

# Laboratory of Flexible Electronics and Intelligent Equipments

Zhejiang University

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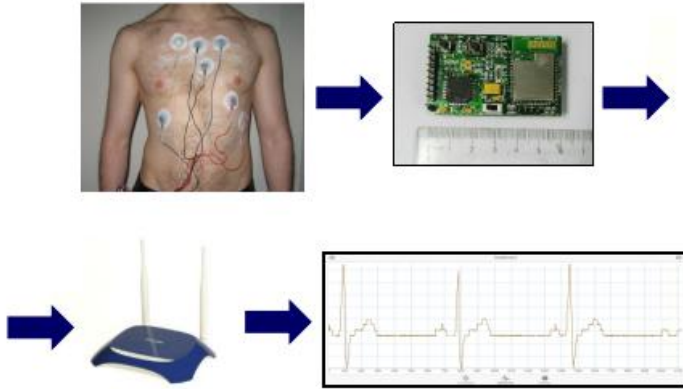
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## About

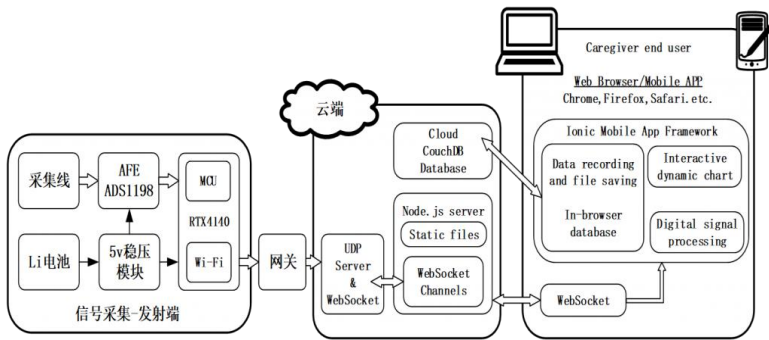
The Laboratory of Flexible Electronics and Intelligent Equipments at Zhejiang University conducts research on Flexible and Embedded Electronics, Soft Sensing and Actuating Tech, Hybri integration tech, Advanced Robotics, Human-Robot Interface & Interaction Tech, Artificial Intelligence and its application in Robotics.

# Project



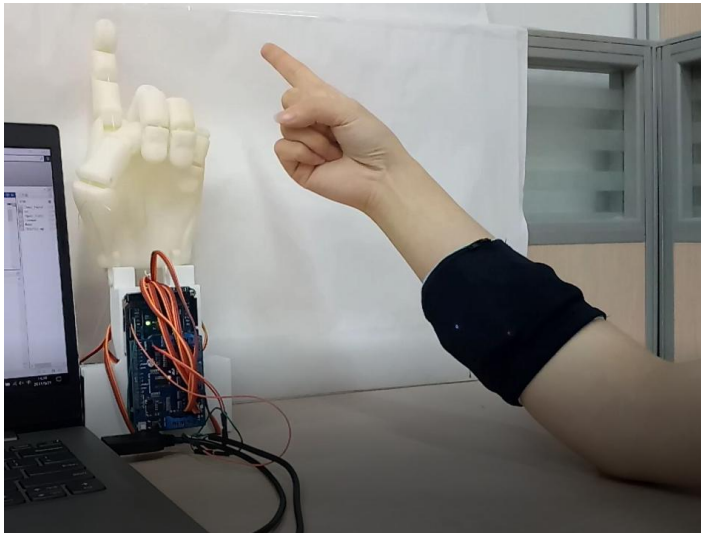
## Project 1: Remote ECG Signal Monitoring System Based on Internet of Things

Cardiovascular disease is one of the three major diseases of death, remote ECG signal monitoring system based on the Internet of things can reduce cardiovascular disease monitoring costs and optimize the medical process. The specific implementation of this project is to use the ECG sensor ADS1198 getting the signal through the WiFi chip with the MCU uploaded to the self-built cloud server, through any terminal access to the server can get real-time ECG data to achieve health monitoring.



