

# Lucy – Smart Bulletin Board

By

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# Abstract

Information boards have long served the purpose of engaging by passers and providing relevant information. While this model has been effective in the past, more can be done to engage and connect the community. Providing the community with an interactive, up-to-date, connected information board platform allows for an improved communication model over the traditional board and opens countless possibilities for innovation, capacity building, and knowledge sharing.

To improve this communication model, our project, Lucy, focuses on four main areas:

- Automatically curated content
- Interaction, visually and auditory, to aid the user
- Awareness of surroundings using location and demographics of potential users
- Extensibility through an easy to use application programming interface (API)

# Problem



Figure 1 - Bulletin board on the University of Cincinnati campus

What is the purpose of a bulletin board? Look at the picture above, *Figure 1*. Does this picture do everything you thought a bulletin board should do well? Is this the most efficient method of achieving that purpose?

These are the fundamental questions we asked ourselves before starting this project. We, as a group, have defined the core purpose of a bulletin board as a means to inform by-passers. The information being displayed is ideally aimed at an audience of people unaware of what you are trying to inform them about and not in the right communities to come across this information, but may be interested in it. A common and perfect example of this would be a class being offered outside of a student's college or major but may still be interested in taking it, such as a cooking, dance or cultural class.

Having defined the purpose, we can now analyze the current solution to the problem, the traditional bulletin board as seen in *Figure 1*. Does this solution accomplish that purpose? Sure. Does it do it well? No. There are a few problems plaguing the traditional bulletin board that being they are cluttered, unorganized, have pieces of outdated information, not curated, pieces of information are in fierce competition for attention and it is very easy to ignore and pass by without glancing at it.

## Solution

Lucy aims to make bulletin boards much more interactive and useful. We want them to feel relevant to the users by providing them with information they care about, such as the weather, shuttle tracking or getting dates for an event or meeting. The content of the bulletin board will always be relevant by not showing outdated content, using location to assess the type of content to display and providing dynamic content that can be retrieved by glancing at the board or querying the board through speech.



Figure 2 - Lucy scheduling an appointment (left) and giving directions (right)

Interaction should be normal and conversation like, similar to other voice assistant services like Google Now, Apple Siri, and Microsoft Cortana. To achieve this, we are using Chrome Web Voice API to do speech to text translations and smart directing of queries to the appropriate services.

Location is important as to what content is being displayed to the end users because a different demographic of users may be passing the board. Knowing these demographics, such as the type of students you are being exposed to, is important to the determination of which student organizations you promote, what social media feeds are interesting to those users and lastly, from an advertiser's standpoint, the type of products and services these students may be interested in.

