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Interaction device for the handicap to communicate with disabled people

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Abstract - To express our thoughts, we communicate with different people in various ways easily. But, it is difficult for Low/High (L/H) syndrome people, blind people and paralyzed or physically handicapped (PH) people to convey what they think. The blind people face difficulties in writing exams while L/H syndrome or paralyzed or PH people feel extremely difficult to express their ideas. This project device can provide solution over these problems. For solving this problem, an ARM7 LPC2148 Microcontroller controls the functioning of speech-to-text module, keypads or buttons, flex sensors and text-to-speech module. With the help of these components, all of the above problems can be removed in single smart device. Using this smart device, blind people can write his/her exam without interpreter using speech-to-text module. By pressing keypad, L/H syndrome people can express their basic thoughts using text-to-speech module. And with the help of flex sensors, paralyzed or PH people can convey their message.

Key Words: **Arduino, Flex Sensor, Servo motor, 3d printed Robotic hand.**

1.INTRODUCTION

The ever increasing population trend of the millennium expects new technical innovation to meet the new challenges being faced by human beings. Research and development of the project for people who are handicap in order to ensure that the facilities are as a platform of communication with dumb and deaf people. Disabled people need special services to enable them to live independently. For example, for visually impaired, it is necessary to read and write Braille skills before they can use those skills to learn or get an education to live independently. Similarly, deaf people need the skills to understand and use of sign language before they can use it to communicate with others. The project mainly focuses on the handicap people who wants to communicate with dumb and deaf people since handicap people cannot communicate by using the sign language, we have developed a robotic hand which will be used as a device to display various sign languages. Sensors play an important role in this system. They are placed at the four places of the body-two sensors on the neck and two on the finger of both the legs. These sensors are collected to the servo motors through Arduino controller and these motors give bending motion to the robotic fingers. 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.

2. PROBLEM STATEMENT

The project is based on the sign languages to communicate with the dumb and deaf people. It is difficult for the physically handicapped people to communicate with dumb and deaf people since sign languages totally depend on the action of the hands. So in order to solve this problem we have come up with an idea to make the communication between the physically handicapped people and dumb and deaf people possible. The flex sensors which we are using which on bending changes its resistance value is detected by the microcontroller (ATmega328p). This controller detects the change of the resistance. At the output side of the controller servo motors are connected and these servo motor are used for the finger movements of the robotic hand. The controller detects the change of the resistance and according to the change the servo motor is rotated and the finger is moved. Each finger of the robotic hand is assigned a flex sensor and a servo motor. As the physically handicapped people are unable to move their hand , we make use of the movement of the neck and the movement of the legs. Three sensors are placed at the neck and two sensors are located at the finger of both the legs. Since each sensor is appointed a single finger of the robotic hand it becomes easy to know which sensor needs to be moved to express a particular sign language.

3. PROPOSED METHOD BLOCK DIAGRAM AND DESCRIPTION OF ALL COMPONENTS

The block diagram mainly consists of four parts: flex sensors, Arduino controller, servo motors and robotic hand. Fig 1 shows the block diagram. Four flex sensors are used out of which two sensors are connected on the neck and the rest of the two sensors are connected to the finger of both the legs. Servo motors are directly attached to the 3d printed robotics hand.

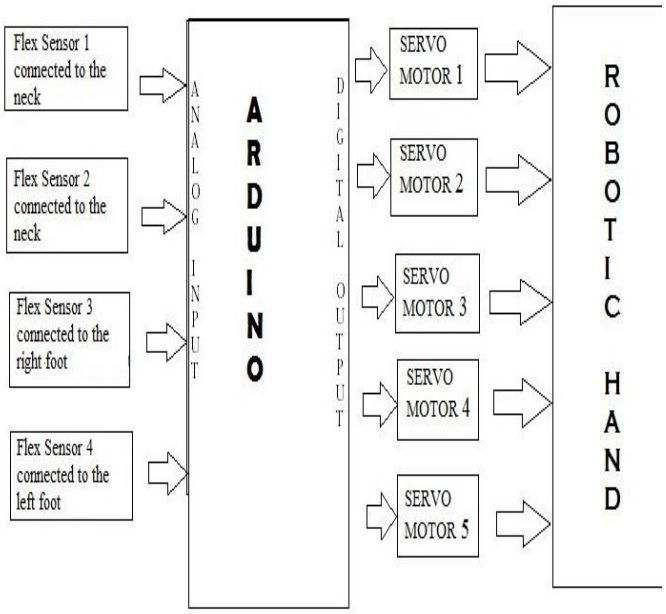

Fig -1: Interaction device for the handicap to communicate with disabled people

3.1 FLEX SENSOR

Flex sensors are analog resistors. These resistors work as variable analog voltage divider. Inside the sensor are carbon resistive elements with thin flexible substrate. More carbon means less resistance. When the substrate is bent the sensor produces resistance output relative to the bend radius. The flex sensor achieves great form-factor on a thin flexible substrate. When the substrate is bent, the sensor produces a resistance output correlated to the bend radius as shown in **Figure 2**.