## 项目 1: 基于物联网的远程心电信号监测系统

心血管疾病是死亡的三大疾病之一，基于物联网的远程心电信号监测系统能降低心血管疾病监测成本和优化医疗过程。本项目的具体实现原理是使用心电采集传感器 ADS1198 将获得的信号通过带 MCU 的 WiFi 芯片上传到自行搭建的云服务器，通过任意终端访问该服务器即可得到实时的心电数据，实现健康监测。



## Project 2: Human Machine Interaction Technology based on Human Motion Signals

This project is based on deep learning to deal with bioelectrical signal graphs, decode human motion intention, and promote the seamless communication and free interaction between human and robot. Based on the human body motion signals and human-machine interaction technology, we fuse biological signals (EMG signals, EEG signals, eye signals, etc.), motion signals (joint acceleration and angular velocity, etc.) and other signals to estimate the continuous motion of joint and compliantly control the mechanical arms, mechanical exoskeleton, virtual manipulator and other movements.

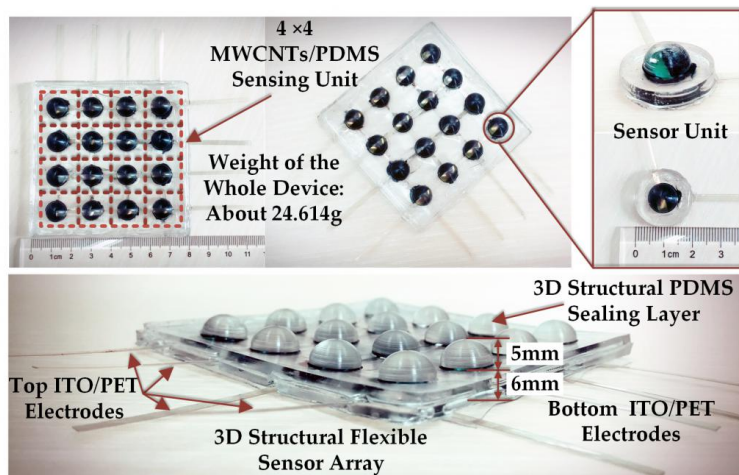


## 项目 2: 基于人体运动信号的人机交互技术

本项目基于深度学习对生物电信号图进行处理，进行人体运动意图解码，促进人类与机器人的无缝沟通和自由互动。基于人体运动信号的人机交互技术，将人体运动时的生物电信号（肌电信号、脑电信号、眼电信号等）和运动信号（关节加速度和角速度等）等多种信号融合，估计关节连续运动，柔顺控制机械臂、外骨骼、虚拟机械臂等的运动。

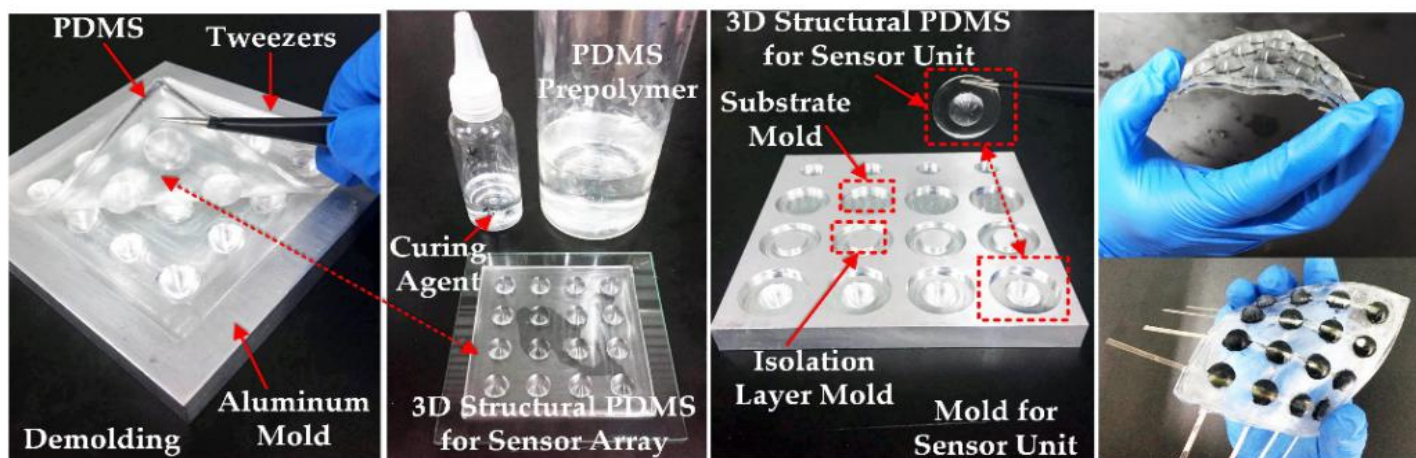
### Project 3: Research on Flexible Hybrid Electronic Heterogeneous Integration Based on Ink-jet Printing and Its Application in Intelligent Multi-source Soft Sensing

