SABIS-Comparative Studies

Akshara Acharekar, Pushkar Adhikari, Pranita Doke, Spurti Shinde

Abstract*— *S.A.B.I.S. (sEMG Accelerometer based Interactive System) is interactive software that would be used for interfacing compatible hardware systems that would help user have an entirely newer level of experience in the field of Human computer interactions. SABIS would be used to interface and calibrate systems that would be used as input for applications which would support such a system. Many aspects of human interactions can be captured using Accelerometers and surface Electromyogram signals, which give an idea regarding the movement that the user may wish to perform. This data can be sampled and converted as inputs for normal day to day computer applications which would integrate computer usage much more in the flow of human actions. Also, an extra level of research is being done to understand the use of a similar system for the elderly and disabled. This would add into an entirely new field of bioinformatics.

Index Terms*—*Human Computer Interaction, Signal Processing, Electromyogram, Accelerometers.

I. INTRODUCTION

Sometimes we can't just use our language to get things done. Always using hardware to work on computer is tough. Also some problems like stroke can result in a profound restriction of physical functioning, which may negatively impact the quality of life for survivors and their care givers. Stroke is the leading cause of serious, long-term disability. For those who are handicapped, it's almost impossible to work on computers. It would be very convenient if will be faster to process. Secondly there is a huge advancement in gaming field, gamers love real time interactive systems to play as it a thrilling experience. The systems that are the future of gaming are needed. Hence to make it easier and faster for everyone, we need a system which can recognize hand gestures, process and validate them and function accordingly. The user will wear a band that will have EMG sensors and accelerometer and will perform hand gestures. The system will recognize the hand gestures, match it with the database and then function accordingly. For gesture-based control, a real time interactive system needs to be built. The data sets are needed to match the data with the input given by the user. Our proposed system is a "sEMG Accelerometer Based Interactive System". Electromyography (EMG) is a technique for evaluating and recording the electrical activity produced by skeletal muscles.

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Accelerometer is used to capture the rotation and movement of the hand and fingers. A sensor band is used for receiving EMG signals to recognize the hand gestures. There is a database in which a data set is stored which will be used to match the hand gestures and function accordingly. It is a real-time interactive system where human-computer interaction takes place.

II. RELATED WORK

Arjan Gijsberts, et al. [3] presented a benchmark evaluation on the second revision of the publicly available NinaPro database. The evaluation involved two distinct approaches to myoelectric control, namely predicting forces at the four fingers and two axes of the thumb, as well as movement classification of 40 different hand movements in 40 intact subjects. The benchmark results indicate that a nonlinear kernel method can reach acceptable levels of performance on either problem. The exp-x^2 kernel, which has not been commonly used in the present context, demonstrates higher classification accuracy than the popular RBF kernel for all considered (non-negative) feature representations in the regression as well classification settings. With respect to movement classification, accelerometry and sEMG were found to be complementary modalities and significant gains were achieved when both are combined in a multimodal classifier. Studies have found that the commonly used window-based accuracy is only weakly related to online controllability, partially because it cannot distinguish between confusion between movement classes and prediction delays. They addressed this shortcoming by proposing the movement error rate, which measures the similarity of the actual and the predicted sequence of movements instead of windows. This metric is insensitive to prediction delays and therefore allows errors and delays to be quantified as two independent and competing characteristics. The balance between the error rate and delays can be regulated by means of temporal smoothing or by altering the analysis window length. Furthermore, this form of analysis confirmed the benefit of integrating accelerometry, as the multimodal classifier reduced both errors as well as prediction delay as compared to the sEMG-only classifier. Xu Zhang, et al. [1] have developed a framework for hand gesturerecognition which can be utilized in both Sign Language Recognition and gesture basedcontrol. They presented a framework that combines informationfrom a three-axis accelerometer and multichannel EMG sensorsto achieve hand gesture recognition. Experimental results onthe classification of 72 Chinese Sign Language words show that theirframework iseffective to merge ACC and EMG information with the averageaccuracies of 95.3% and 96.3% for two subjects. On the basisof multi-stream Hidden Markov Models classifiers, the decision tree increases theoverall recognition accuracy

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by 2.5% and significantly reduces the recognition time consumption. The ability of continuousSign Language Recognition by their framework is also demonstrated by the recognitionresults of 40 kinds of Chinese Sign Language sentences with an overall wordaccuracy of 93.1% and a sentence accuracy of 72.5%. Thereal-time interactive system using developed framework achieves therecognition of 18 kinds of hand gestures with average ratesof 97.6% and 90.2% in the user-specific and user-independentclassification, respectively. They have also shown by example of gamecontrol that their framework can be generalized to other gesture basedinteraction.

III. FRAMEWORK

Fig. 1 is a simple architecture of the proposed S.A.B.I.S system. The user performs actions in his usual flow from which data is collected and received by receiver. These actions performed are received as a set of signal data which need to be processed for further use. Thus, this data is hen sent through a data analyzer which analyses the signal to get rid of the different noise present. The data is then sampled so that it can be compared with the present data sets for a

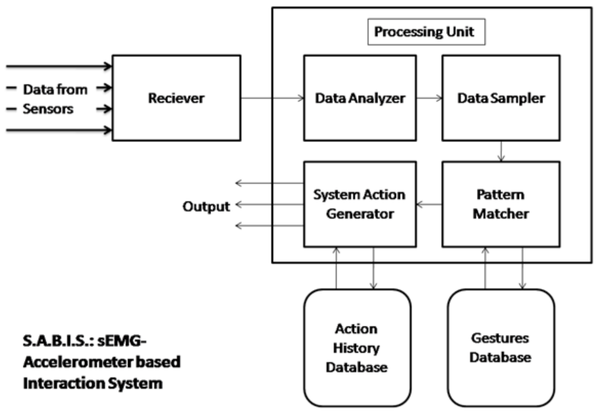

Figure 1. Basic Architecture of Proposed S.A.B.I.S. System

fruitful output. The main database of the system consists of gesture data that would be collected from humans. Also, a set of action history database would be performed facilitate actions which may have a chain of gestures required for any specific output.

On successful match in the samples and the gestures stored in the database, an associated action would be performed. This action generated by the S.A.B.I.S. system would act as user input to the system he is interacting.

IV. CONCLUSION

This paper focuses on study of various methods and plans to develop a software system to interface different compatible hardware for EMG-Accelerometer based interaction. The different papers studied have had commendable results, which would help us to design our system efficiently. Thus, our aim is to (a) Design a system to read and analyze sEMG-Accelerometer signals, (b) Engineer our system to work in flow of human interactions, (c) To obtain better accuracy and low false accept and reject rate.

V. FUTURE SCOPE

We plan to expand the project domain from primarily being interaction or gaming to medical sciences and bioinformatics. Though the proposed system would sound costly and inaccessible for masses, our primary aim would be to incorporate every kind of users into using the system. Further plans may also include design of smart home, which could be controlled by the use of our system.

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