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Ecosystem for Smart Glass Technologies: Proposal Presentation

January 20th, 2017

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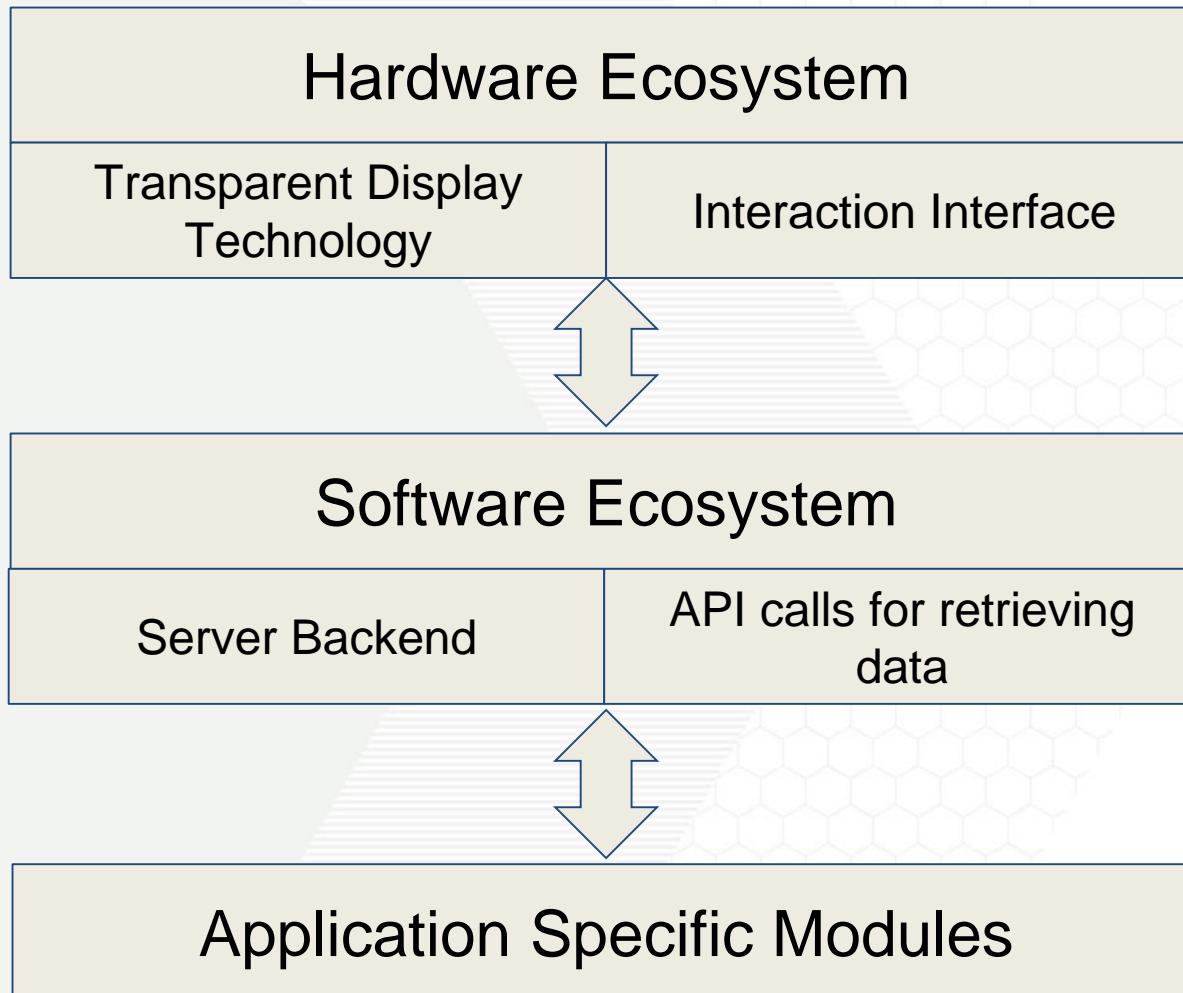Jonathan Osei-Owusu