With the continuous improvement of bionics, functional nanomaterials and micro-nano manufacturing, the flexible hybrid electronics with portable, bendable, stretchable, excellent electrical properties and other characteristics showing a great application prospects in robotics, medical instruments, wearable products and so on. The project uses high-precision nano-material deposition system (MicroFab Technology Inc, RDLAB) as the main processing and preparation platform for the research of novel micro-nano patterned soft sensing structure and flexible hybrid electronic isomerization integration technology for the future of wearable electronic products (Such as electronic skin, body movement intentions recognition and plantar pressure sensors) to open up new avenues.



### 项目 3: 基于喷墨打印的柔性混合电子异构集成技术研究及其在智能多源柔性传感方面的应用

随着仿生学、功能纳米材料和微纳制造等领域的不断进步，具有轻薄便携、可弯折拉伸、电学性能优异等特点的柔性混合电子（FHE）技术在机器人、医疗器械、可穿戴设备等领域展现出了很大的应用前景。本项目以高精纳米材料沉积系统（MicroFab Technology Inc, RDLAB）为主要加工制备平台，进行新颖微纳图案化的柔性传感结构及柔性混合电子异构集成技术研究，为未来的可穿戴电子产品（如电子皮肤，人体运动意图识别和足底压力传感器）开辟新途径。



