Implementation of Flex sensor and Electronic Compass for Hand Gesture Based Wireless Automation of Material Handling Robot

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Abstract- Generally robots are programmed to perform specific tasks this limits the use of these robots.To increase the use of robots where conditions are not certain such as fire fighting or rescue operation we can make robots which follows the instruction of human operator and perform the task, in this way decisions are taken according to the working conditions by the operator and task is performed by the robots thus we can use these robots to perform those tasks that may be harmful for humans. Also this system is not complex as sensors used are common i.e. Flex sensors, Ultrasonic sensor, Electronic compass and accelerometer.

Index Terms- Accelerometer, Electronic compass, Flex sensors.

I. INTRODUCTION

We can design robotic hand that copies the movement of the human hand and perform the task for this we need to mount a number of sensors on fingers and palm of the operator these sensors senses the movement of finger and palm of the operator and the output of all these sensor is transmitted to the robotic hand by means of the wireless communication robotic hand and receives these signals. Robotic unit is not always a human like hand it may be jaw or gripper or cutter a camera is needed when the task is performed at lager distance from the operator. when camera is fixed at appropriate place on the robotic unit then the real time video regarding the object on which task has to be performed can be transmitted from robotic unit.

Robotic hand is a Human like hand which performs the tasks that human performs with his hands.

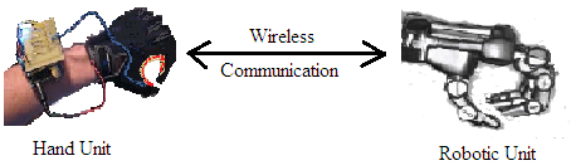

Figure 1: Robotic hand

As the robotic hand contains five finger and these fingers has to be bend as human fingers bend thus more number of motors needed and more powerful processor is needed to control movement of these motors. For operation at larger distance from operator camera is needed to be interfaced with robotic unit and a screen is needed for operator to see video from robotic unit and to take necessary control action. Here sensors are mounted on all fingers so that all fingers of robotic unit can be controlled by movement of hand of operator.

II. IMPLEMENTATION

Project can be implemented by using sensors like flex sensor, ultrasonic sensor and three axis accelerometer and electronic compass. As shown in figure 2, flex sensors are mounted on each joint of all five fingers and bending of sensor due to hand movement of the operator changes the resistance of the sensor and this change in resistance is fed as input to the robotic unit. Here first flex sensor i.e. flex sensor 1 is mounted on top joint of forefinger of the hand and flex sensor 2 is mounted on middle joint of the forefinger and flex sensor 3 is mounted on lower joint or joint of forefinger near palm in similar way flex sensors are mounted on all joints of the all finger of the hand of operator.

As shown in figure 3, robotic unit contains five mechanical fingers, movements of the fingers can be carried out using stepper motor or servo motor when operator carry out movement of his hand then some flex sensors bends and resistance of the sensors changes and this change is transmitted to robotic unit.

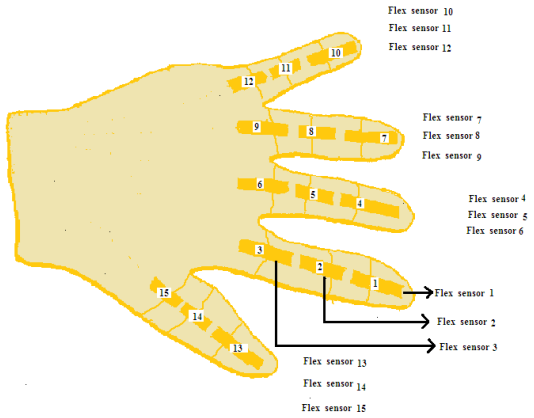

Figure 2: Hand unit with 15 flex sensors fixed at all joints of human finger when operator bends his finger these sensors

also bends and resistance of these sensors get changed which is input to the robotic unit

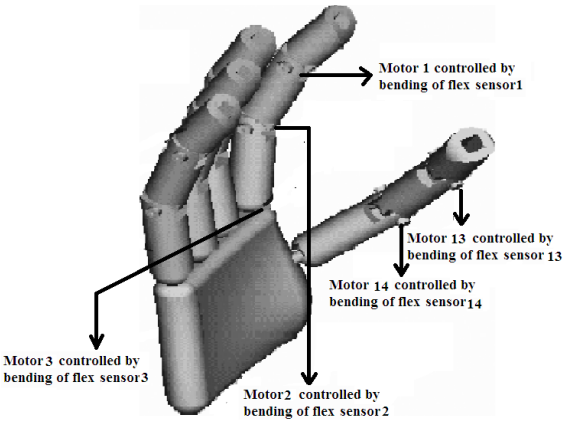

Figure 3: Robotic unit which contains 1 motor for each joint of the hand and each motor is controlled by bending of respective flex sensor i.e. motor 1 is controlled by flex sensor 1similarly motor 15 is controlled by flex sensor 15