Nishant Shah

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Agenda

- Project Description and Goals
- ESGT Overview
- Background Research
- Cost and Budget
- Smart Mirror Features
- Design Approach
- Projected Schedule
- Status
- Accomplishment
- Question and Answer
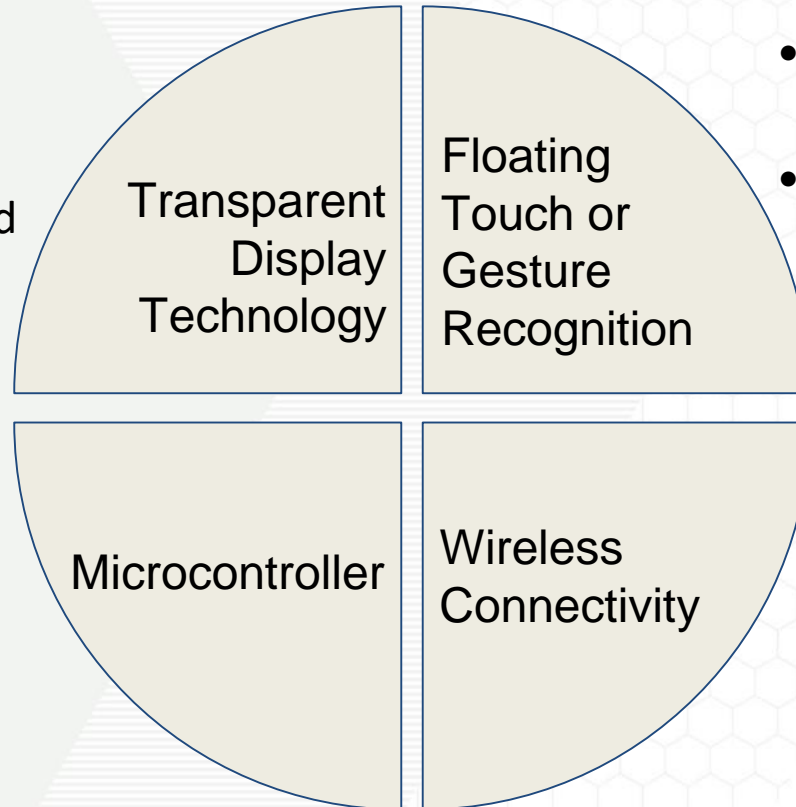
Project Description and Goals

- ESGT: Ecosystem for Smart Glass Technologies
- **Objective**
  - Create hardware and software ecosystem for all glass IoT devices
  - Extensibility to add support for any glass product
- **Motivation**
  - Transparent IoT devices are not widespread yet
    - Difficulty implementing transparent technology
    - No commercial products readily available to the user at an affordable price
- Smart Mirror will be prototype to demonstrate ESGT

ESGT Overview

Hardware Ecosystem	
Transparent Display Technology	Interaction Interface

Software Ecosystem	
Server Backend	API calls for retrieving data

Application Specific Modules

Background Research

- TCOs for transparent circuitry
- Inkjet printing for rapid prototyping

- Performance and power tradeoff
  – Powerful enough to drive large display, but efficient to run off battery

Transparent Display Technology

Floating Touch or Gesture Recognition

Microcontroller

Wireless Connectivity

- Traditional capacitive touch with high sensitivity
- Gesture recognition from images captured via stereoscopic sensor

- Wi-Fi to connect to the Internet
  – Offload computation to the cloud
- Bluetooth for smartphone communication

Cost and Budget (Prototype 1)

Table 1. Prototype 1 Equipment Costs	
Component	**Cost**
Raspberry Pi™ 3 Model B	$35.00
Raspberry Pi™ Power Supply	$8.99
Two-Way Mirror	$72.00
Touchscreen LCD Monitor	$289.95
HDMI Cable	$0.00 (Received for free)
Total	**$405.94**

Cost and Budget (Prototype 2)

| **Table 2.** Prototype 2 Equipment Costs	
Component	**Cost**
Rectangular Annealed Glass	$20.11
Raspberry Pi™ 3 Model B	$0.00 (Reuse from Prototype 1)
Raspberry Pi™ Power Supply	$0.00 (Reuse from Prototype 1)
Conductive Silver Ink	$0.00 (Received for free)
HDMI Cable	$0.00 (Received for free)
Inkjet Printer	$0.00 (Received for free)
Total	**$20.11**

