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Human Emotion Recognition using Smart Environment

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Abstract— In today's growing world human emotion recognition is of utmost importance because many emotion-based devices are developing in order for customer satisfaction. In order to implement the emotion technology, it is necessary that analyzing the change in physiological variables due to a variety of change in circumstances and reprocessing services by recognizing the user's emotion state. This paper is hardwired logic architecture for human emotion recognition as well as all the functions supported by software-based platform are designed and implemented in an FPGA.

Keywords— Human emotion, physiological Signal, Emotion recognition, Hardwired logic, reprocessing.

I. INTRODUCTION

Human emotion recognition technology is getting more popular for next-generation user interface applications, which will be able to provide ambient assisted living by seamless natural interaction between human and machine. People's moods heavily influence their way of communicating, but also their acting and productivity. Emotion also playas crucial role in all-day communication [1]. For example in china many hotels have robots, which would react to the customers according to the moods of the customer. This proves that the emotion of any customer or the end user has been taken as the prime factor for any product to be successful in the market.

Human emotion recognition which use cognitive user modeling. For example, to extract and represent a student's knowledge, skills, and goals, to help users find information in hypermedia applications, or to tailor information presentation to the user. New generations of intelligent computer user interfaces can also adapt to a specific user, choose suitable teaching exercises or interventions, give user feedback about the user's knowledge and predict the user's future behaviour such as answers, goals, preferences, and actions. Recent findings on emotions have shown that the mechanisms associated with emotions are not only tightly intertwined neurologically with the mechanisms responsible for cognition, but that they also play a central role in decision making, problem solving, communicating, negotiating, and adapting to un- predictable environments. Emotions are now therefore considered as organizing and energizing processes, serving important adaptive functions [2, 3].

For those prospective applications, many researches and studies have been conducted so for. Initial researches focused on psychological identification of fundamental elements representing various human emotion and developed one dimension state such as pleasant-unpleasant and arousal relaxation [4]. After then, more complex structure of two dimension state was developed by combining those one dimension states and various human emotions could be mapped discretely into the two dimensions State. In order to recognize human emotions, physiological signals such as heart rate, blood pressure, body temperature and brain wave were measured and analysed in real time [5].

This paper is an attempt to develop an emotion recognition device on a FPGA which would find the emotions of the person wearing the sensors. This is implemented on the Spartan 3E FPGA boards. The signal under study is gathered from different sensors. Is sent to the FPGA using Bluetooth. The decision of which emotion is detected is given from the processor as the output by the indication from the UART.

II. CONCEPTUAL DESIGN OF FPGA-BASED HUMANEMOTION RECOGNITION SYSTEM

A. OVERALL SYSTEM DESIGN

The physiological data like the EEG, Heart rate, blood pressure and the body temperature are sent to the FPGA. The EEG is sensed from the Brain wave sensor which is inbuilt with the Bluetooth communication sending the data from the sensor to the Bluetooth in the Android mobile. The heart rate, blood pressure and body temperature signals connected to the FPGA's serial port .By getting all the data the FPGA would decide the emotion of the person to which the sensors are connected.

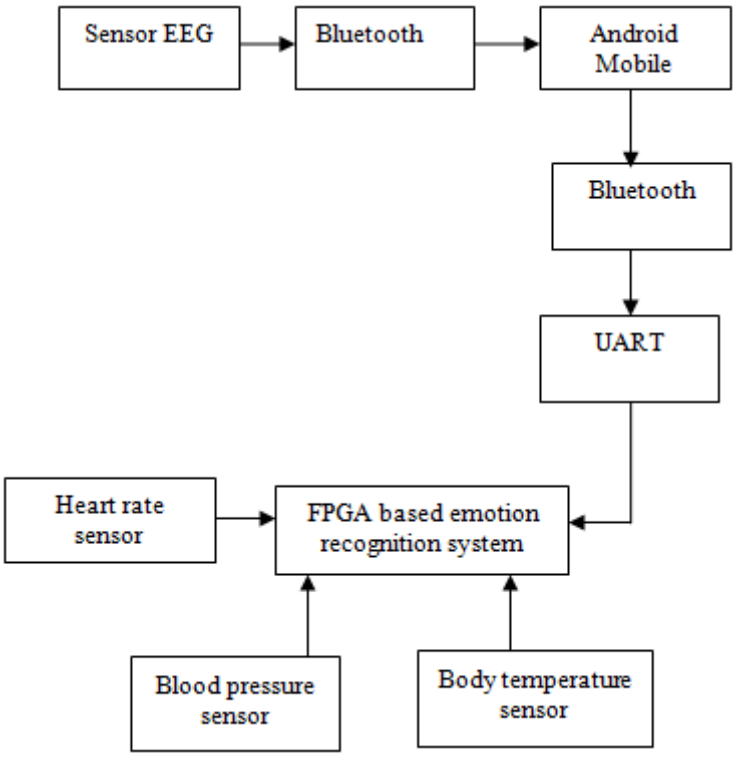

Fig. 1 Emotion recognition block diagram

III. A HUMAN EMOTION INTERACTION PLATFORM

A. Classification of rule based set on Heart rate, Blood pressure and Body temperature

In order to extract human emotions, the proposed multimodal emotion recognition model calculated the Heart rate, Blood pressure and Body temperature signals for extracting human emotions, adopted the emotion recognition model to two dimensional states.