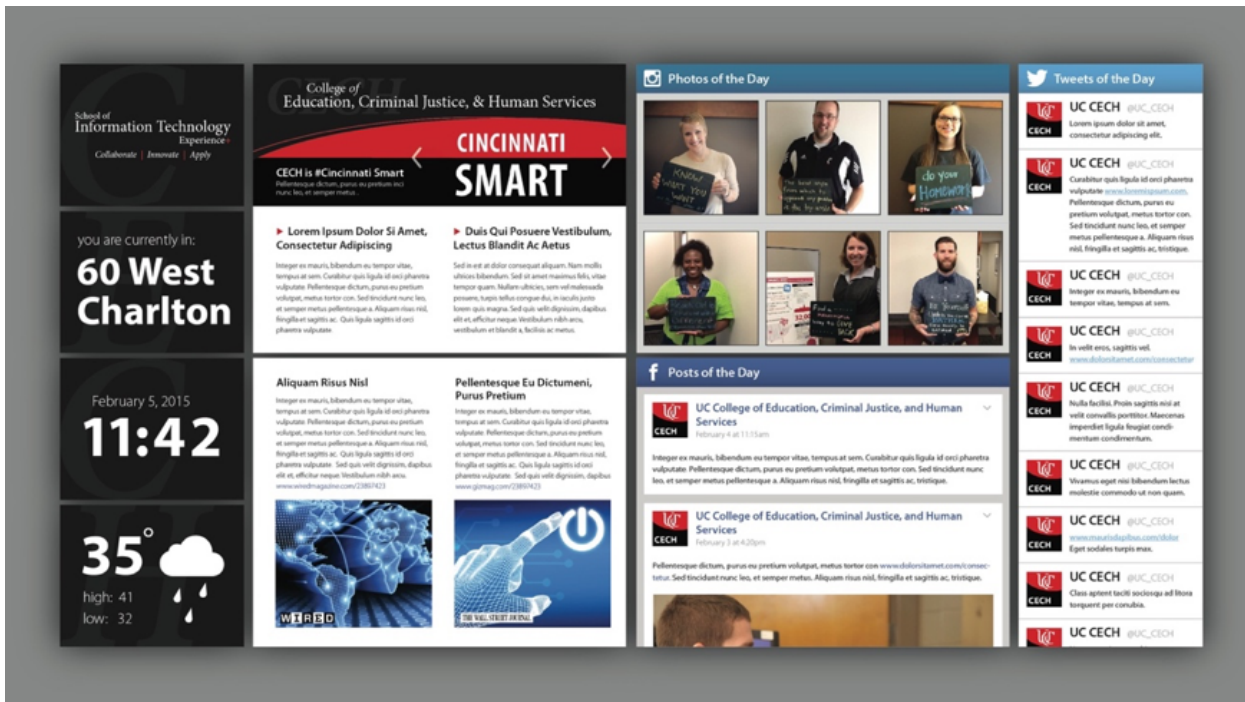
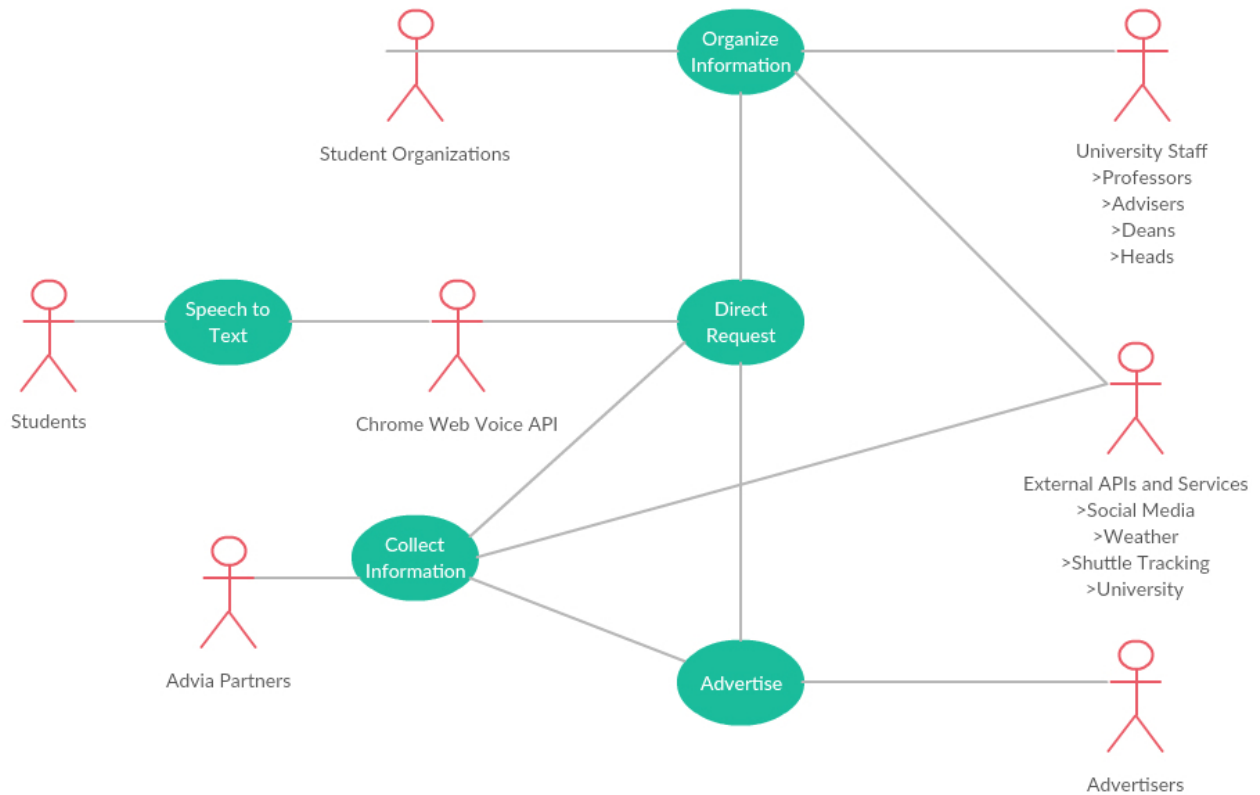


