

# Hands-Free Interaction in Complex Situation

To control computing devices (e.g. personal computer, mobile etc.) users use their hands to operate them. But in many cases, hands are occupied with different purposes in our daily life, so we are not always able to use them on demand. Some examples are cooking or carrying bags with both hands; user's fingers are stiff with cold; surgeons are busy in surgery using both hands. To provide information more effectively and efficiently with a comfortable, precise and sterile interaction technique, feet can be an effective mean.

## Motivation

During surgery, surgeons require a great amount of information in order to operate the patients as effectively as possible. For this, they need to access large medical data sets, visualize them slice-by-slice or in 3D and explore them interactively by means of different user interfaces. However, operating rooms are usually equipped with a wide range of surgical tools, a big number of them with interaction devices. However, very few interaction systems have been designed to allow a practical and efficient exploration of data in critical medical environments like an operation room (OR).

Under these circumstances, it is necessary to provide a surgeon with a comfortable, precise and sterile interaction technique to manipulate and interact with visual data sets efficiently. The feet can be an effective mean for accomplishing this goal, in comparison with other touch or touchless modalities.

## State of the Art

During a surgical procedure, the surgeons usually operate with hand-manipulate surgical instruments. Therefore, hand-driven interaction is complicated and not applicable due to the constraints of sterile interaction. In this situation, voice, gesture or gaze interaction can be taken into

account. However, researchers analyzed that a speech recognition system can be an alternative way, but due to the noisy environment in an OR, it is not an adequate solution. Whereas some researches also focus on gesture or gaze modalities, which also create complexity considering bodily and special constraints. In this situation, surgeons are still dependant on their assistants to interact the visual data. To overcome the barrier of dependency, a foot-based augmented interaction technique can be used to manipulate and interact with visual data in a hygienic way.

## Research Questions and Methods

With the development of technology, researchers have been focusing on wearable computers and sensor interfaces. One area remained relatively little explored: the design and implementation of sensor and computer-equipped foot-based interaction. Thus, the study focuses on the following research questions:

- How feet can be significantly applied to manipulate and interact with visual data?
- How much foot-based interaction can be usable and how can it be designed?

There are two methods applied in this study: usability studies and prototyping. Usability studies include the designs of questionnaires for qualitative analysis, and also to measure and collect data for quantitative analysis. Prototypes of interaction devices will be employed for evaluation.

## Expected Contribution

The contribution of the research will be implementing and analyzing foot-based prototypes which can be extrinsic, intrinsic, or mediated input-sensing. And also investigate those prototypes which are culturally acceptable in the perspective of Asian and European users.



Ambreen Zaman  
MIT

Mathematics /  
Computer Science

Dhaka, Bangladesh  
ambreen@uni-bremen.de

International Graduate School for Dynamics in Logistics  
Contact: Dr.-Ing. Ingrid Rügge

Universität Bremen  
Hochschulring 20  
28359 Bremen, Germany

www.logistics-gs.uni-bremen.de  
info@IGS.LogDynamics.de