Performance Optimization and Development of Hand Gestures Recognition and Translation Glove Using Flex Sensor and Accelerometer

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Abstract- *This paper demonstrates vital parameters that can be employed to optimize the overall performance of a low cost wearable glove interface so as to degree someone's hand moves. These wearable interfaces are used in multiple applications; together with robotic tele-operation, computer-interaction, signal-language vocalization and rehabilitation of paralyzed. Since the accuracy and precision of the sensor data extremely important in those programs, a hybrid sensing method is used. The flex bend sensors are used to measure the flexion of fingers, in which as an accelerometer is used to sense the orientation of the palm. An 8-bit microcontroller is used to manner the sensor information. Various reasons of deterioration in sensor records are defined. Solutions also are proposed to decorate the accuracy of the sensor output. The efficacy of the proposed solutions is also manifested within the document. Also this device is not complex as sensors used are commonplace i.e. Flex sensors and accelerometer. In many utility of controlling robot system will become pretty difficult and complex while there comes the part of controlling it with remote or many exclusive switches; mostly in navy application, business robotics, production automobiles in civil facet, clinical application for surgical procedure.*

Keywords- Flex Sensor, Accelerometer, Robot, Arduino.

I. INTRODUCTION

Robotics is a modern rising generation within the field of technology. A range of universities in global are working on this subject. Robotics is the brand new rising booming discipline, so that you can be of first-rate use to society within the coming years. These days many types of wi-fi robots are being advanced and are put to numerous applications and uses. The creator has evolved a robot, along with his personal learning and assets, which is operated & controlled wirelessly with the assist of hand gestures which transmits signals to the robot via an car tool in place of controlling it manually via a traditional remote controller. The Robot movements and acts inside the way relying at the gestures made via the palms and hand from a distance. The robotic movements in up, down, left or proper guidelines and captures the encompassing surroundings with the assist of digital camera affixed over it. It is also controlled with the aid of unique hand gestures.The whole assignment essentially contains of three gadgets. The hand gloves with person circuit board and a Self empowered robotic. The machine uses sensors like flex sensor and accelerometer. This design capabilities the great use of nowadays available superior area within the discipline of embedded electronics and unguided verbal exchange with maximum diploma of security and simplicity in programs. The count number of appeal of this task is that it gives resourceful quantity of blessings at price powerful manner. It provides the encryption in conversation, transmits the video indicators at higher statistics rates. The range special is spectacular sufficient to appraise the prototype alongside the real time application it possess. Another investigate approximately this layout is that its faster response. The assignment is well controlled to reply to the sensor actions within seconds and bring alive photograph on the show device at the equal time. Developing the version of gesture managed robotic incorporating the following capabilities:

- Hassel free control
- Greater coverage for transceiver
- Cost effectiveness
- Spying robotic talents
- Quicker time response with future growth provision

II. RELATED WORK

A lot of work has been carried out in which specific forms of cameras, intensity imaging, infrared and other imaging gadgets were used. In all of these works, the recognition needs a tool in the front of you. There is any other very famous shape of hand gesture recognition. With the fast advancement in generation, principal breakthroughs are made within the design and characterization of piezo-resistive sensors [1, 2]. These sensors are typically referred as flex bend sensors when you consider that they measure the bending within the flexor tendons, which includes palms. These sensors are mounted on a wearable glove, generally one for

every finger [3]. The output of the sensor is fed to a microcontroller for similarly processing [4]. With this interface it becomes very clean to collect the human palms motion in neurophysiological settings [5, 6, 7]. These interfaces have numerous biomedical packages, together with hand prostheses and gesture vocalization [8, 9, 10]. Moreover, such interfaces are also being notably used in robot tele-operation and human-pc interaction equipment [11, 12, 13, 14, 15]. Hence, there is a dire want of powerful method(s) to improve the accuracy and integrity of the sensor output which can be extremely crucial for the above-referred to applications.

III. EXPERIMENTAL ARCHITECTURE

The sensor remarks (flex-sensors and accelerometer) is used to offer analog signals regarding the placement and orientation of the robotic to the microcontroller. The microcontroller techniques these signals, transmits the processed facts serially at 9600 bauds to the pc. This statistics is then displayed for similarly analysis. The complete experimental setup is proven in Fig. 1. The designing of the hardware for this glove interface is critical due to the fact the software program may be written with some simple knowledge in embedded software improvement. The hardware has many dreams and these desires ought to be met with severe care for better results. The first and the foremost purpose is to offer the energy to all the sensors attached due to the fact powering sensors without delay from a microcontroller is not a great exercise.