Figure 3 - Lucy, Proposed Design

# User Profile



## Students

Students are the target audience for this project. The goal of our project is to inform and advertise to these users to promote increased activity in student organizations, school events and build a stronger community. Students are able to interact with the application through a TV set up within the School of Information Technology and can query the application for more specific information through voice commands. Frequency of use is predicted to be multiple times daily by the entire School of Information of Technology student population.

## Advia Partners

For this project we have partnered with Advia Partners to leverage their media player which provides us demographic information to selectively advertise to by passers based on gender and

age. The media player also counts impressions of the board and potential impressions not made.

All this information is useful to advertisers as they can see how often their ads are being seen and target an audience.

### Chrome Web Voice API

Chrome Web Voice API is an integrated component of Google Chrome and is being used to allow users to interact with Lucy through voice. It take speech input from a microphone on the dashboard and converts it to text. This text is sent to the Lucy application and the request is directed from there.

### Student Organizations

Student organizations are responsible for providing relevant and important information to Lucy.

We expect them to interact with Lucy at least once a week providing meeting times and information about the next upcoming meeting.

### University Staff

University staff are a large population of our targeted user base. We would like to see university officials, such as the head of the school or dean, advisors, both academic and co-op, and professors interact with Lucy to provide relevant and useful information to students. The use case is hard to predict but we are planning for their use to be weekly.

### External APIs

External APIs are essential to Lucy because they will provide all real-time data and dynamic data. We are planning to include social media, like Facebook and Twitter, weather data, shuttle tracking data and any other relevant APIs used by the University of Cincinnati. These services

will be used frequently depending on the service in terms of every second, for shuttle tracking, or weekly for less frequent services, like the ones for the University.

### Advertisers

Advertisers are an important aspect of our ecosystem as this is what pays for the entire ecosystem. Lucy will have an advertiser console for any advertiser to access to update their advertisements. We expect advertisers to take a more of a set it and forget it approach, maybe logging into the system monthly or quarterly.