Smart Mirror Features

- Display weather, agenda, news, and other relevant information
- Smartphone application to set up and configure the smart mirror
- Won't obstruct user figure when smart mirror is displaying information
- Appearance of a regular mirror when display is off
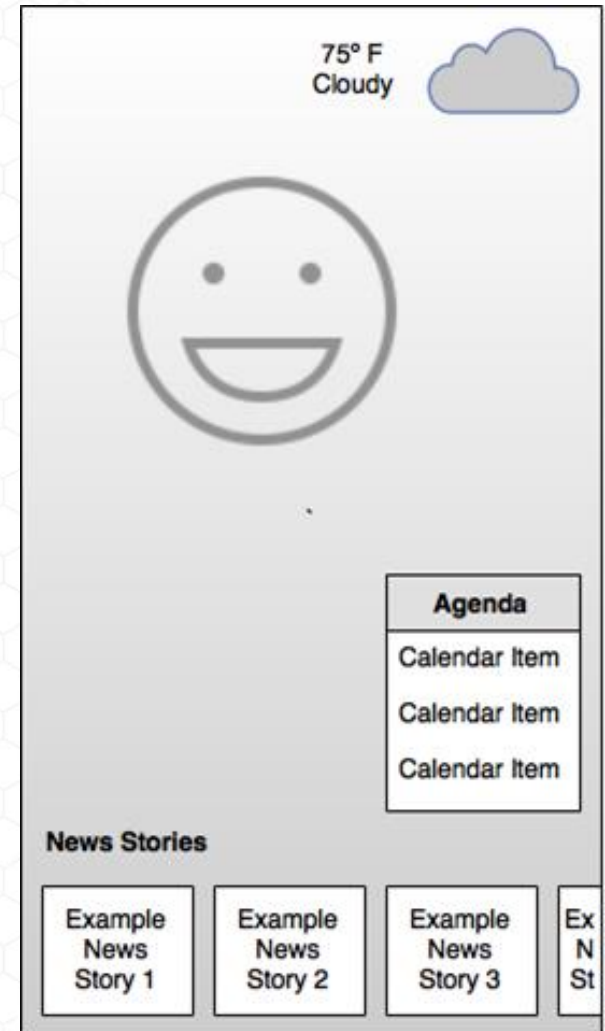
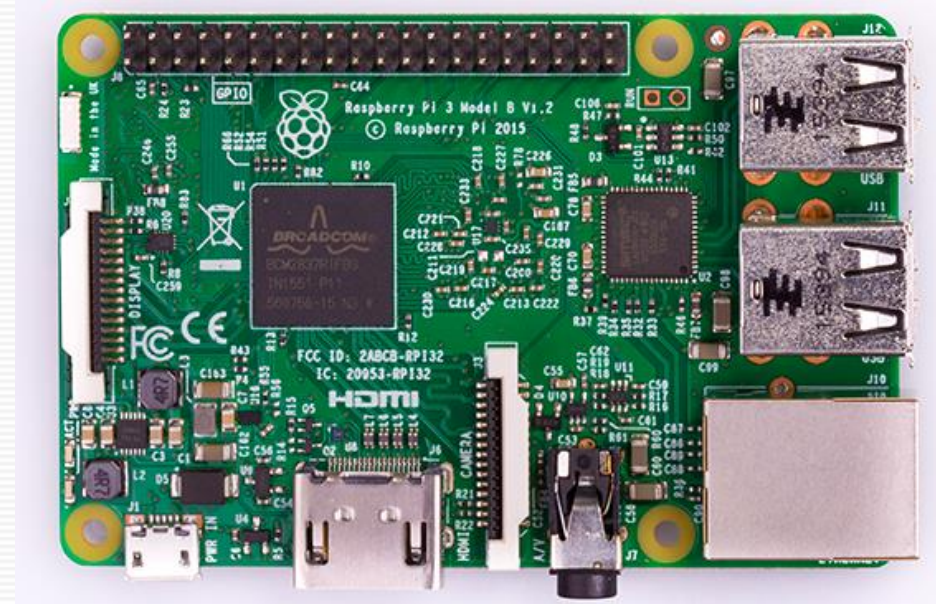# Design Approach (Hardware)

- **Translucent Display**
  - Adhere behind mirror
- **User interaction**
  - Touch Screen
    - Floating capacitive touch
  - Gesture Sensor (leap motion)
    - Interaction with mirror with gestures
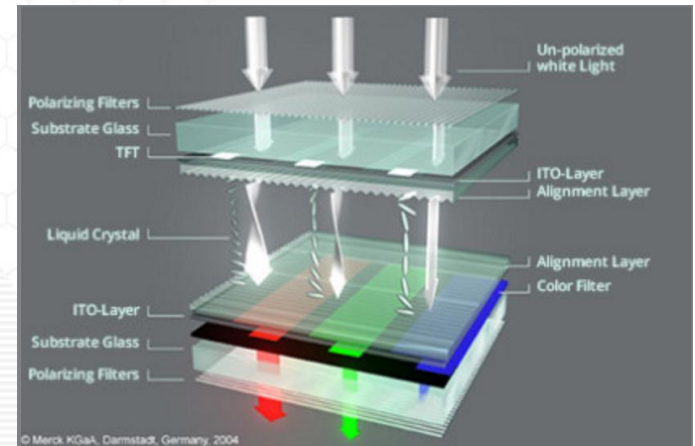
Design Approach (Microcontroller)