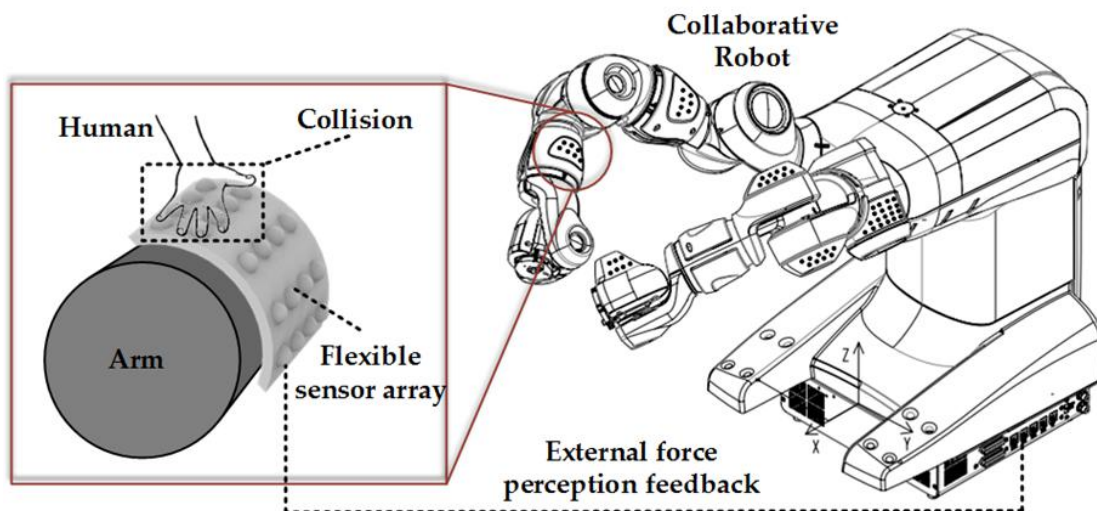


## Project 4: Human Security Cooperation Initiative Sensing System of Collaborative Robot and Its Secondary Development

With the rapid development of science and technology, the intersection and integration between intelligent robots and other fields have created many scenes that require human-robot collaboration. Driven by demand, a new generation of collaborative robots is opening more applications. In the process of human-robot collaboration, safety is the most basic and important part of all the links. This project takes YuMi robot as the research object, launches the absolute safety technology research of human-robot cooperation, and makes the corresponding secondary development so that it can effectively avoid the vicious safety accidents and more flexibly collaborate with people.

### 项目 4：面向协作型机器人的人机安全协作主动传感系统研究及其二次开发

随着科学技术突飞猛进的发展，智能机器人与其他领域的交叉与融合，产生了许多需要人与机器人协作的场景。在需求的推动下，新一代协作型机器人正在开启更多的应用领域。在人与机器人交互的过程中，安全性成为所有环节中最基础、最重要的一环。本项目以 YuMi 机器人为研究对象，展开人-机协作的绝对安全技术研究，并对此机器人进行相应的二次开发，使其有效避免恶性安全生产事故并能更加灵活的与人进行交互。



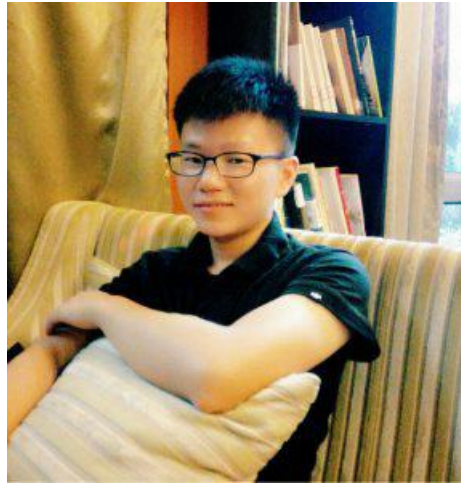
# Team



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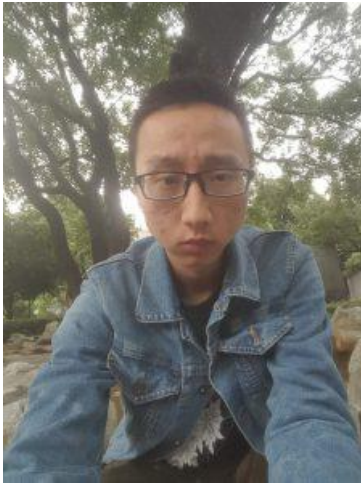
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# Publications

## Journal Papers:

1. S. Islam, S. Kao-Walter, and **G. Yang**, "Study of Ligament Length Effect on Mode Mix of a Modified In-Plane Shear Test Specimen," *Materials Performance and Characterization*, vol. 5, no. 3, pp. 249-259, July 2016.
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4. **Yang**, J. Chen, L. Xie, J. Mao, T. Hannu, and L.-R. Zheng, "A Hybrid Low Power Bio-Patch for Body Surface Potential Measurement" *IEEE Journal of Biomedical and Health Informatics (JBHI)*, vol.17, no.3, pp.591-599, **IF: 2.07**, May 2013.
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7. Chen, L. Rong, F. Jonsson, **G. Yang**, and L.-R. Zheng, "The Design of All-Digital Polar Transmitter based on ADPLL and Phase Synchronized  $\Delta\Sigma$  Modulator," *IEEE Journal of Solid-State Circuits (JSSC)* vol.47, no.5, pp.1154-1164, **IF: 3.11**, May 2012.