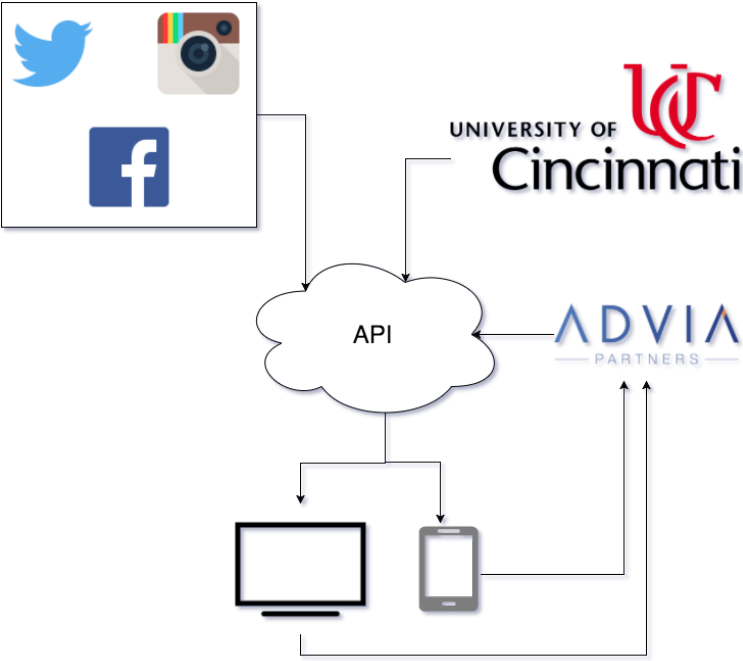


Figure 4 - System Architecture Diagram

# Timeline

Lucy officially began on April 1<sup>st</sup> 2015 in accordance with the grant we filed with the University of Cincinnati, College of Education, Criminal Justice and Human Services and a prototype was completed in time for the Information Technology Exposition at the end of April 2015. At the beginning of the Senior Design course the beginnings of speech to text, social media integration and weather was completed.

