"Build your Own" Multi-touch Surface: Bootcamp on Construction & Implementation of Multi-touch Surfaces

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Abstract

Multi-touch interaction with computationally enhanced surfaces has received considerable attention in the last few years. Approaches to the implementation of multi-touch interaction such as Frustrated Total Internal Reflection (FTIR) and Diffused Illumination (DI) have allowed for the low cost construction of multi-touch interactive surfaces, pushing the development of new technologies and applications forward. Although these and other related techniques have been presented in an academic setting, the steps involved in building a high quality multi-touch enabled surface, on a software and hardware level, are not trivial. The bootcamp "Build your Own" Multi-touch Surface *aims to share knowledge and experience of developing multi-touch technologies with the wider Tabletop and Interactive surface community, and give hints and tips which will enable interested researchers to build their own multi-touch surfaces.*

Bootcamp Topic

The bootcamp focuses on the technical aspects that are important in the construction of optical multi-touch surfaces; these include infrared illumination, silicone compliant surfaces, projection screens, cameras, filters, and projectors. In addition, we outline how to integrate all this hardware into a solid multi-touch surface, and provide an overview over existing software libraries that allow the implementation of multi-touch applications.

Infrared Illumination: We present two alternative approaches to the implementation of multi-touch surfaces which vary from the FTIR technique discussed throughout the remainder of the bootcamp; namely Diffused Illumination (DI, or rear illumination) and Diffused Surface Illumination (DSI)). These techniques afford tangible tracking, and/or non-projective displays. We show different ways of illuminating a surface with IR (DI and DSI) and how to setup non-projection based displays (such as LCD screens).

Silicone & Projection surfaces: To create a functional and easy to use interactive multi-touch surface often additional layers of various materials are required. We present a range of these including projection screens, various compliant surfaces, and film to block interference from ambient IR light. We explain the need for each layer, discuss our experiences with the various materials which can be used to construct them, and give tips on how to overcome the technical challenges which may be faced when constructing these components of a multi-touch surface.

Cameras, Filters & Projectors: Camera and projectors are the backbone of any optical multi-touch surface. We will illustrate how different camera and filter configurations effect factors such as image brightness and contrast, and in consequence blob tracking accuracy and performance. We will also discuss solutions to problems which arise due to blob white-out caused by ambient and scattered IR-light. Furthermore we will discuss resolution and speed issues as well as (near-) infrared sensitivity of different camera models.Properties of projectors such as throwing distance, image size, brightness, and hotspots are discussed also.

Hardware integration: The last, and often most difficult, step in the construction of multi-touch hardware is to put all "ingredients" together to get your surface ready to use. We show different methods for the set-up of interactive multi-touch installations ranging from small interactive tables to large walls.

Software: The most skilfully constructed multi-touch surface is useless without good tracking software and powerful applications to run. We will provide a review and demonstration of the current state-of-the-art in multi-touch software libraries. Particular focus will be placed on open-source and freeware libraries.

More and more research groups are building multi-touch systems of different kinds by themselves. This bootcamp aims to encourage the exploration of multi-touch by researchers who may not have considered self-construction of such hardware viable by practically demonstrating the steps involved in creating these interactive surfaces.

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