同行专家业内评价意见书编号：20250855113

附件1

浙江工程师学院（浙江大学工程师学院）
同行专家业内评价意见书

姓名：鲍彦池

学号：22260392

申报工程师职称专业类别（领域）：机械

浙江工程师学院（浙江大学工程师学院）制

2025年03月27日

填表说明

一、本报告中相关的技术或数据如涉及知识产权保护、军工项目保密等内容，请作脱密处理。

二、请用宋体小四字号撰写本报告，可另行附页或增加页数，A4纸双面打印。

三、表中所涉及的签名都必须用蓝、黑色墨水笔，亲笔签名或签字章，不可以打印代替。

四、同行专家业内评价意见书编号由工程师学院填写，编号规则为：年份4位＋申报工程师职称专业类别(领域)4位+流水号3位，共11位。

一、个人申报

（一）基本情况【围绕《浙江工程师学院（浙江大学工程师学院）工程类专业学位研究生工程师职称评审参考指标》，结合该专业类别(领域)工程师职称评审相关标准，举例说明】

1.对本专业基础理论知识和专业技术知识掌握情况(不少于200字)

在专业基础理论知识方面，我深入学习了人机工程学、设计心理学等核心课程。通过人机工程学，我熟知人体尺度、运动范围等数据，能够精准地将这些知识运用到产品设计中，确保产品的操作舒适性与易用性。比如在设计一款办公座椅时，依据人体脊柱曲线和坐姿下的压力分布理论，优化座椅的靠背和座面角度，有效提升了使用者的久坐舒适度。

设计心理学的学习，则让我掌握了用户认知、情感与行为之间的关系。在设计智能设备交互界面时，我能根据用户的认知习惯，合理布局功能模块，利用色彩心理学原理选择恰当的色彩搭配，增强用户对产品的情感认同。

专业技术知识上，我熟练掌握三维建模软件（如 Rhino）和交互设计工具（如 Axure）。利用 Rhino 强大的曲面建模功能，我能够将创意概念转化为精致的产品三维模型，精确把控产品外观细节；Axure 则助力我创建高保真的交互原型，模拟人机交互过程，提前测试和优化交互逻辑。凭借这些扎实的专业知识，我构建起了应对复杂设计项目的能力体系。

2.工程实践的经历(不少于200字)

1、针对办公室群体，设计了popstress系统，识别并缓解群体压力。通过可穿戴传感器检测计算用户的压力状态，并通过爆米花机制作爆米花的过程反馈压力状态，从而将情绪可视化出来并通过引导用户吃爆米花和轻松交谈的方式，缓解压力。

2、孕妇妊娠期容易情绪不稳定，出现情绪低落、压抑的问题，会对其自身及胎儿的健康造成很大影响。为了让孕妇及其家人更好地察觉到孕妇的情绪状态并及时调整，设计了一个孕妇情绪反馈及干预系统。此系统通过情绪花的颜色亮度和开合状态等反映孕妇的情绪状态，并通过引导孕妇深呼吸来缓解情绪。

3.在实际工作中综合运用所学知识解决复杂工程问题的案例（不少于1000字）

随着孕期心理健康的认知程度逐渐提高，越来越多的人关注到孕妇的身心健康。由于孕妇在怀孕期间很容易陷入情绪不稳定的状态中，造成情绪波动的原因涉及生理变化、心理适应、家庭关爱支持程度及社会角色的转变等多种因素。上述种种原因容易导致妊娠期出现焦虑及抑郁情绪，会对孕妇自身及胎儿造成一系列消极影响，所以及时关注到孕妇情绪并给予干预引导是十分必要的。

首先研究了当前孕妇妊娠期情绪健康管理的方式，以及常用的孕妇情绪评估和监测的方法，对妊娠期情绪健康管理的痛点需求及当前解决方案的优缺点进行了总结分析。并且，通过与妇产科医生护士、孕妇自身、孕妇家人的合作交流，洞察了情绪可视化、多感官干预、家庭情感参与以及精准情绪识别等关键设计要点。

然后从工业设计和人机交互学的角度出发，设计了可穿戴传感采集设备，包括内含PPG传感器的运动手套以及嵌入呼吸传感器的托腹带，能够准确稳定地采集孕妇的生理信号数据。可穿戴传感设备中包括传感器、主控板、蓝牙模块等的硬件连接和软件配置工作，从而完成数据的实时采集和传输。

同时，也完成了SensPlant系统的设计迭代和原型制作，以及实时计算的生理指标与SensPlant系统之间的映射控制。对于情绪花原型样机的制作，包括模型构建、切片处理、3D打印与硬件安装等过程，也详细定义了舵机驱动花朵开合的角度和计算的心率变异性指标之间的关

