Repetitive Stress Injuries Research Device

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Student Poster Description

The amount of computer use over the years has drastically increased the events of repetitive stress injuries (RSIs), including carpal tunnel system. There is a desire to create a device to track finger motion and wrist pressure during normal computer use for an extended period of time to research some of the possible causes of RSIs. The device must measure the position of all finger digit and wrist joints as well as pressure distribution as a function of time. Feasibility criteria include that the device must be able to function for the middle 90% of women's right hands, and allow for normal computer use. The device must be portable and cost less than $1,500. By considering other features that might be desired, merit criteria were determined. These include high resolution of the pressure distribution at the wrist, small size, not requiring a special keyboard or mouse, being easy to put the device on the participant, and quick setup time.

The final design for this device was developed and includes four subsystems: the finger motion subsystem, the wrist pressure subsystem, the hand attachment subsystem, and the hardware and software subsystem. The finger motion subsystem tracks the motion of each finger segment as well as the thumb and wrist using flex sensors. Flex sensors change resistance as they are bent which can be converted to a voltage change using a voltage divider. The wrist pressure subsystem captures an array of pressure points at the wrist using force sensitive resistors. These resistors work similarly to the flex sensors. The hand attachment subsystem connects the finger motion sensors and wrist pressure sensors to the hand. The subsystem consists of a fingerless glove with channels sewn on the fingers and pockets sewn on the wrist area to house the sensors.

Finally, the hardware and software subsystems digitize and store the data collected by the sensors and display the information in a user-friendly format. Using a printed circuit board (PCB), variable resistances change into analog voltage input for a data acquisition system. LabView calibrates the information and displays angle and force information to the user. Each subsystem was constructed separately and then the entire device was put together and tested. From the original design, there was only one major modification where the type of wrist pressure sensor changed. The original force sensor (CUI SF-5L) had a significant amount of drift under static loading, so a Tekscan Flexiforce force sensitive resistor was used in its place. Because of the sizing difference in the new sensors, fewer pressure sensors were used. Overall, this design project has been a success. All of the subsystems work independently and when put together. The device has been trial tested and it meets all of the original specifications. Hopefully, the device will be used to perform testing on repetitive stress injuries. This design project has been a good learning experience and recommendations have been made to create a better device in the future.

Key Words

Student Poster, Applied Biology & Biomedical Engineering, Biomedical Engineering