Three flex sensors attached on finger of the operator and mechanical finger consist of three motors. When movement of the operator finger takes place flex sensors at different joints on finger bends, all flex sensors does not bend to same extent but it bends according to movement of the finger. This sensor bending changes the resistance of the sensor and this change is given as input to the motors of the mechanical finger

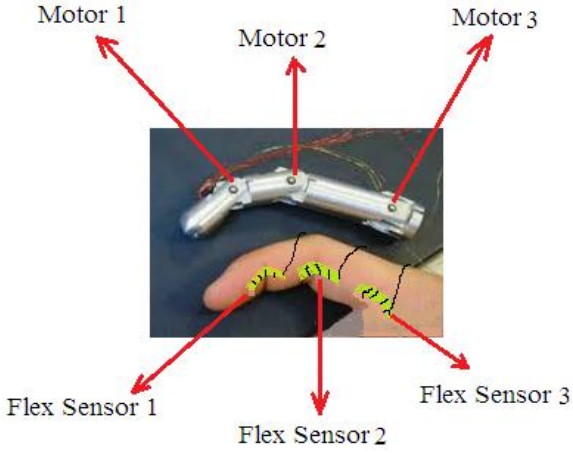

Figure 4: Human finger (operator finger) having three flex sensors attached at different joints of the finger and mechanical finger consist three motors at different joints.

Motor 1,motor 2 and motor 3 rotates according to the bending of flex sensor 1,flex sensor 2and flex sensor 3respectively. Communication between flex sensors on operator finger (hand unit) and motors on mechanical finger (robotic unit) takes place using zigbee module or using GSM module. We can construct mechanical hand by attaching sensors on all fingers of the operator and accordingly increasing mechanical fingers connecting mechanical palm and arm on robotic unit as shown in figure 1.

III. BLOCK DIAGRAM

Proposed project contains Hand unit and Robotic unit so there is one block diagram for each.

Hand unit It consists of Flex sensors, Ultrasonic sensor, Electronic compass and accelerometer. These sensors may mounted on glove i.e. hand unit is wearable and this unit is need to be wear by the operator.Here ultrasonic sensor is attached to palm of operator on hand unit it is used to control the vertical movement of the robotic hand or robotic unit.

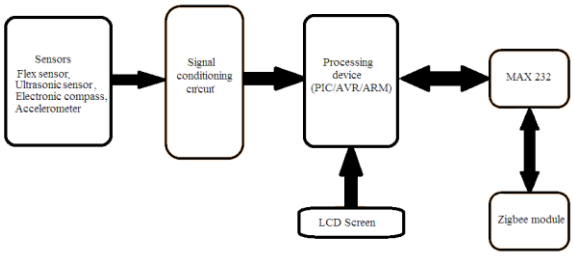

Figure 5: Block diagram of Hand unit with LCD Screen

Electronic compass is used to control horizontal movement of robotic hand or robotic unit i.e. movement of robotic hand parallel to the ground. Accelerometer is also mounted on hand unit it is used to control the twisting movement of the wrist of robotic unit.LCD screen is used to see

LCD screen is needed only if the hand unit and robotic unit are at larger distance from each other. We can use PIC or AVR microcontroller but if LCD screen is used then ARM processor is preferable.

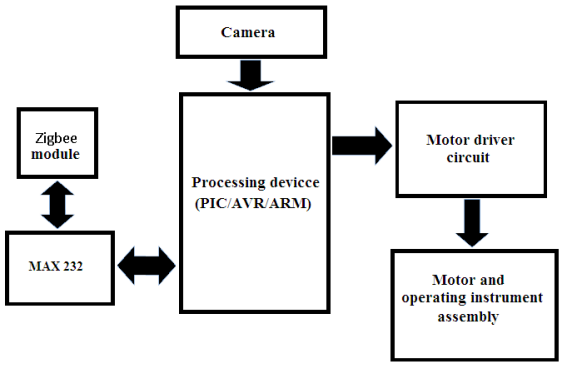

Figure 6: Block diagram of the robotic unit with camera

Here output from the Flex sensor, Ultrasonic sensor, Electronic compass and accelerometer is given to robotic unit as input through wireless communication using zigbee module camera is interfaced so that videos of object on which operation has to be perform can be transmitted to operator, motors and operating instrument are operated by PIC or AVR or ARM processor. For the operations where operator and robotic units are at larger distance camera of robotic unit and LCD screen of hand unit.

IV. CONCLUSION

Using the proposed technology, we can enhance the use of conventional robots by adding human intelligence as decisions are taken by operator and working capability of robots. Hardware and software of the Project is not very complex as the unit is designed to perform operations by copying the movement of hand of operator.

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