As shown in below table1, 2 and 3 we use Heart rate, Blood pressure and Body temperature mean values and then classified into three kinds of rule based tables.

Table 1. Classification of rule based set on Heart rate

Emotion	**value**
Excitement	72
Fear	73
Sadness	74

Table 2.Classifiction of rule based set on Blood Pressure

Category	**Value(Celsius)**
Hypothermia	<35
Desired	36-37
Fever	37-38
Hyperthermia	38-40
Hyperpyrexia	>40

Table 3. Classification of rule based set on Body Temperature

Category	**Value**
Hypotension	<90
Desired	90-119
Pre hypertension	120-139
Stage 1 hypertension	140-159
Stage 2 hypertension	160-179
Hypertensive emergency	>180

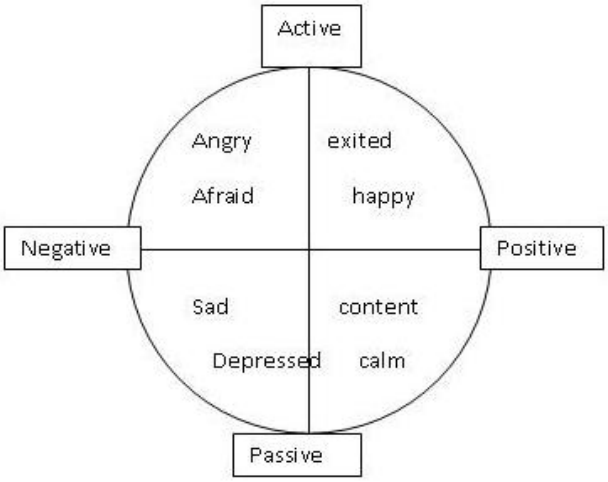

Fig. 2. Classification of rule based set on EEG

B. Finite state machine diagram for Human Emotion Recognition

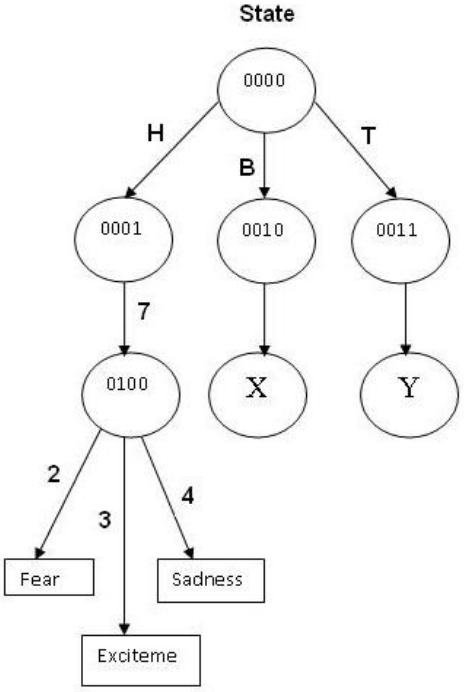

Fig. 3. FSM for Heart rate

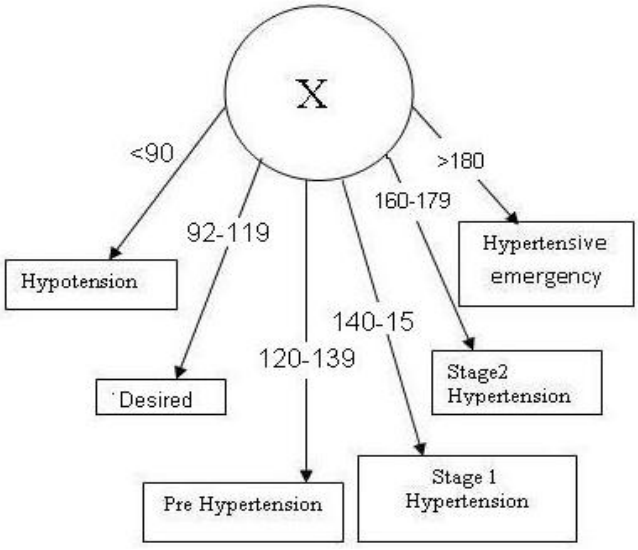

Fig. 4. FSM for Blood pressure

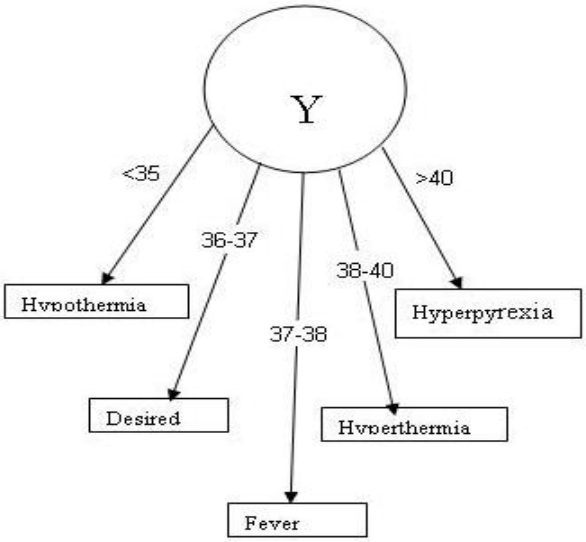

Fig. 5. FSM for Body temperature

C. Architecture of the multi modal emotion reasoning engine

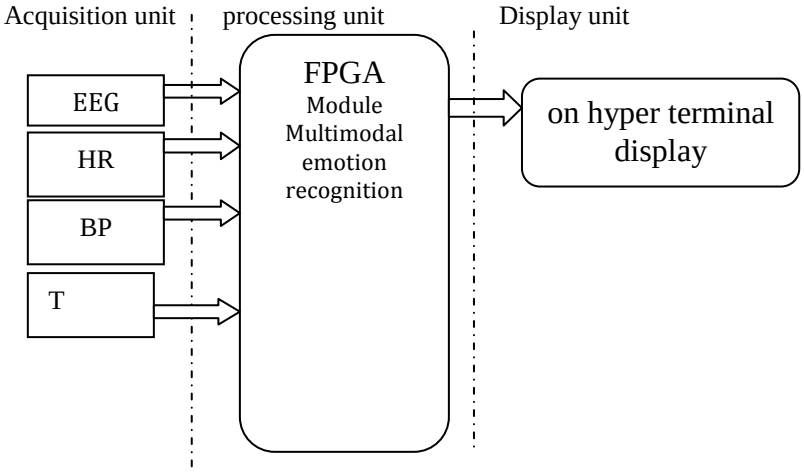

Fig. 6. Architecture of the multimodal emotional recognition engine

The proposed multimodal emotional recognition model takes the characteristic, which is integrated the multimodal emotional signals adaptively and performing the emotional recognition. As shown in Fig. 6, we were composed of three units for developing multimodal emotional recognition platform based on the above-mentioned information; Acquisition unit, processing unit, and display unit.

