

# InteracTable

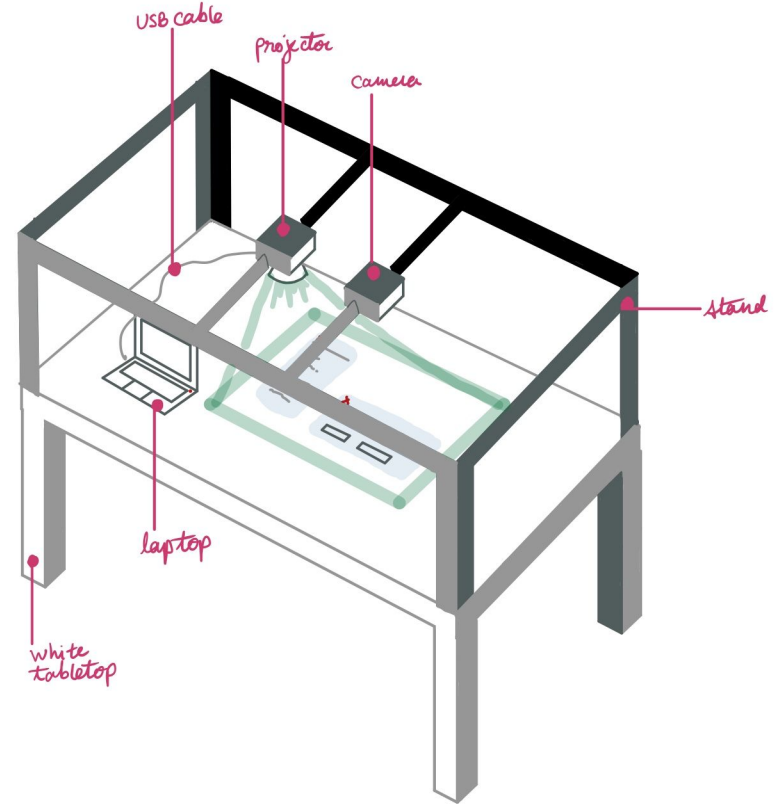
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# Project Description

An everyday table converted into a touch screen music system



# ECE Areas Covered

## Signals

- Analyzing signals from the piezo sensor or accelerometer
- Computer vision algorithms to detect finger placement

## Software

- Designing an interactive GUI
- Matlab code for CV computations

# Technical Requirements and Constraints

The projection must be bright enough to be visible on any white table top

The prototype must be affordable (less than \$600)

The system must be able to connect to a laptop via USB cable

The system will be constrained to track a single finger

The buttons will be large enough and spaced enough to achieve 100% accuracy in selection

The delay between the detection and response to a finger tap should be under 1 second

The red dot should be large enough to ensure consistent detection

The dimensions of the projected screen should be variable

# Technical Challenges

## Challenges

Surfaces can be of varying dimensions

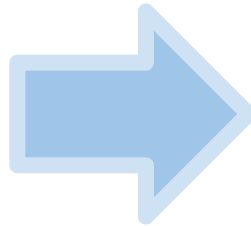
The red dot may be obstructed by the colors of the projected screen

A hand may distort the projected screen by interfering with light rays

Delays in processing data

Difficulty mounting the projector and camera on a custom stand

Setting up the circuit for the piezo sensor



## Possible Solutions

Project a border at the edge of the screen as reference for calculations

Track the shape of the dot in conjunction with the color

Change the angle of the projection

Use the Matlab Parallel Computing Toolbox

Fix the positions of the projector and camera and use tripods

Use an existing accelerometer in a phone

# Solution Approach: Overview

Projector to project  
screen on surface

Qt used to create  
UI for projected  
screen

Color HD Camera to  
view finger movement

Matlab used for  
finger detection  
and tracking

Piezo sensors to  
detect finger tap

Simple algorithm to  
convert analog  
signal to response

# Solution Approach: Algorithms

## Tracking

- Lucas Kanade algorithm
- Some of the assumptions might be violated in our case: brightness constancy
- Computationally intensive: considers every frame of the video

