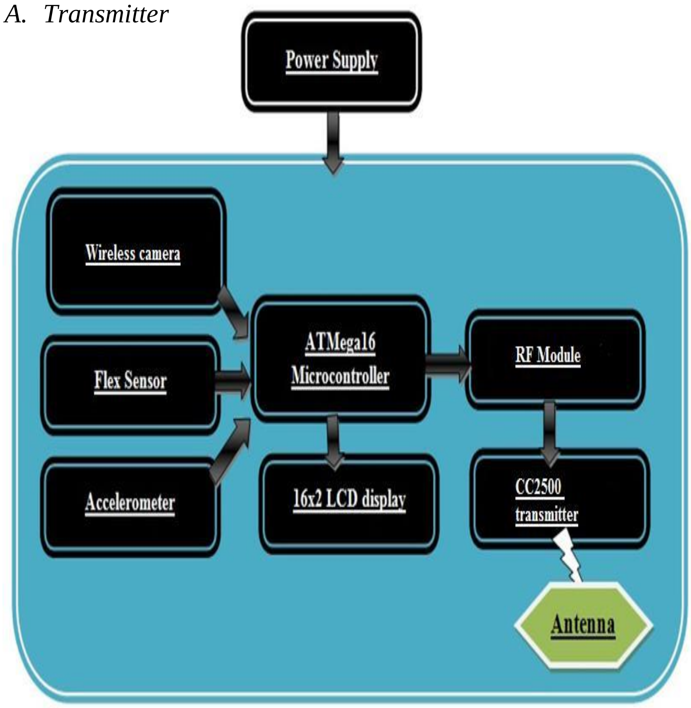

Fig. 1 Block Diagram of Transmitter Unit

Above figure shows the general block diagram of the transmitter unit of the robot. Flex sensor and accelerometer are interfaced with microcontroller. Output devices are LCD display and RF transmitter unit of CC2500.