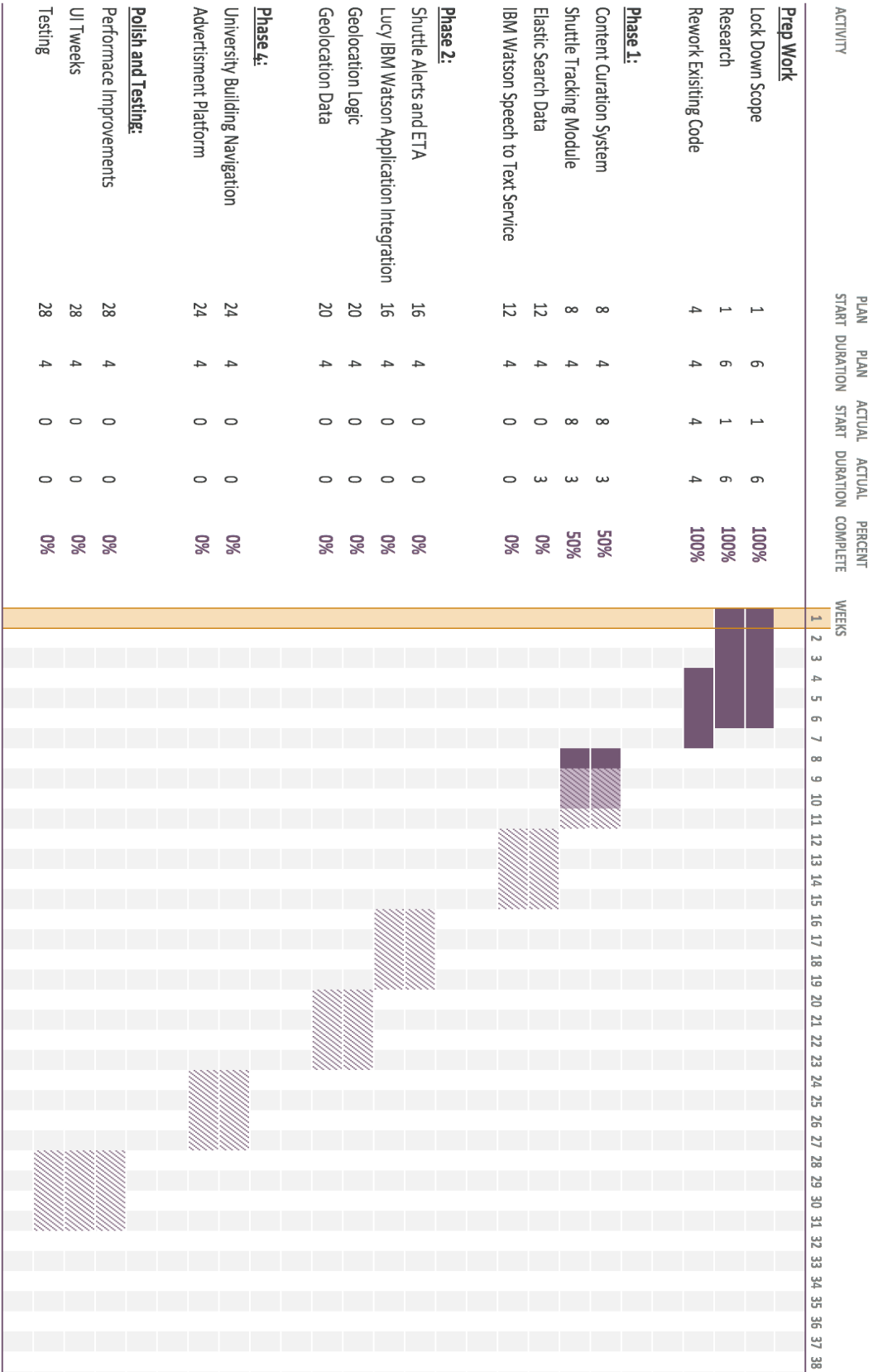


Figure 5 - Project Gantt Chart

## Proposed Budget and Justification

The development of this project will require a prototype and development hardware. Table 1 lists the requested items for this project as well as the total cost. The large format HDTV provides a large enough screen to effectively display information to users while not forcing them to be in an uncomfortably close distance to read the text. The mobile TV stand provides a movable, flexible platform for moving the system and testing in multiple environments as well as demonstrations. Logitech provides a highly rated webcam in their C920 model with high definition video and crisp audio that allows the system to get the best available environmental data for the price. The core of the system however is the platform that powers the software. Lenovo provides a reliable product in their M73 model with its i5 processor and small form factor that create the foundation for a quick system that does not take up too much valuable space. Building on that system however are the 16GB of RAM and lightning fast solid-state hard drive enhancements to give it the extra boost it needs to give the user real-time feedback.

Through the research and development of this project, this system will provide users a different way to get the information they seek. The funding for this project will allow for building this working, polished pilot that connects with people and opens them to thinking about the countless possibilities of this platform. All in all this project will give university community members a great portal to the information they desire, help students and faculty gain the research knowledge through the development of this system, and deliver a platform with large scale potential.

Item	Cost
RCA 55" 1080p HDTV	\$549.99
Mobile TV Stand	\$229.99
Logitech – C920 Pro Webcam	\$74.99
Lenovo ThinkCentre M73 10B60008US	\$509.00
Mushkin Enhanced Blackline 16GB (2 x 8GB) RAM	\$139.99
DisplayPort to HDMI Cable	\$11.99
Samsung 840 Pro Series Hard Drive	\$139.99
2.5" to 3.5" Hard Drive Bracket	\$9.99
Logitech Wireless Combo MK320	\$24.99
Belkin Surge Protector	\$10.45
<b>Total</b>	<b>\$1838.33</b>

*Table 1 - Proposed Budget*

# Testing

## Overview

This section will explain the testing methodology for Lucy. The only group that should use this section are the developers of Lucy.

## Scope

Lucy is a client-server type application with little if any processing done on the client-side. Most testing will be on the server-side with the API as the client-side's main purpose is just to spit out what the server tells it to.

## Objective

The objective of the testing is to verify the quality of the code used in Lucy and to verify the multiple services of Lucy are working in parallel, including the scrapers, external API's, Advia Media Player, network connections, etc.