系，以及led亮度渐变的速度与呼吸指标之间的关系等。对于情绪树的制作，包括定义设计理念、激光切割等过程。通过情绪花开合状态以及情绪树装饰等可视化元素的设计，为孕妇提供一个生动直观的情绪反馈。运用了多感官协同刺激的原理，在孕妇情绪低落时，结合视觉（灯光变化）、听觉（音乐引导）和深呼吸训练的多感官干预方式，打造一个沉浸式的音景反馈系统，从多个角度缓解孕妇情绪。也探索研究了让孕妇及家人共同装饰孕期情绪小树的设计理念，这棵装饰满不同情绪花朵的树能够成为家庭的一份珍贵纪念，情绪树作为整个孕期情绪记录的载体，在增强家庭情感互动的同时，也便于孕期结束后情绪认知的提升。

随后，通过设计完备严谨的用户实验，共招募了20名被试，采集了被试的客观生理数据、主观量表数据及访谈内容，后续结合定量分析和定性分析方法，验证了上述系统的情绪反馈和干预效果具有显著性。

最后，运用实验采集到的数据，依次完成了数据预处理、特征提取和筛选等工作，基于支持向量机（SVM）方法构建了孕妇情绪识别模型，准确率达到69.3%。评估比较后发现多模态信号融合后的模型性能具有一定提升，为孕妇妊娠期的情绪健康管理提供科学有效的依据。

（二）取得的业绩（代表作）【限填3项，须提交证明原件（包括发表的论文、出版的著作、专利证书、获奖证书、科技项目立项文件或合同、企业证明等）供核实，并提供复印件一份】

1.
公开成果代表作【论文发表、专利成果、软件著作权、标准规范与行业工法制定、著作编写、科技成果获奖、学位论文等】

成果名称	成果类别 [含论文、授权专利（含发明专利申请）、软件著作权、标准、工法、著作、获奖、学位论文等]	发表时间/授权或申请时间等	刊物名称/专利授权或申请号等	本人排名/总人数	备注
Prenatal anxiety recognition model integrating multimodal physiological signal	国际期刊	2024年09月18日	Nature Scientific Reports	1/8	SCI期刊收录
PopStress: Designing Organizational Stress Intervention for Office Workers	国际期刊	2023年12月05日	Frontiers in Computer Science Human-Media Interaction	1/5	ESCI期刊收录
未来设计师全国高校数字艺术设计大赛全国总决赛一等奖	获奖	2024年08月26日	未来设计师全国高校数字艺术设计大赛	2/3	

2.其他代表作【主持或参与的课题研究项目、科技成果应用转化推广、企业技术难题解决方案、自主研发设计的产品或样机、技术报告、设计图纸、软课题研究报告、可行性研究报告、规划设计方案、施工或调试报告、工程实验、技术培训教材、推动行业发展中发挥的作用及取得的经济社会效益等】

（三）在校期间课程、专业实践训练及学位论文相关情况	
课程成绩情况	按课程学分核算的平均成绩： 83 分
专业实践训练时间及考核情况(具有三年及以上工作经历的不作要求)	累计时间： 1 年（要求1年及以上） 考核成绩： 84 分
本人承诺	
个人声明：本人上述所填资料均为真实有效，如有虚假，愿承担一切责任，特此声明！ **申报人签名：** 鲍彦池	

2226392

二、日常表现考核评价及申报材料审核公示结果

日常表现考核评价	非定向生由德育导师考核评价、定向生由所在工作单位考核评价： ☑优秀 ☐良好 ☐合格 ☐不合格 德育导师/定向生所在工作单位分管领导签字（公章）：　　年 3月 27日
申报材料审核公示	根据评审条件，工程师学院已对申报人员进行材料审核（学位课程成绩、专业实践训练时间及考核、学位论文、代表作等情况），并将符合要求的申报材料在学院网站公示不少于5个工作日，具体公示结果如下： ☐通过 ☐不通过（具体原因：　　） 工程师学院教学管理办公室审核签字（公章）：　　年　月　日

浙 江 大 学 研 究 生 院

攻读硕士学位研究生成绩表

学号：22260392	姓名：鲍彦池	性别：女	学院：工程师学院	专业：机械	学制：2.5年
毕业时最低应获：26.0学分		已获得：32.0学分		入学年月：2022-09	毕业年月：
学位证书号：			毕业证书号：		授予学位：