B. Receiver

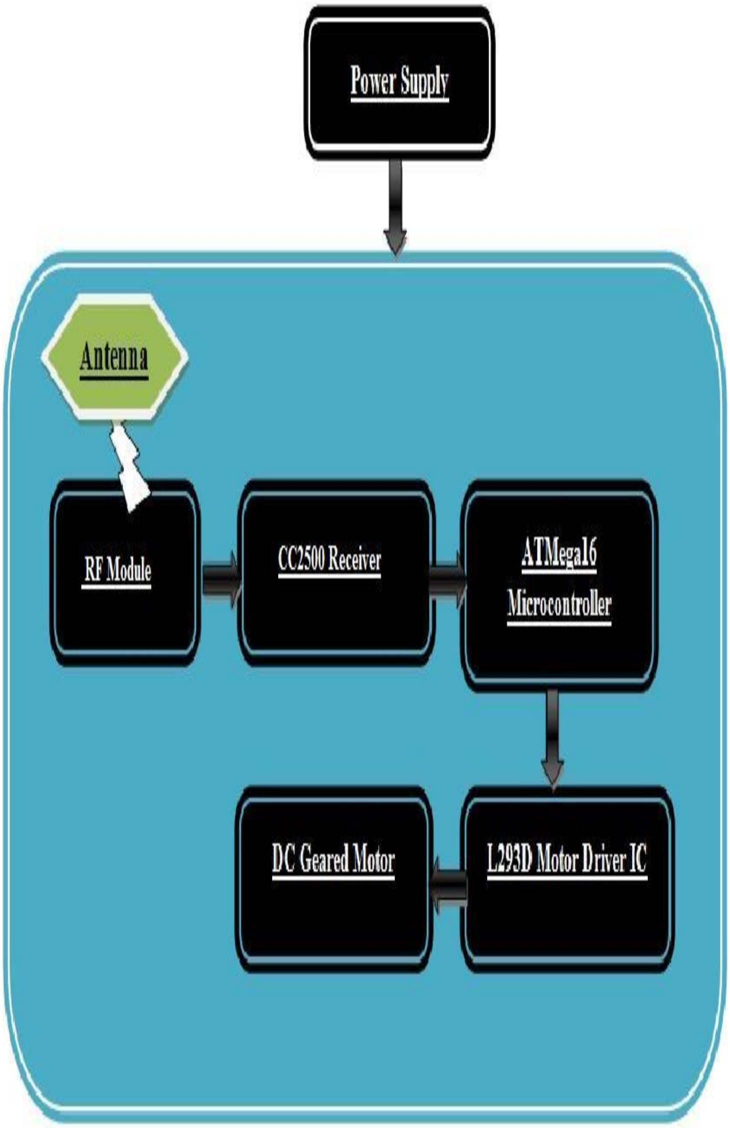

Fig. 2 Block Diagram of Receiver Unit

The receiver part of RF module receives transmitted signals in synchronization. These incoming signals are analog in nature. These are converted into digital in microcontroller itself. Instructions are processed and output signals are provided to motor driver, by the output of which the motor actions take place.LM293 motor driver provides 12V signal to boost in speed whereas only controlling is done by controller's 5V supply. Both units are powered by 12V regulated supply. ATMEGA 16 is major intelligent part of the whole assembly Alongside a display is used to display the status of the robot.