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2. Ding, X.P. Ouyang, **G. Yang**, J. Yang and H.Y Yang. "ProportionBased Fuzzy Gait Phase Detection Algorithm Using the Plantar Pressure", in the 5th International Conference on Enterprise Systems (**ES2017**), Beijing China, 22-24 Sep.2017
3. Jia Deng, Jian Niu, Kun Wang, Li Xie, and **Geng Yang**, "Discriminant Analysis based EMG Pattern Recognition for Hand Function Rehabilitation", in the 7th International Conference on Wireless Mobile Communication and Healthcare (**MobiHealth 2017**), Wien Austria, 14-16 Nov. 2017
4. Hamed, H. Tenhunen, and **G. Yang**, "A Programmable Low Power Current Source for Bioimpedance Measurement: Towards a Wearable Personalized Health," in *IEEE 37th Annu. Int. Conf. of the Engineering in Medicine and Biology Society(EMBC2015)*, pp.2038-2042, Italy, Aug. 2015
5. S. Islam , S. Kao-Walter, and G. Yang "Measuring Shear Fracture Toughness with a Modified Shear Test Specimen" in the *15th International ASTM/ESIS Symposium on Fatigue and Fracture Mechanics*, Anaheim, CA, USA, 20-22 May 2015
6. Rajeev Kumar Kanth, Pasi Liljeberg, Tomi Westerlund, Harish Kumar, Hannu Tenhunen, Qiansu Wan, **Yang**, Li-Rong Zheng, "Information and communication system technology's impacts on personalized and pervasive healthcare: A technological survey", IEEE Conference on Norbert Wiener in the 21st Century (**21CW**), 2014
7. Ji, **G. Yang**, K Yang, L.R. Zheng, "A User-friendly Wearable Device Based on Plastic Substrate for Heart Disease Monitoring," in the *4th International Conference on Computational & Mathematical Biomedical Engineering (CMBE2015)*, France, Jun.2015
8. Ji, W. Ouyang, K. Yang, **G. Yang**, "SKIN-ATTACHED SENSOR AND ARTIFACT REMOVAL USING CLOUD COMPUTING" in *7th International Conference on e-Health (e-Health2015)*, Spain, Jul. 2015
9. Shen, J. Mao, **G. Yang**, L. Xie, Y. Feng, M. B. Nejad, Z. Zou, H. Tenhunen, and L.-R. Zheng, "A 180 nm-CMOS Asymmetric UWB-RFID Tag with Real-Time Remote-Monitored ECG-Sensing," 8th International Conference on Biomedical Electronics and Devices (**BIODEVICE2014**), Portugal, Jan. 2015
10. Anurag, S. R. Moosavi, A.-M. Rahmani, T. Westerlund, **G. Yang**, P. Liljeberg, and H. Tenhunen, "Pervasive Health Monitoring Based on Internet of Things: Two Case Studies," *4th International Conference on Wireless Mobile Communication and Healthcare(MobiHealth2014)*, Nov. 2014
11. Hu, Y. Qin, Y. Tian, Z. Hong, **G. Yang**, L.-R. Zheng, J. Jia, C. Yang, X. Wu, and Y. Wang. "Biofeedback Neuromuscular Electrical Stimulation Front-end for Dysphagia Treatment," 10<sup>th</sup> Biomedical Circuits and Systems Conference (**BIOCAS2014**), Oct. 2014
12. Hiremath, **G. Yang**, and K. Mankodiya, "Wearable Internet of Things: Concept, Architectural Components and Promises for Person-Centered Healthcare," *4th International Conference on Wireless Mobile Communication and Healthcare (MobiHealth2014)*, Nov. 2014