Smaller the radius, higher will be the resistance value. The impedance buffer in the circuit is a single sided operational amplifier used with these sensors as shown in **Figure 3**. Since low bias current of the op amp reduces error due to source impedance of the flex sensor as volt-age divider. The variation in deflection or bending of flex sensor results in variation of resistance itself. The signal conditioning circuit is used to read these resistance changes and it is given to ADC.

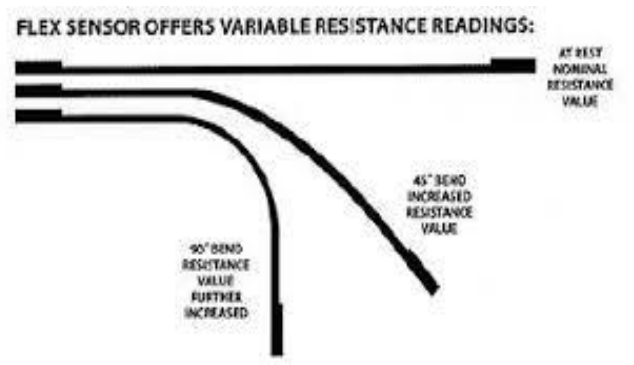

Fig – 2: Flex sensor bend proportional to varying degree of resistance.

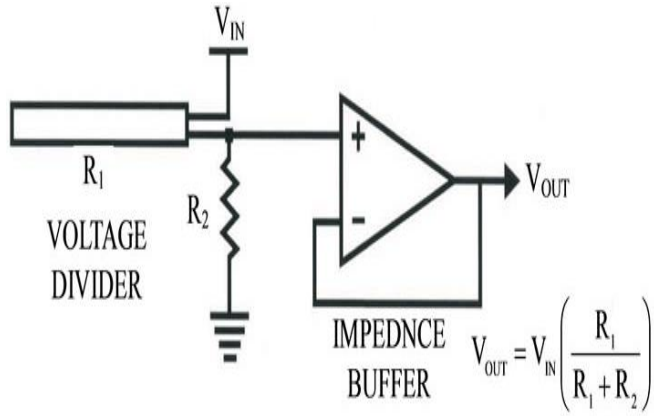

Fig – 3: Basic Flex Sensor Circuit

3.2 ARDUINO

Fig-4: Arduino microcontroller

Arduino is an open source, computer hardware and software company, project, and user community that designs and manufactures microcontroller kits for building digital devices and interactive objects that can sense and control objects in the physical world. The project's products are distributed as open-source hardware and software, which are licensed under the GNU Lesser General Public License (LGPL) or the GNU General Public License (GPL), permitting the manufacture of Arduino boards and software distribution by anyone. Arduino boards are available commercially in preassembled form, or as do-it-yourself kits.

3.3 SERVO MOTOR

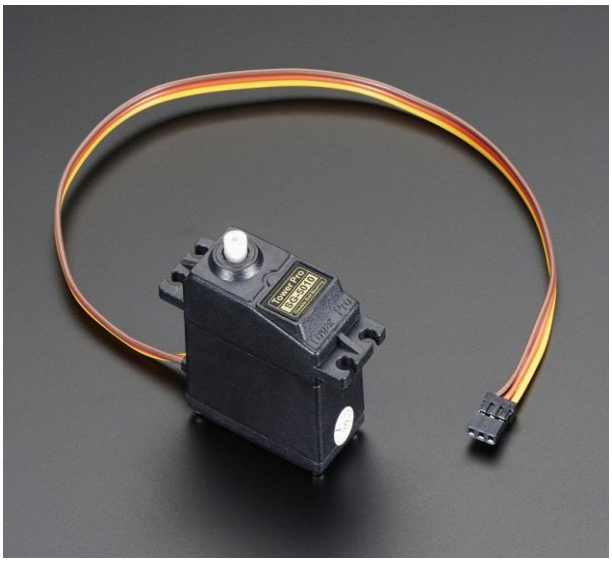

Fig – 5: Servo motor SG5010

The digital microprocessor is 10 times faster than an analog servo, this results in a much quicker response from the beginning with the servo developing all the rated torque 1 degree off of the center point. Using Hitec's proprietary programmer and servo test device, model HFP-20, Hitec digital servos can be programmed for, direction of rotation, center and end points, failsafe option, speed and dead bandwidth adjustment. This is great for matching sets of servos for dead band width, center and end points in giant scale aircraft applications and for reversing a digital servo when two are used on a "Y" harness.

4. WORKING AND FLOW CHART

Basically, each flex sensor is appointed a single servo motor that is, if flex 1 in Fig 5 bends, Its resistance values changes and this change is detected by the controller. The analog input given to the controller needs to be converted to the digital signal since the servo motors on the other hand reads digital signal. The motion of the motor depends on the amount of sensor bend, more the senor bend more is the rotation of the servo. So as the flex 1 is bend the controller needs to rotate servo 1 as shown in Fig 5. As the servo1 rotates the finger1 of the robotic hand moves. The examples given in fig 7 can be referred and implemented to communicate.