- **Raspberry Pi 3 Model B**
  - 4 USB ports
  - 40 GPIO pins
  - Full HDMI port
  - A 1.2GHz 64-bit quad-core ARMv8 CPU
  - 802.11n Wireless LAN
  - Bluetooth 4.1
  - Bluetooth Low Energy (BLE)
  - Micro SD card slot

Design Approach (Software)

- **User Interface**
  - Mirror GUI will be implemented using HTML and CSS
    - Flexibility and portability to different systems.
  - Add interactivity using javascript
- **Backend**
  - Python and Ruby for computation and communication with phones and other peripherals
- **Module API**
  - Allow more UI components to be added easily
  - UI and Backend will have a module framework with an API
- **Database**
  - Local database to cache data retrieved from various sources

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Design Approach (Software)

- Backend code will connect and send or retrieve data from peripheral devices
  - **Phone**
    - Main source for personal data such as calendar and email
    - Sensors (GPS) can give contextual information about the user
    - Communication through bluetooth or Wi-Fi
  - **Leap Motion**
    - Additional source of direct user input through gestures
    - Communication will be through a direct USB connection

Projected Schedule

- Simplified Gantt chart

Title	5	01/01	01/08	01/15	01/22	01/29	02/05	02/12	02/19	02/26	03/05	03/12	03/19	03/26	04/02	04/09	04/16	04/23	04/3(
▶ 1) Project Proposal																			
▶ 2) Contingency Planning																			
▶ 3) Hardware Development																			
▶ 4) Software Framework Development																			
▶ 5) Smart Mirror Application Development																			
▶ 6) Project Documentation and Demonstration																			
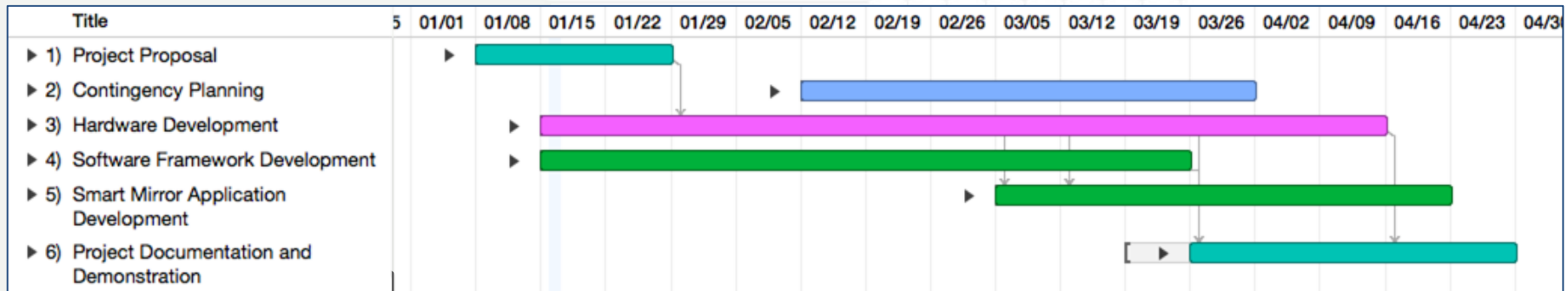
Hardware and software development done in parallel
- – Use simple prototype to allow software team to get started
  - Work on software framework, common to all glass IoT devices
- – Hardware team implements transparent display technology
  - Shift towards software when smart mirror application development begins
- Ample time for project documentation and demonstration

Status

- List all the needed parts for Smart Mirror Project

- Will place an order for prototype parts (week of 1/23-1/27)

- Collect feedback of project ideas from advisor and survey samples

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Accomplishment

- **Survey**
  - Project specification
- **Break Off Into Teams**
  - Hardware
    - Assemble parts
    - Configuration on I/O
  - Software
    - Backend Server (database)
    - UI design
    - Analyzing data from sensors
    - Module API

Question and Answer