学习时间	课程名称	备注	学分	成绩	课程性质	学习时间	课程名称	备注	学分	成绩	课程性质
2022-2023学年秋季学期	工程数值分析		2.0	76	专业选修课	2022-2023学年秋冬学期	研究生英语		2.0	84	专业学位课
2022-2023学年秋季学期	智能物联网与嵌入式应用		1.0	82	专业学位课	2022-2023学年冬季学期	产业技术发展前沿		1.5	90	专业学位课
2022-2023学年秋季学期	工程伦理		2.0	86	专业学位课	2022-2023学年春季学期	新时代中国特色社会主义理论与实践		2.0	83	专业学位课
2022-2023学年秋季学期	创新设计方法		2.0	通过	专业选修课	2022-2023学年春季学期	研究生论文写作指导		1.0	87	专业选修课
2022-2023学年秋季学期	工程技术创新前沿		1.5	89	专业学位课	2022-2023学年夏季学期	研究生英语基础技能		1.0	0	跨专业课
2022-2023学年秋季学期	自然辩证法概论		1.0	80	公共学位课	2022-2023学年夏季学期	产品创新与商业模式		2.0	85	专业学位课
2022-2023学年秋冬学期	高阶工程认知实践		3.0	88	专业学位课	2023-2024学年秋季学期	数据可视化		3.0	通过	跨专业课
2022-2023学年冬季学期	智能装备设计制造		2.0	85	专业学位课	2023-2024学年夏季学期	研究生英语应用能力提升		2.0	76	公共学位课
2022-2023学年冬季学期	设计工程学		2.0	81	专业选修课		硕士生读书报告		2.0	通过	

说明：1.研究生课程按三种方法计分：百分制，两级制（通过、不通过），五级制（优、良、中、及格、不及格）。

2.备注中“*”表示重修课程。

学院成绩校核章：

成绩校核人：张梦依

打印日期：2025-03-20

scientific reports

OPEN

Prenatal anxiety recognition model integrating multimodal physiological signal

Yanchi Bao[1], Mengru Xue[1]✉, Jennifer Gohumpu[1], Yumeng Cao[1], Shitong Weng[1], Peidi Fang[2], Jiang Wu[3] & Bin Yu[4,5]

Anxiety among pregnant women can significantly impact their overall well-being. However, the development of data-driven HCI interventions for this demographic is often hindered by data scarcity and collection challenges. In this study, we leverage the Empatica E4 wristband to gather physiological data from pregnant women in both resting and relaxed states. Additionally, we collect subjective reports on their anxiety levels. We integrate features from signals including Blood Volume Pulse (BVP), Skin Temperature (SKT), and Inter-Beat Interval (IBI). Employing a Support Vector Machine (SVM) algorithm, we construct a model capable of evaluating anxiety levels in pregnant women. Our model attains an emotion recognition accuracy of 69.3%, marking achievements in HCI technology tailored for this specific user group. Furthermore, we introduce conceptual ideas for biofeedback on maternal emotions and its interactive mechanism, shedding light on improved monitoring and timely intervention strategies to enhance the emotional health of pregnant women.

Keywords Pregnant woman, Multimodal physiological signal, Emotion recognition, Feature fusion, Anxiety model

Pregnant women frequently experience emotional instability during pregnancy, which can have adverse effects on both their physiological and psychological well-being. As awareness of maternal mental health grows, there is a heightened focus on the well-being of expectant mothers[1]. The prenatal period is associated with an increased risk of prenatal anxiety and depression, which can result in various negative impacts on the developing fetus[2]. Research has shown that timely attention to maternal emotions and proactive interventions, including emotional support, can positively affect the Physiological and psychological well-being of pregnant women and the overall health of the unborn child[3].

Studies have revealed that specific monitoring and intervention measures can significantly benefit the emotional well-being of pregnant women[4]. For example, monitoring sleep patterns[5] and implementing stress management strategies, such as mindfulness breathing exercises[6], have shown promising results. Some studies have monitored the health status of pregnant women through the measurement of Photoplethysmography (PPG) data[7], while others have employed text mining for sentiment analysis to prevent postpartum depression[8]. Although these studies have contributed to monitoring and enhancing the emotional well-being of pregnant women, research that integrates multiple physiological signals from pregnant women for monitoring purposes is limited. Furthermore, it has been demonstrated that the fusion of multimodal signals enhances emotion recognition accuracy when compared to single-modal signals[9–11].

The limited availability of publicly accessible datasets for pregnant women presents a substantial hurdle for data collection and model development when analyzing pregnancy-related data. Consequently, this scarcity of data resources has led to a relatively small number of data-driven interactive intervention measures designed for the pregnant population.