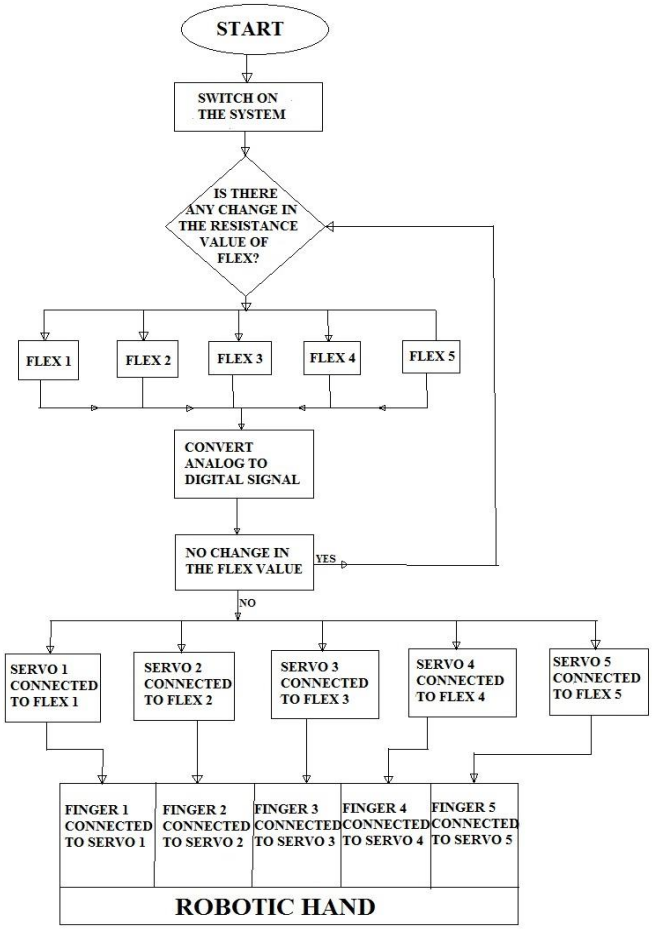

Fig – 5 Flowchart of the device

5. EXPERIMENTAL RESULTS

Figure 6 shows the finger movements made by the robotic hand if the matching of resistance value is done then the message will produce according to predefined data. Figure 7 shows the finger movements made by the robotic hand if the matching of resistance value is done then the message will produce according to predefined data. Communication can be made using both the reference tables shown in figure 6 and figure 7..

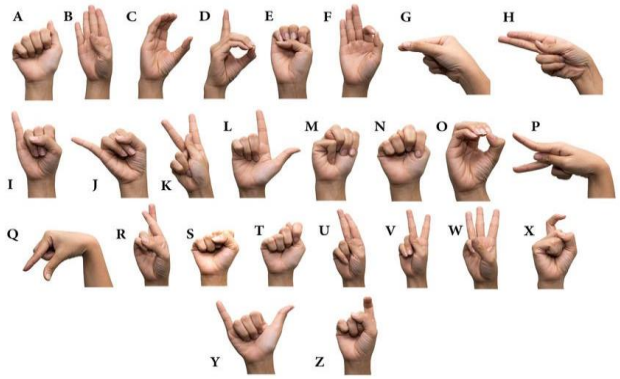

Fig – 6: Alphabets according to the finger movements

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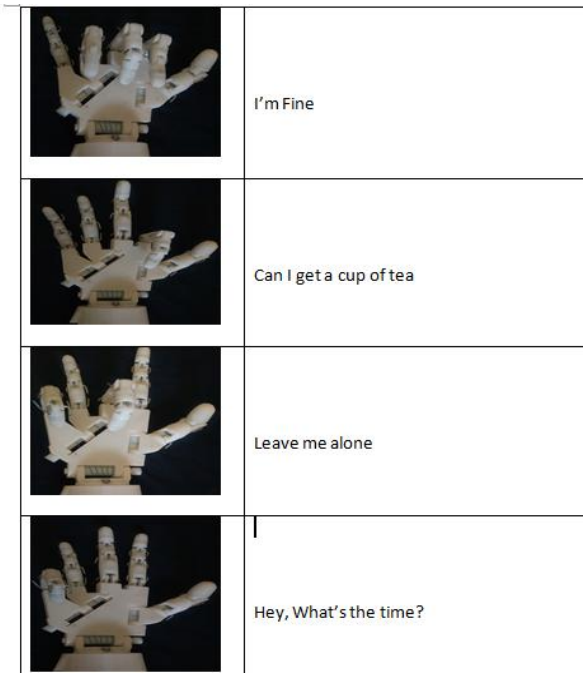

Fig – 7:Finger movements and messages

6. CONCLUSION AND FUTURE SCOPE

The paper discussed a hardware and software co design of controller using five servomotors employing micro controller. Micro controller programming can be done with an ease to suit the requirements, which employ FPGA based control. Micro controller based programs can be flexibly modified to suit the necessary drive control of the serve motor. Researcher can work for wireless control of the robotic arm by employing some wireless application protocol. The robotic arm can be fitted with wheel and more sensors to equip the device with more flexible movements of the robotic arm.

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