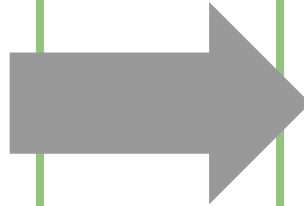
## Detection

- Color Thresholding or blob detection
- Only consider frame in which tap detected by sensors
- Might be faster than tracking

# Testing

Test tracking and detection algorithm: choose optimal method

Test piezo sensor circuit: ensure accurate readings are obtained

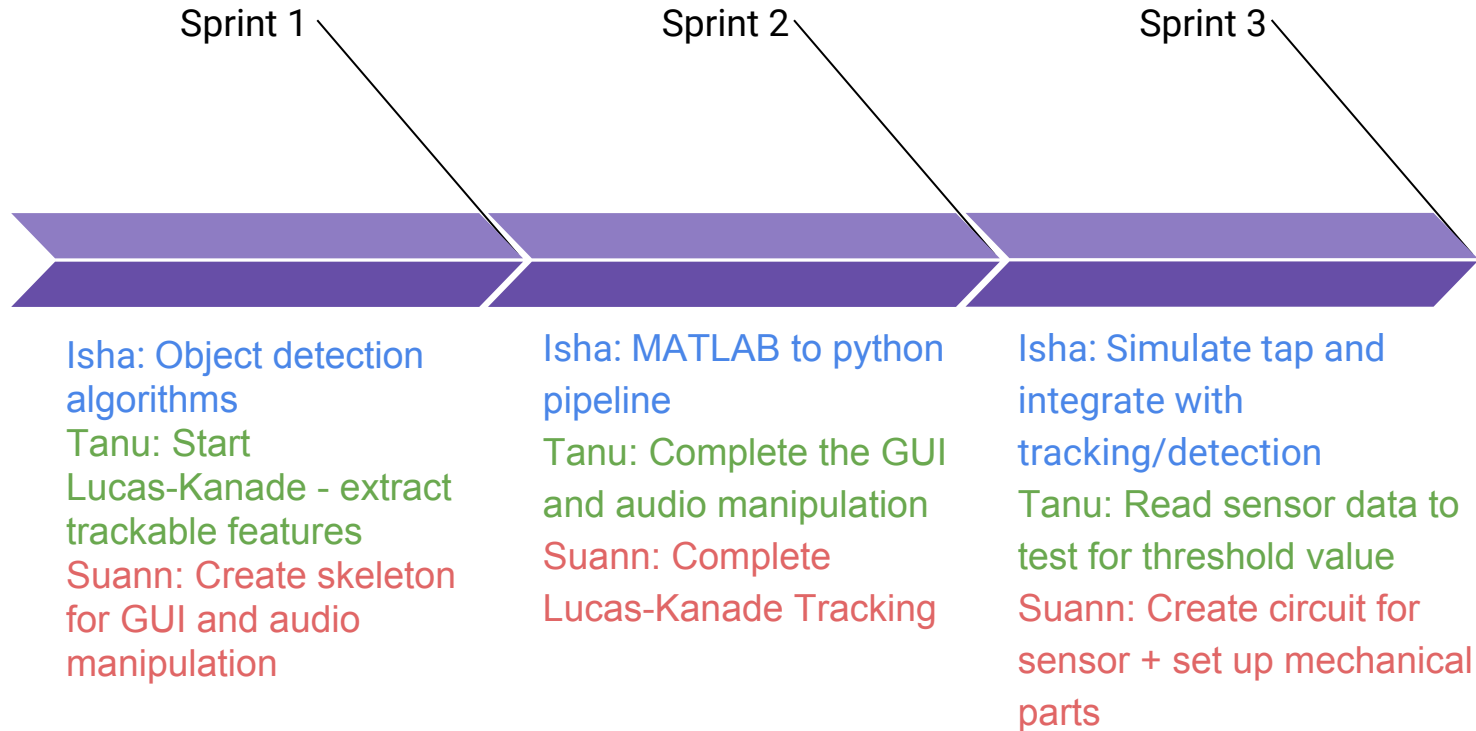


Test single button system: correct response with finger location and tap

Test multi button system: audio files correctly manipulated by user input



# Tasks and Division of Labor



# Tasks to be accomplished together

- Integrate tap simulation and real sensor data
- Test in demo environment
- Write paper and get an A :)



**Q & A**