Acquisition unit has the ability to gathers physiological signal, processing unit has the ability to process the multimodal emotion reasoning for extracting human emotions with physiological variables, and display unit has the functionality to display the emotion based on rule based table.

IV. IMPLEMENTING THE HUMAN EMOTIONAL INTERACTION PLATFORM

We implemented the multi modal emotional recognition based on the rule based table. For the functional verification of the multimodal emotional recognition engine, we performed the functionality and integration testing through sensors for extracting physiological variables.

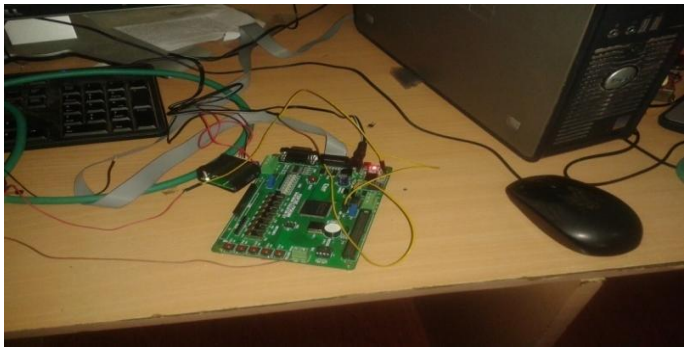

Fig. 7.Test environment

Fig. 8. Results of the multimodal recognition Engine

V. CONCLUSION

In this paper, we proposed the algorithm of the multimodal emotion recognition regarding the user's internal physiological variables. The procurement of the components for the implementation like the sensor, Bluetooth modules and FPGA board. An FPGA for human emotion recognition is implemented for multimodal emotion reasoning. For the debugging of functional and arithmetical operations of FPGA, internal register files are implemented in the FPGA.

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