## Entry and Exit Criteria

### *Entry Criteria:*

- All services and clients are running
- Self testing is complete
- Test environment is setup

### *Exit Criteria:*

- All tests are run
- Bugs are documented and fixed

## Logging Test and Reporting

If an issue is found during testing, then a developer will investigate the error and determine if its origin is within Lucy or outside. If it is within an issue will be opened up in GitHub and a developer will be assigned. If it is outside of Lucy a developer will have to follow up with third parties to determine the cause of the issue and if any action on our part is required.

## System Testing

Lucy will be tested as a complete ecosystem, client, server and third parties. This will make sure all aspects of Lucy are running properly.

## Testing Procedures

The following are the steps required to perform testing:

- Create all test cases, scenarios and get server statuses
- Prepare a document of the steps to use to conduct the test and expected results
- Specify the point of failure in the report

Below are the tests that will be performed:

1. Unit testing – This will test that the server-side code is fully functional and any third party API's are working as expected.
2. Functional testing – This will test that the client-side code is fully functional and any third party API's are working as expected.

## Pass/Fail Conditions

It is expected that all services and third parties pass the tests. If not, a developer will note the failure and take the appropriate action to resolve or document the issue.

## Schedule of Team Member Testing

The schedule of the team member testing is summarized in the table below.

Team Member	Timeline to be Completed	How Often?
Developer	01/01/2016 to 04/12/2016	Weekly

*Table 2 - Testing Schedule*

## Risks

The following will impact the testing:

- Server uptime
- Third party service availability
- Delay in bug fixes

## Conclusion

Lucy's goals are to bring the bulletin board to the 21<sup>st</sup> century by making them more relevant to end users by being smarter and more dynamic. By taking advantage of the myriad number of APIs out there and the need of multiple organizations to engage, inform and promote themselves while striving to make the interaction of information and users seamless so we can eliminate cluttered wall spaces across the University of Cincinnati and condense them into a usable space of organized, retrievable and relevant information.

When the users of this system are able to access the information they need with ease we hope to further promote the culture within the University by connecting people with organizations and events of similar interest or goals.

# Bibliography

Huang, L. (2010, Mar). Social contagion effects in experiential information exchange on bulletin board systems. *Journal of Marketing Management*, 26(3/4), 197-212.

Yun, O., Min, X., Li, Y., & Xunting, L. (2013). Advertising Efficacy Research on E-Paper Application for MRT Station Bulletin Board. *Applied Mechanics and Materials*, 262, 203-206.