To achieve more accurate monitoring and identification of the emotional states of pregnant women, this study designed a complete experiment, and utilized the Empatica E4 wristband to measure physiological signal data during the late stages of pregnancy, both during periods of rest and relaxation. Additionally, participants completed questionnaires based on their self-reported feelings at each stage to gather subjective data on their anxiety levels. The relaxation state involved deep breathing exercises guided by a biofeedback system. By fusing

[1]Ningbo Innovation Center, Zhejiang University, Ningbo, China. [2]The Affiliated People's Hospital of Ningbo University, Ningbo, China. [3]University of Nottingham Ningbo China, Ningbo, China. [4]Nyenrode Business University, Breukelen, The Netherlands. [5]Amsterdam University of Applied Sciences, Amsterdam, The Netherlands. ✉email: mengruxue@zju.edu.cn

scientific reports

View all journals | Search

Explore content | About the journal | Publish with us | Sign up for alert

nature > scientific reports > articles > article

Article | Open access | Published: 18 September 2024

Prenatal anxiety recognition model integrating multimodal physiological signal

Yanchi Bao, Mengru Xue ✉, Jennifer Gohumpu, Yumeng Cao, Shitong Weng, Peidi Fang, Jiang Wu & Bin Yu

Scientific Reports **14**, Article number: 21767 (2024) | Cite this article

Metrics

Download PDF

Sections | Figures

Abstract

Introduction

Related work

Experimental research

Discussion

Conclusion

Data availability

References

Abstract

Anxiety among pregnant women can significantly impact their overall well-being. However, the development of data-driven HCI interventions for this demographic is often hindered by data scarcity and collection challenges. In this study, we leverage

frontiers | Frontiers in Computer Science

TYPE Original Research
PUBLISHED 05 December 2023
DOI 10.3389/fcomp.2023.1265399

OPEN ACCESS

EDITED BY
Miguel Melo,
University of Porto, Portugal

REVIEWED BY
Vishnunarayan Girishan Prabhu,
University of North Carolina at Charlotte, United States
Gregor Gersak,
University of Ljubljana, Slovenia

*CORRESPONDENCE
Mengru Xue
✉ mengruxue@zju.edu.cn

RECEIVED 22 July 2023
ACCEPTED 15 November 2023
PUBLISHED 05 December 2023

CITATION
Bao Y, Xue M, Gohumpu J, Cao Y and Hu J (2023) PopStress: designing organizational stress intervention for office workers. *Front. Comput. Sci.* 5:1265399. doi: 10.3389/fcomp.2023.1265399

PopStress: designing organizational stress intervention for office workers

Yanchi Bao[1,2], Mengru Xue[1,2]*, Jennifer Gohumpu[1,2], Yumeng Cao[1,2] and Jun Hu[3]

[1]Ningbo Innovation Center, Zhejiang University, Ningbo, China, [2]Zhejiang University, Hangzhou, China, [3]Eindhoven University of Technology, Eindhoven, Netherlands

Introduction: Excessive work stress on office workers will affect people's health and work efficiency, and organizational stress management is becoming more and more critical. Current studies focus on the management of individual stress. The collective nature of stress and coping needs further exploration.

Methods: This paper proposes the PopStress system, which converts the negative stress of an office group into the energy of a popcorn machine. When the organizational stress accumulates to the threshold, the popcorn machine will start making popcorn and attract office workers to take a break and eat. Through multisensory stimuli such as visual, audio, and olfaction, the system encourages natural and entertaining social stress-relieving behaviors within the office.

Results: Twenty-four office workers were recruited and divided into six groups for the user study. The results showed that PopStress enables users to understand the collective stress status, and successfully relieved the individual's physiological and psychological stress. This work provides insights into organizational stress management, health product design, and social design.

