# "国家建设高水平大学公派研究生项目"联合培养博士研修计划
## Research Plan for CSC Scholarship Program

| 姓名/Name | 姓/Surname：Wang | | 名/First name: Guanyun |
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| 性别/Sex | Male | 出生日期/Date of birth (yy/mm/dd) | 1987/09/08 |
| 所在院系/School/ Department | Computer Science & Technolgy | 所学专业/Major | Digital Arts and Design |
| 国内导师/ Domestic supervisor | Fangtian YING | 留学国别/ Hosting country | US |
| 留学国外大学/ Hosting university | Massachusetts Institute of Technology | 留学院系/Hosting faculty or department | Media Lab |
| 国外导师/ Hosting supervisor | Hiroshi ISHII | 研究领域/ Research area | Tangible Interfaces in Human Computer Interaction |
| 学习期限/Duration of study | | 6 months ( from 2014/09/01 to 2015/02/28 ) | |

**研究课题名称/ Research title：**

Research of Shape-changing Interfaces in Wearable Devices and Its Application

**研究背景/ Research background：**

1. Topic

Tangible User Interface (TUI) is based on physical embodiment of digital information & computation, in order to go beyond the current dominant paradigm of "Painted Bits" or Graphical User Interface (GUI). Humans have evolved a heightened ability to sense and manipulate the physical world, yet the GUI based on intangible pixels takes little advantage of this capacity. The TUI builds upon our dexterity by embodying digital information in physical space. TUIs expand the affordances of physical objects, surfaces, and spaces so they can support direct engagement with the digital world.

2. Previous Research Programs

The tangible media group at MIT Media Lab has been working on several projects that draw worldwide attention and become focus in high-level conferences on human computer interaction. It can provide intelligent human computer interfaces and products by using shape-changing interfaces. Additionally, the thesis titled *PneUI: Pneumatically Actuated Soft Composite Materials for Shape Changing Interfaces* was announced the best thesis in UIST2013. Based on this shape-changing interfaces program at the MIT Media Lab, I plan to adopt user research method to create wearable interactive products in compliance with the user's habits.

**申请人科研准备工作概述/ Scientific preparations of the applicant：**

In recent two years, I did some research work mainly related to human computer interaction (HCI), which interests me very much. Furthermore, I participated in many programs involving wearable interactive products.

In order to make wearable interactive products more powerful in function and easy to use, we

adopted user research method and behavioural analysis to create interactive products in compliance with the user's habits.

During the program of designing interactive musical instruments, I focused on addressing problems faced by children who lean music. For this reason, I designed a wearable DrumGenius system that includes two modes: one is the dynamic learning mode and the other interactive game mode so that children can explore the music world by doing games. The learning mode allows children to experience the magic of music by listening to the rhythm and dancing; the game mode provides opportunities for children to cooperate and compete with each other as well as encourage their parents to participate in the learning activities.

To address the problem of baby crying that frustrates parent so much, I engaged in a program called wawa-clothes. When conducting this program, I worked together medical students to make a wearable baby clothes which can monitor baby's vital signs such as body temperature, heartbeat, activities to remind parents of any discomforts endured by their babies.

Later, I participated in a joint project for disable persons in "the Twelfth Five-year Plan" and found that it taken a long time for patients to recover from stroke thorough physical exercises and there is so little result. After talking with medical students and experts, I understood that stoke can cause mobility problems because it blocks neurological transmission. Thus, I cooperated with other participants to develop a wearable device to help rehabilitate neurological function. It can help send neural signals through myoelectric stimulation when patients walking in order to recover the neurological function.

Experiences I learned from the above-mentioned programs have helped to address many design problems with user in mind so that I can develop user friendly, interactive, and intelligent products.

I enjoy what I have done and what I will do in the coming years. I believe that I can accomplish the project on schedule and obtain desired outcomes under the guidance of Prof. Hiroshi from MIT and Prof. Ying from Zhejiang University.

出国学习预期目标/The goals of the research：

(1) I will conduct an overall research on production and application of shape-changing interfaces [Figure 1], and develop wearable devices with promising future, such as driving safety, motion detection, rehabilitation training, healthcare, etc. [Figure 2]
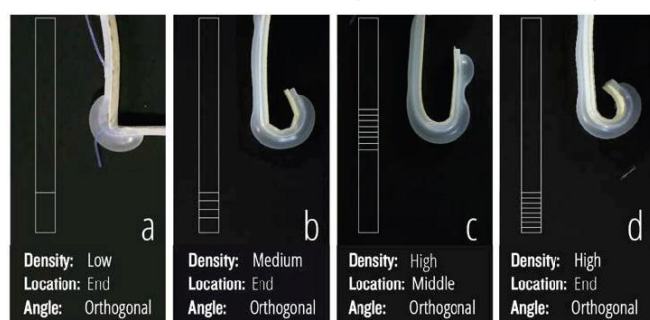


