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Dr. Emotion

情緒醫生－平衡自律神經之環境調控系統

隊伍名稱

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作品摘要

人體的自律神經系統分為交感神經和副交感神經，兩者相互調節生理機能。當情緒長期處於興奮緊張抑或是憂鬱低落，此時交感與副交感神經將會呈現不規律亢奮或受到抑制，容易導致身體機能失調。一般檢測自我情緒，需要有專業的儀器或是以繁複的問卷填寫形式進行，才可以判定情緒狀態。但這些檢測過程往往耗時、不便利且價格昂貴，無法即時呈現情緒狀態。

本作品藉由手握滑鼠時，量測手指的生理信號，以及情緒分類演算法，設計一個可使自律神經達到平衡狀態的即時環境調控系統，並命名此系統為Dr. Emotion。主要架構分為三個部分，

分別為生理訊號量測、情緒分析與分類、環境因素調控。

本團隊突破制式的硬體規格，將多方面的軟硬體整合，成為一套功能完善的Dr. Emotion嵌入式系統，其中包括感測電路整合及微控制晶片微小化、ZigBee通訊傳輸技術和使用者電腦操作介面等等。本團隊著眼於智慧家庭或辦公樓房的電腦滑鼠操作場景，以改裝後的滑鼠作為感測和調控平台，在狹窄的滑鼠內部空間置入了搭載ZigBee通訊功能的自製微控制晶片以及感測電路。於是仿如平常一般操作滑鼠時，也同時量取了皮膚導電率、心跳率、體溫等訊號。透過擷取到的這些生理訊號的特徵點，便可進行分析當下情緒的轉折；在情緒分析部分，採用決策樹分類演算法，即時辨識出三種不同的情緒狀態，分別為激動、平靜、低落；最後，環境因素調控的部分，是根據色彩心理學以及氣味芳療法，藉由自動控制燈光和氣味，塑造出合適的環境以達成自律神經系統的平衡。經由此生理狀態的變化，成功地調控使用者情緒狀態恢復至平穩。簡而言之，我們製作了一個閉迴路的自動調控系統，隨時偵測相關的生理訊號，即時平衡自律神經的活性。

本作品將此技術融入於滑鼠操作，活化生活氛圍，實現即時辨識使用者情緒，並能有效平衡自律神經系統，讓使用者不需額外操作就達到情緒平靜與穩定，起到「潤物細無聲」的預期效果，以落實智慧生活之實質意義，人人皆可成為自己的「情緒醫生」。

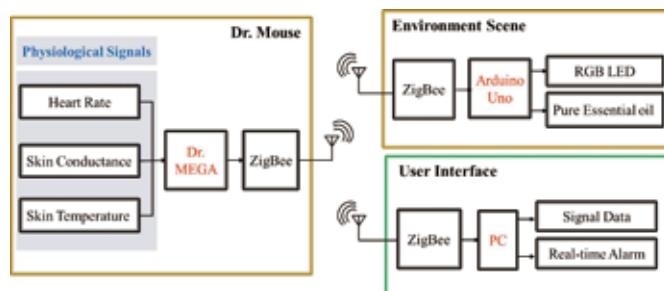


圖1 > Dr. Emotion軟硬體整合架構圖



指導教授

練光祐 / 臺北科技大學電機工程系

於 1984 年取得成功大學工程科學系學士學位，1988 年起就讀臺灣大學電機研究所，於 1993 年取得博士學位。1986~1988 年服務於工業技術研究院機械所。1994 年進入中原大學電機系擔任副教授，2002 年升任教授，於 2004~2007 年兼任系主任。2007 年轉至臺北科技大學擔任教授至今，曾於 2009~2012 年兼任系主任。

研究領域

嵌入式系統設計、智慧家庭技術、智慧型控制系統、非線性系統分析控制與應用。

Abstract

The human body autonomic nervous system is divided into the sympathetic and parasympathetic. Interactively, they regulate a person's physiological functions. Whenever the mood of a person is constantly excited/ nervous or depressed, the sympathetic and parasympathetic nervous systems become irregularly agitated or suppressed, leading to tendencies of physical disorders. Normally, the use of specialized equipment or complex questionnaires is required in order to accurately evaluate one's emotional state. However, in addition to the customary disadvantages of being time-consuming, troublesome and costly, these testing processes do not display emotional conditions instantly.

In response to the above mentioned drawbacks, a real-time environment regulation system, which can bring the user's autonomic nervous system to equilibrium, named Dr. Emotion is designed. The design concept is that while being held in the user's hand, the mouse can transfer physiological signals from the fingertips to the computer which then allows the emotion classification algorithm to make calculations. Divided into three parts, the main structure is made up of 1) the measurement of physiological signals, 2) emotional analysis and classification and 3) environmental factor regulation.

The team made a breakthrough in standard hardware specifications by integrating various hardware components to produce a set of embedded system named Dr. Emotion that includes sensor circuit integration and micro-controller chip miniaturization, ZigBee communication transmission technology and computer control interface for the user ... etc. Considering a smart home or an office building as the computer-mouse-controlled setting, this team made modification by fitting a self-made micro-controller chip with a ZigBee communication feature and a sensor circuit in the limited space of a computer mouse. This way, the user can have the skin conductivity, heart rate and body temperature signals measured while using the mouse. By extracting the characteristic points of these physiological signals, emotional transition at the moment can be analyzed. In terms of emotion analysis, decision tree classification algorithm is used

to identify three different emotional states, namely, agitated, calm and depressed. Lastly, in terms of environmental factor regulation, a suitable atmosphere is created through automatic lighting and scent control as suggested by principles of color psychology and aroma therapy, balancing the autonomic nervous system. These surrounding influences change the user's physiological state to bring the emotional state back to calm. In short, a closed-loop automatic control system was created here so that detection of related physiological signals can be done at any time; as a result, the autonomic nervous system activity is balanced instantly.

In this work, the technology is integrated into the holding of a computer mouse; not only does it enliven the atmosphere of a living space and actually identifies the user's emotion instantly, it also effectively balances the autonomic nervous system helping the user reach emotional calm and stability with the simple touch of the mouse. As predicted, the result silently but actively maintains one's emotional well-being, just like in Tang Dynasty poet Du Fu's poem, "Good rain moistens all things softly, without sound." As anyone can become his/her own "Dr. Emotion," the essence of smart living is brought to reality.

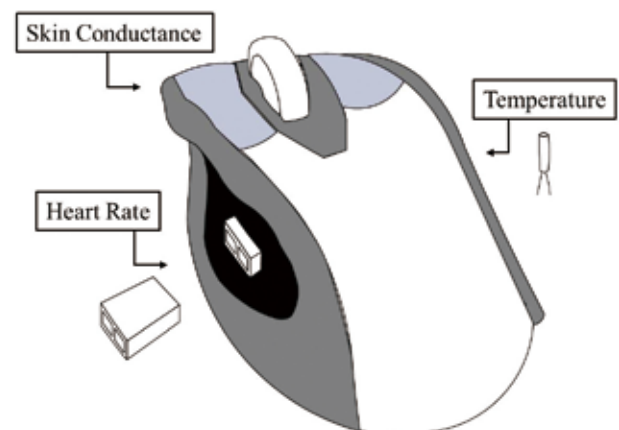


Fig.2 > The researchers incorporated the three sensors in Dr. Mouse.