C. Design Flow

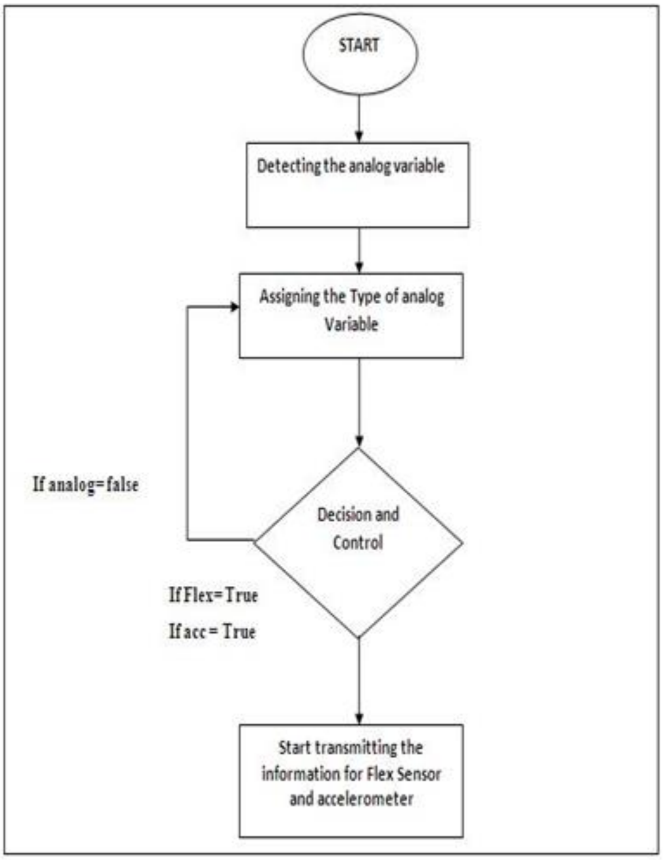

Fig. 3 Basic flow diagram of transmitter

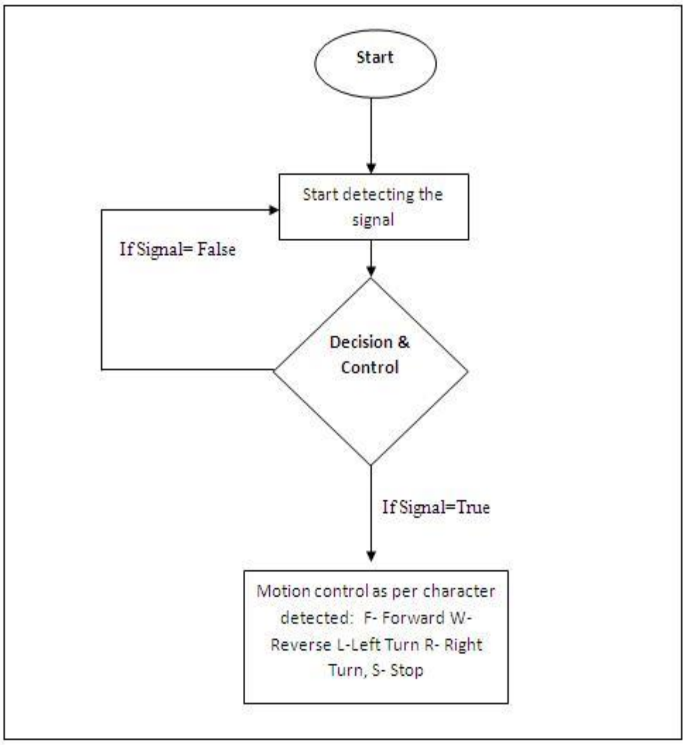

Fig. 4 Basic Flow Diagram of Receiver

IV. HARDWARE IMPLEMENTATION

A. Microcontroller

Fig. 5 Physical View of ATMEGA16

ATmega16 is an 8-bit high performance microcontroller of Atmel's Mega AVR family with low power consumption. Atmega16 is based on enhanced RISC (Reduced Instruction Set Computing) architecture with 131 powerful instructions. Most of the instructions execute in one machine cycle. Atmega16 can work on a maximum frequency of 16MHz.

B. Flex Sensors

Flex sensors are analog resistors. These resistors work as a variable analog voltage divider. Within the flex sensor, carbon resistive elements are present with a very thin flexible substrate. More quantity of carbon results in less resistance. When the substrate is bent the sensor produces resistance output according to the bend radius. Great form factor is achieved by the flex sensor on a thin flexible substrate. As the substrate is bent, resistance output is produced by the sensor according to the bend radius as shown in Figure 6.

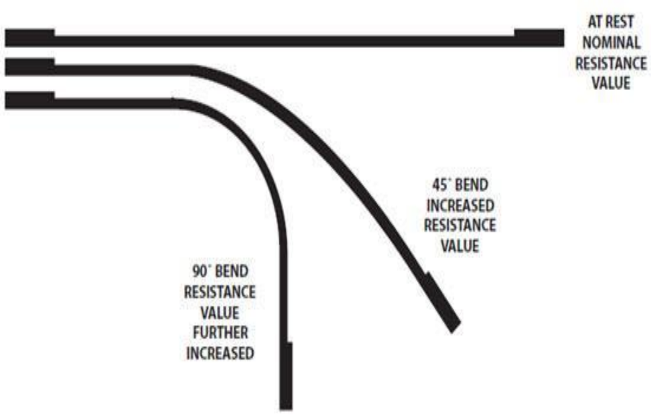

Fig. 6 Flex Sensor Bend Proportional to Varying Degree of Resistance.

C. Accelerometer

Fig. 7 Accelerometer Chip

The ADXL335 is a small, thin, low power, complete 3 -axis accelerometer with signal conditioned voltage outputs. The product measures acceleration with a minimum full-scale range of ±3 g. It can measure the static acceleration of gravity in tilt-sensing applications, as well as dynamic acceleration resulting from motion, shock, or vibration. The bandwidth of the accelerometer can be selected by using the CX, CY, and CZ capacitors at the X-OUT, Y-OUT, and Z-OUT pins. Bandwidths can be selected within a range of 0.5 Hz to 1600 Hz for the X axis and Y axis, and a range of 0.5 Hz to 550 Hz for the Z axis.

D. RF Module

Fig. 8 Cc2500 Module

E. Applications

- Collection of data
- Wireless metering
- Remote control / Remote measurement system
- Multi slave communication
- Access control

V. CONCLUSION

In this project, we aimed to build an automated robot which works on the gesture moments. It is a wireless communicating device. Unlike other remote controlled robot, this design is more efficient in the range of use and security. The objective of preparing these projects is to understand the different kind of sensor available and interface them with smartest microcontroller. Also it has been beneficial to understand the concepts of programming of controller. More outcomes from the project are to learn PCB designing, etching, soldering, assembling processes employed in any project design.

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