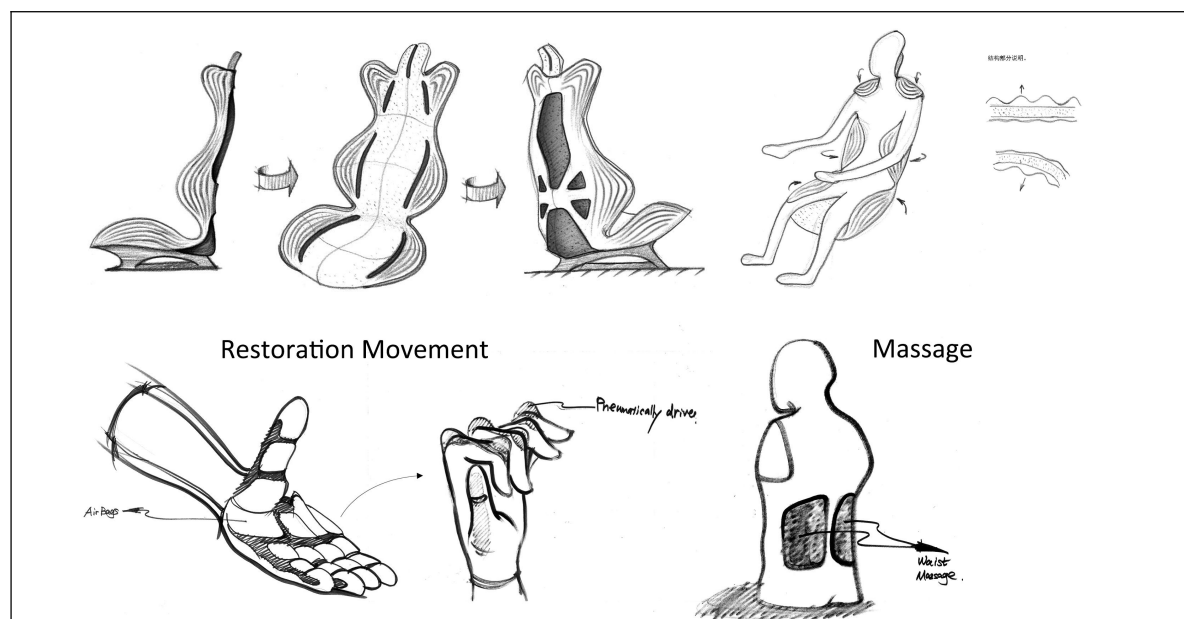| Density: Low | Density: Medium | Density: High | Density: High |
| Location: End | Location: End | Location: Middle | Location: End |
| Angle: Orthogonal | Angle: Orthogonal | Angle: Orthogonal | Angle: Orthogonal |

Figure 1.

Restoration Movement       Massage

Figure 2.

(2)  I will compare shape-changing material with traditional materials and manufacturing method, and use experimental data collected from user experiences to generate a valuable research report.

## 科研方法/Experimental methods：

User research method

  With focus on human's behaviors, habits and capacities as well as space, user research method is aimed to optimize tools, machines, system, tasks and environment in order to improve productivity, safety, comfort level and efficiency.

- Target users: Target users refer to people that have specific needs. In this research, target user means those who are in mobility, such as driving, motion, training, etc.
- Analysis of user needs: by analyzing user needs, functional and emotional requirements from uses can be integrated into development of new products so that the products cannot only solve specific problems and implement its intended functions but also meet emotional requirements of users.
- Mechanization analysis: by using established business models, this research analyzes the possibility of mechanizing the research outcomes.

## 时间安排/Time plan：

Sep. 2014 – Oct. 2014 Acquire knowledge in the subject, improve Proficient in English, and learn the shape-changing material and its production methods;

Oct. 2014 – Nov. 2014 Advance research when participating in relevant projects in the lab, do some user research and creative design, feasibility analysis in function and shape;

Nov. 2014 – Dec. 2014 Determine the production method of the prototype of a wearable device by observing users' behaviors;

Dec. 2014 – Jan. 2015 Run a functional test of the prototype and evaluate its test results;

Jan. 2015 – Feb. 2015 Analyze final data and write a lab report.

拟留学院校在此学科领域的水平和优势/Level and advantage of the hosting institution on this project：

The laboratory I want to visit is MIT Media Lab, because:

Firstly, Media Lab is an interdisciplinary research laboratory where projects at the convergence of different disciplines are encouraged. It has developed many new technologies such as wearable computing, tangible interfaces, affective computing.

Secondly, the tangible media group in the Media Lab with Prof. Hiroshi as its head is devoted to achieving seamless connection between interfaces, human, digital information and physical environment. This group has a set of sophisticated mathematical techniques to sense and control physical world. These techniques are different from those developed through traditional GUIs. In addition, this group has been designing tangible interfaces based on digital information in the physical form, and these interfaces can connect "bit world" with "atom world" seamlessly. Ultimately, its goal is to transform the traditional interfaces of painted bits into tangible interfaces in order to help people understand the digital world and interact with the physical world.

Thirdly, the tangible media group has been working on several projects that draw worldwide attention and become focus in high-level conferences on human computer interaction. Additionally, the thesis titled *PneUI: Pneumatically Actuated Soft Composite Materials for Shape Changing Interfaces* was announced the best thesis in UIST2013.

Based on the above mentioned, I believe that I can complete the research task assigned to me with desired outcomes on time.

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回国后续工作介绍/Work introduction after returning to China

I will conclude the experiment results which I will have done at Zhejiang University and accomplish my doctoral paper.

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国内导师签字 Signature of domestic supervisor：

Date(yy/mm/dd)：

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国外导师签字 Signature of hosting supervisor：

Date((yy/mm/dd)：