KEYWORDS

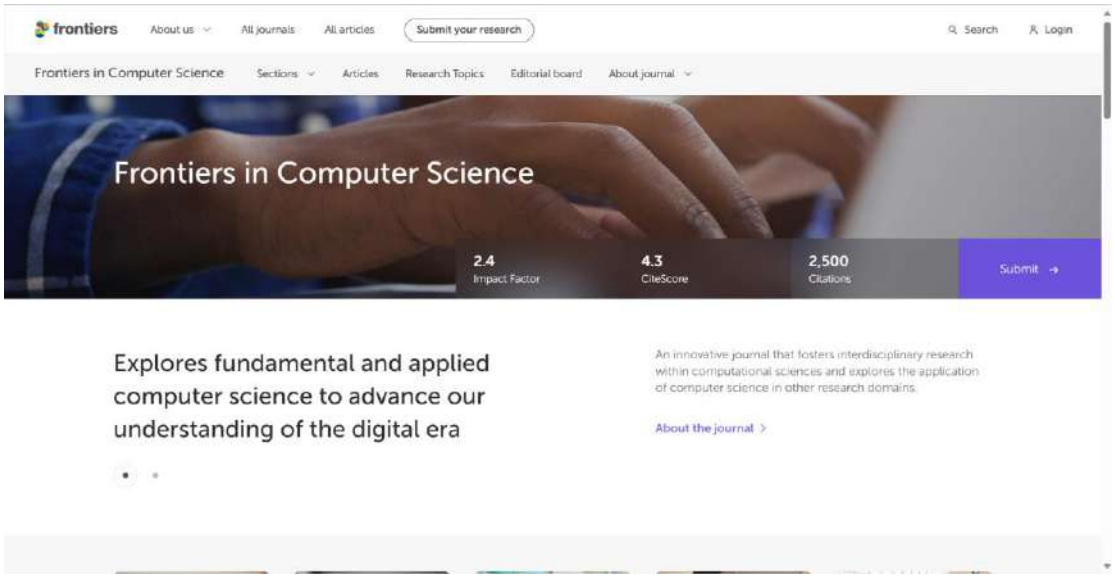
organizational stress, biofeedback, stress intervention, multisensory interaction, visual, auditory, olfactory

1 Introduction

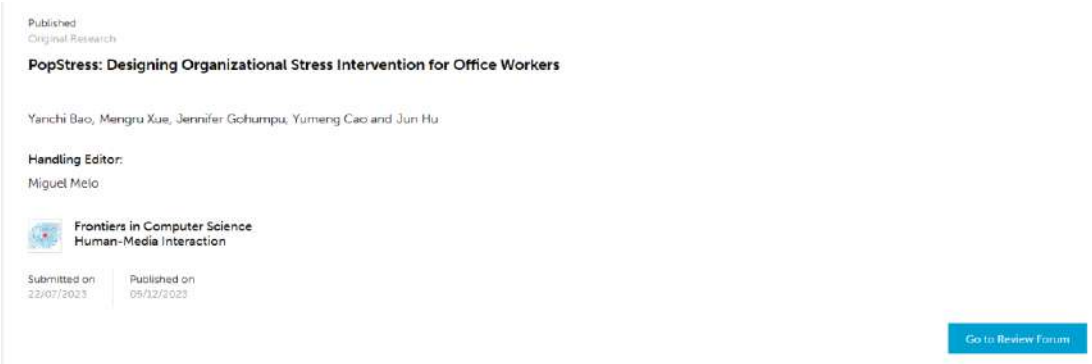
Nowadays, office workers are facing an escalating burden of organizational stress. Prolonged exposure to this stress can result in fatigue, depression, irritability, and an increased risk of various illnesses, including cardiovascular diseases (Chrousos, 2009). Apart from individual stress, organizational stress (Lansisalmi et al., 2000) is another type of stress within an organization. Major stressors within organizations are related to interpersonal relationships, including different types of peer pressure and social comparisons (Feslingcr, 1954). Organizational stress could decrease organizational efficiency and job satisfaction (Scott et al., 2006), thereby impacting the individual's health. Therefore, understanding the collective nature of stress and exploring approaches to leverage this situation warrants further research.

Currently, biofeedback technologies have been applied for physiological stress management, but most work emphasizes individuals instead of an organization. Researchers use physiological signals (e.g., EEG, EMG, EDA, HRV) as well as physical features (e.g., facial expressions, vocal tone, and body posture) to collect people's reactions to stress and offer various forms of feedback (Sharma and Gedeon, 2012). Among these, HRV is the most commonly used parameter for biofeedback technology that is considered accurate to reflect physiological stress levels (Yu et al., 2018b). Additionally, research has indicated

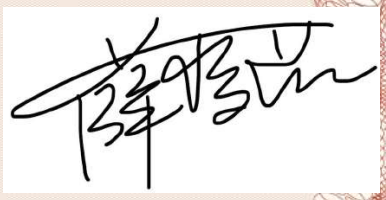
期刊封面：



文章及作者署名：



获奖证书



第12届未来设计师

全国高校数字艺术设计大赛全国总决赛

一 等 奖

参赛组别：研究生组

作品类别：视觉传达设计

作者姓名：曹雨萌、鲍彦池、Jennifer Gohumpu

作品名称：盲行天下-多场景视障人群辅助帮扶系统

参赛单位：浙江大学

指导老师：薛梦茹、胡一川

大赛官网：www.ncda.org.cn

证书编号：HJNCDA202408007152

工业和信息化部人才交流中心

2024 年 08 月 26 日