# LUCY

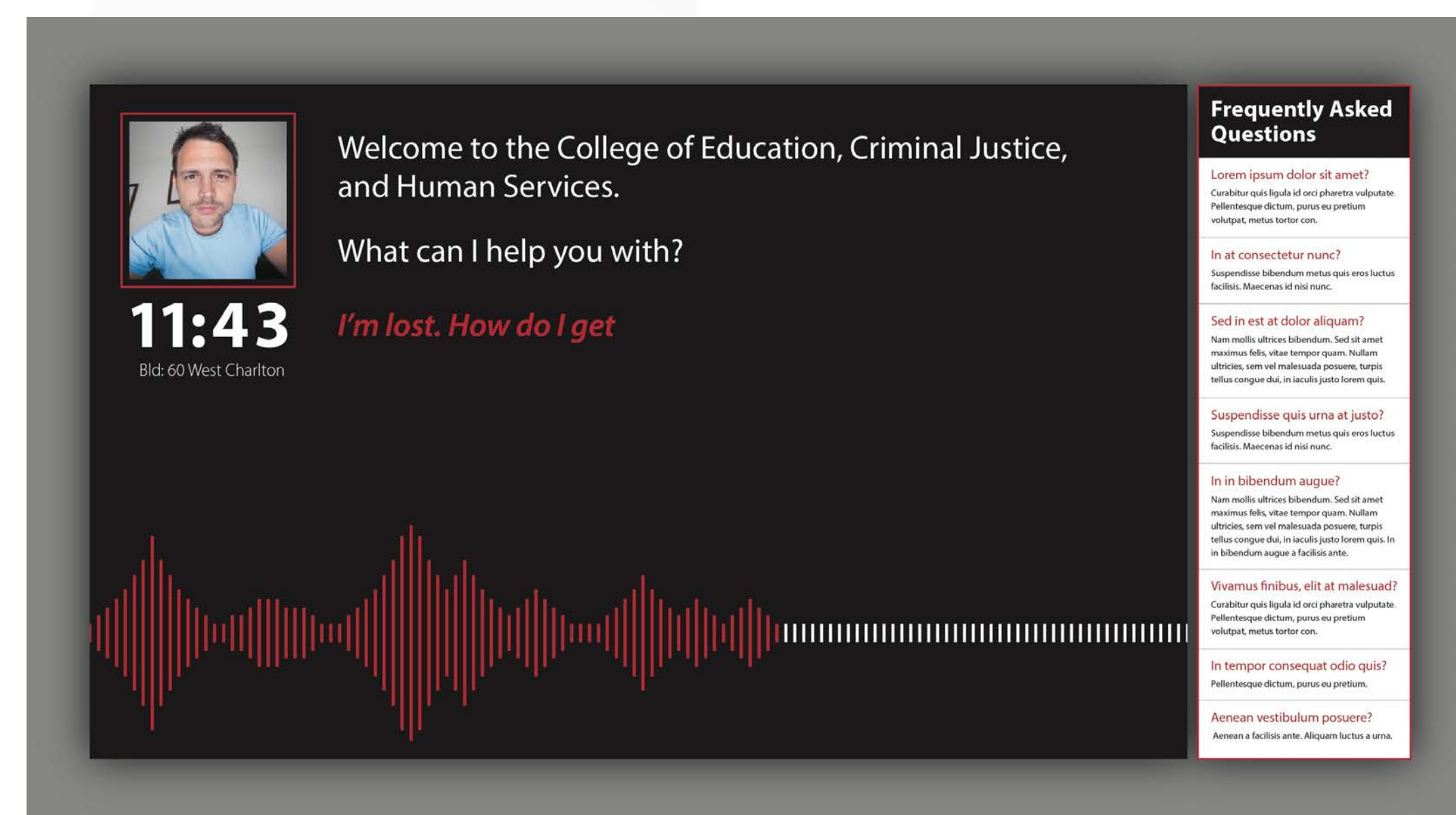
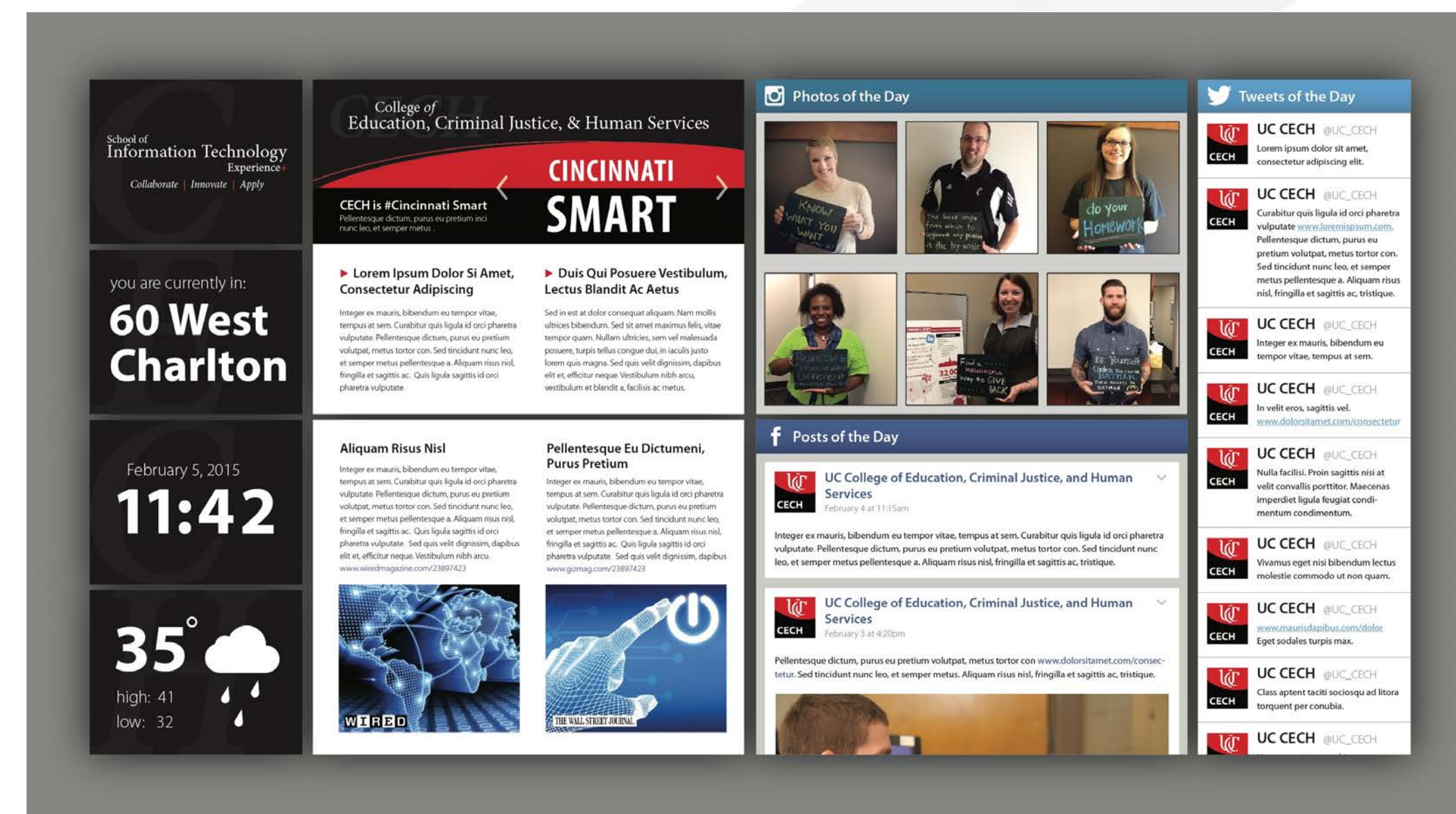
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Information Technology // College of Education,  
Criminal Justice, and Human Services