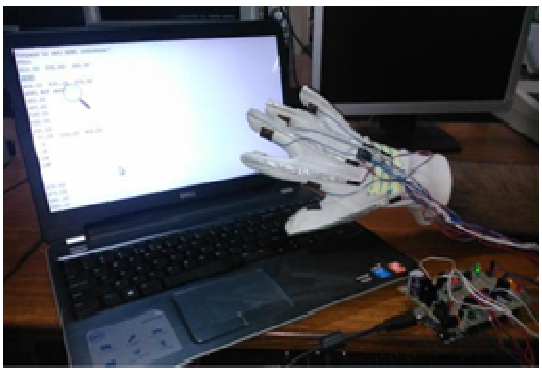

Figure 1. Gesture System

The flex sensor based glove is designed using five 4.5 inch flex sensors Shown in Fig. 2, one for every finger. If you see the American Sign Language Chart for static gestures, you'll comprehend that for maximum of the gestures, this easy glove will paintings.

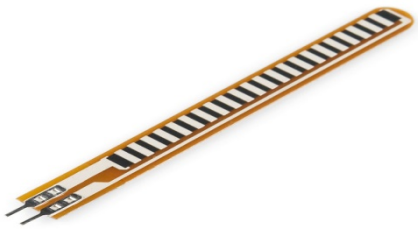

Figure 2. Flex Sensor

When the gestures are made thru the glove protected hand, the values of the sensors are examine and fed to a microcontroller. The microcontroller is pre-programmed to compute and apprehend the gesture shaped. The hassle of this glove interface is that the rotation of wrist and orientation of hand in the Cartesian coordinate system can't be sensed. When it comes to orientation, the addition of an accelerometer to the equal glove interface resolves the trouble. We used ADXL335, three-axis accelerometer. It gives analog output throughout x-, y- and z-axis as shown in Fig. 3. This axial statistics is fed to the microcontroller, the angular tilt of the body is calculated.

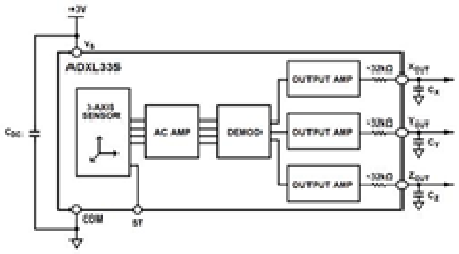

Figure 3. Accelerometer Schmatic

The accrued statistics is communicated to the health practitioner through distinct communication channel rely on the patient's role. The transmission tool used inside the transmission levels are WiFi or Bluetooth devices. All records accrued from the IoT gadgets are communicated to the nearby machine which contains the software program to test the threshold stages of parameter.

Design Flow:

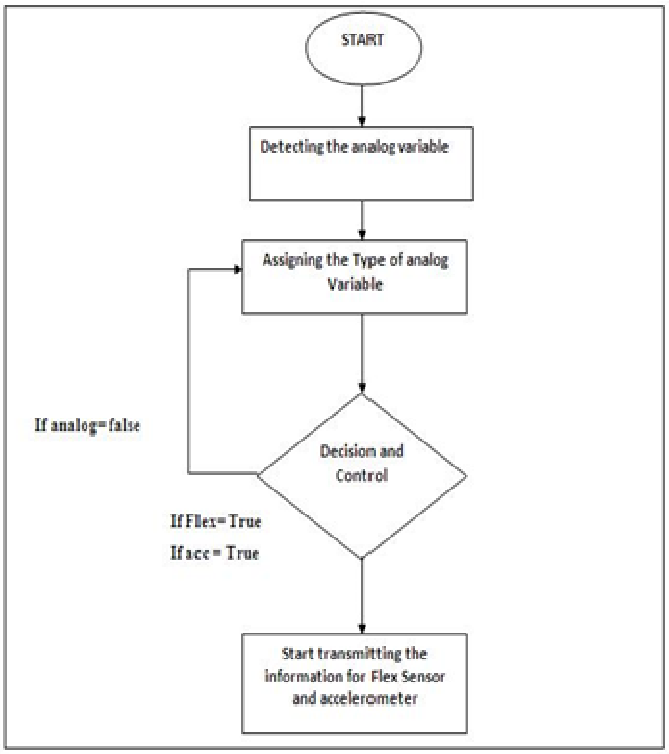

Figure 4. Transmitter Flow-Diagram

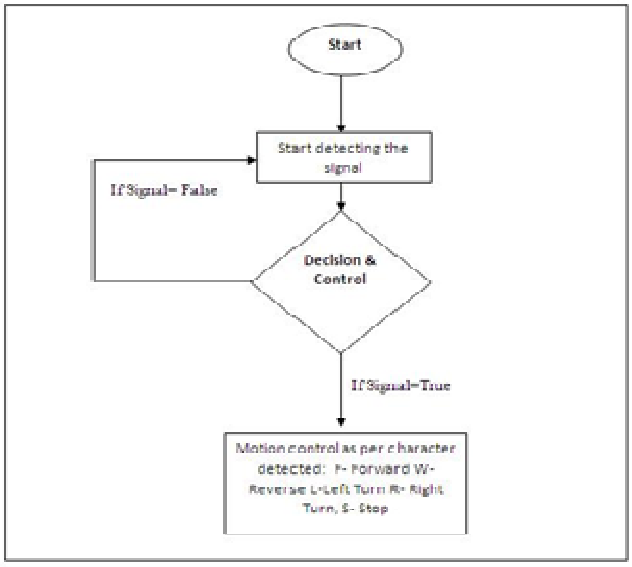

Figure 5. Receiver Flow-Diagram

IV. RESULTS AND DISCUSSIONS

A. Test Case 1:

In this situation, the performance of the flex sensor at the index finger of the human hand is tested, with and without the application of the proposed median filtering technique. The index finger is absolutely stretched as shown in Fig. 6. The data outcomes of the sensor output without the utility of median clear out and with the software are shown in Fig. 7.

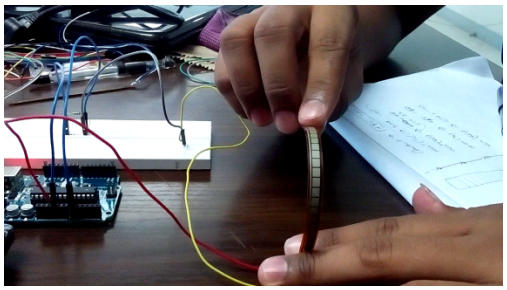

Figure 6. Flex-Sensor for Test Case 1

Positions of flex sensor	Readings of flex sensor
Constant (Straight Position)	470,-90
Opposite (half)	308,-197
Opposite (full)	610,93
Front (half)	455,-60
Front (full)	470,-43

Figure 7. Analyzed Data for Test Case 1

B. Test Case 2:

In this situation, the overall performance of the accelerometer, installed in the back of the palm is examined, with and without the utility of the proposed median filtering technique. The hand is fully stretched as proven in Fig. 8. The data outcomes of the sensor output without the utility of median filter out and with the utility are shown in Fig. 9

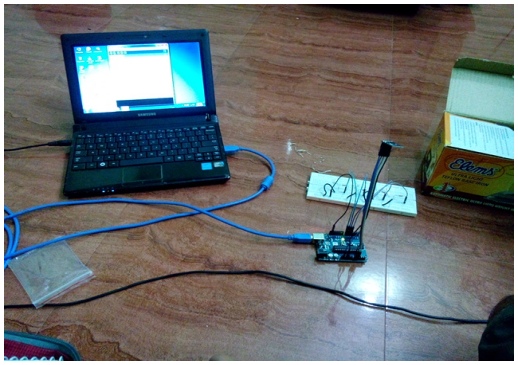

Figure 8. Accelerometer for Test Case 2

Movements	Average Values		
	X	Y	Z
Stable	350	300	400
CLK-Y	338	266	334
CLK-My	341	282	381
AntiCLK-Y	338	398	332
AntiCLK-My	350	380	377
Stable	350	300	400
UP-X	271	336	335
UP-Mx	283	333	381
Down-X	402	331	335
Down-Mx	390	332	386

Figure 9. Analyzed Data for Test Case 2

V. CONCLUSION

The focus of this paper was on the performance optimization of a flex sensor based totally glove for hand gesture reputation and translation. The want and use of gestures became discussed in the begin and various strategies for gestures reputation were discussed. The glove designed the usage of flex sensors and an accelerometer may be used efficaciously for hand gesture popularity. The research was carried on this glove interface to optimize the overall performance for such an interface. The findings as discussed inside the paper throw mild at the simple and great issues which must be realized and solved for the improvement of a great system. The methods for overall performance optimization have been mentioned in a very special manner. Almost all of the troubles which have an effect on the performance of this gesture recognition glove interface machine were mentioned at the side of their effective and easy answers. These answers can be applied without issue and for best outcomes. The authenticity of the proposed solution has been established via the test effects. In the end, it has been discussed that concrete steps need to be taken on this regard to design a much beneficial and sensible interface for further research and packages.

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