13. Abtahi, A. Björilin, **G. Yang**, F. Seoane and K. Lindecrantz, "BODYKOM MOBILE CARDIAC MONITORING SYSTEM: CURRENT STATUS AND DEVELOPMENTS," 10th Medicinteknikdagarna (**MTD 2014**) Oct. 2014
14. Xie, **G. Yang**, Linlin Xu, F. Seoane, Q. Chen, and L.-R. Zheng, "Characterization of Dry Biopotential Electrodes," *IEEE 35th Annu. Int. Conf. of the Engineering in Medicine and Biology Society(EMBC2013)*, pp.1478-1481, Aug. 2013
15. **Yang**,L. Xie, and L.-R. Zheng, "Evaluation of non-contact flexible electrodes connected with a customized IC-steps towards a fully integrated ECG sensor," *Norchip 2013*, pp. 1-5, Nov. 2013.
16. **Yang**, Li Xie, Zhibo Pang, Qiang Chen, Lirong Zheng"INTEGRATION OF Bio-Patch AND iMedBox FOR IN-HOME HEALTHCARE AND SERVICES" in IFMBE Medicinteknikdagarna (**MTD 2013**), Stockholm, 2013
17. **Yang**, J. Chen, F. Jonsson, T. Hannu, and L.- R. Zheng,"A Multi-Parameter Bio-Electric ASIC Sensor with Integrated 2-Wire Data Transmission Protocol for Wearable Healthcare System" Design Automation & Test in Europe (**DATE 2012**), Germany, Mar. 2012
18. Xie, **G. Yang**, M. Mäntysalo, F. Jonsson, and L.-R. Zheng, "A System-on-Chip and Paper-based Inkjet Printed Electrodes for a Hybrid Wearable Bio-Sensing System," *IEEE 34th Annu. Int. Conf. of the Engineering in Medicine and Biology Society(EMBC2012)*, pp.5026-5029, Aug. 2012.
19. (**Invited**) **Yang**, Q. Wan, and L.- R. Zheng,"Bio-Chip ASIC and Printed Flexible Cable on Paper Substrate for Wearable Healthcare Applications," the 4th International Symposium on Applied Sciences in Biomedical and Communication Technologies (**ISABEL 2011**), Spain, 2011.
20. Wan,**G. Yang**, Q. Chen, and L-R. Zheng, "Electrical Performance of Inkjet Printed Flexible Cable for ECG Monitoring," *IEEE 20th Electrical Performance of Electronic Packaging and Systems (EPEPS 2011)*, pp.231-234, Oct. 2011.
21. (**Invited**) **Yang**, J. Mao, T. Hannu, and L.- R. Zheng, "Design of a Self-organized Intelligent Electrode for Synchronous Measurement of Multiple Bio-signals in a Wearable Healthcare Monitoring System" the 3rd International Symposium on Applied Sciences in Biomedical and Communication Technologies (**ISABEL 2010**),Italy, 2010.
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23. **Yang**, J. Chen, T. Hannu, and L.- R. Zheng, "Intelligent Electrode Design for Long-Term ECG Monitoring at Home" *IEEE Proc. of 3rd International Conference on Pervasive Computing Technologies for Healthcare (PervasiveHealth 2009)*, pp.1-4, United Kingdom, Apr. 2009.
24. **Yang**, J. Chen, T. Hannu, and L.- R. Zheng, "An ASIC Solution for Intelligent Electrodes and Active-cable Used in a Wearable ECG Monitoring System,"*International Conference on Biomedical Electronics and Devices (BIODEVICES 2009)*, pp.209-213, Portugal, Jan. 2009.
25. **Yang**, J. Chen, Y. Cao, T. Hannu, and L.- R. Zheng, "A Novel Wearable ECG Monitoring System Based on Active-Cable and Intelligent Electrodes," *IEEE Proc. of 10th International Conference on e-Health Networking, Applications and Services (HealthCom2008)*, pp.156-159, Singapore, Jul. 2008.



# Contact

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## How to join

M.sc, Ph.D, Post-doc positions are open all year round, welcome talent candidates with suitable background sending your CV and supplementary documents to my email ([yanggeng@zju.edu.cn](mailto:yanggeng@zju.edu.cn)).

The prospective candidates are expected to have study or working experience in one or several fields: Mirco-electronics, Mechatronics, Sensor and actuator technology, Biomedical circuits and system, Embedded system, Electronics, Computer and Communication technology. etc.