## Introduction

Information boards have long served the purpose of engaging passers-by and providing relevant information. While this model has been effective in the past, more can be done to engage and connect the community. Providing the community with an interactive, always up-to-date, connected information board platform allows for an improved communication model over the traditional example and opens countless possibilities for innovation, capacity building, and knowledge sharing.

To improve this communication model at the University of Cincinnati, our project, Lucy, will focus on four main areas: Automatically curated content updates to provide the latest university specific information, audio and visual interaction with that data to allow users to easily find what they are looking for, awareness of surroundings through the use of a mounted video camera for data analytics, and extensibility through the use of components and an easy to use API (application programming interfaces).



## Features

### TV Client

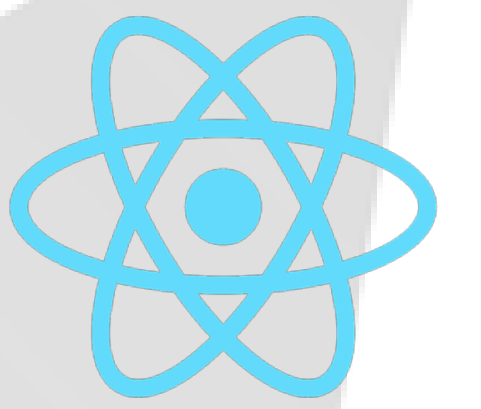
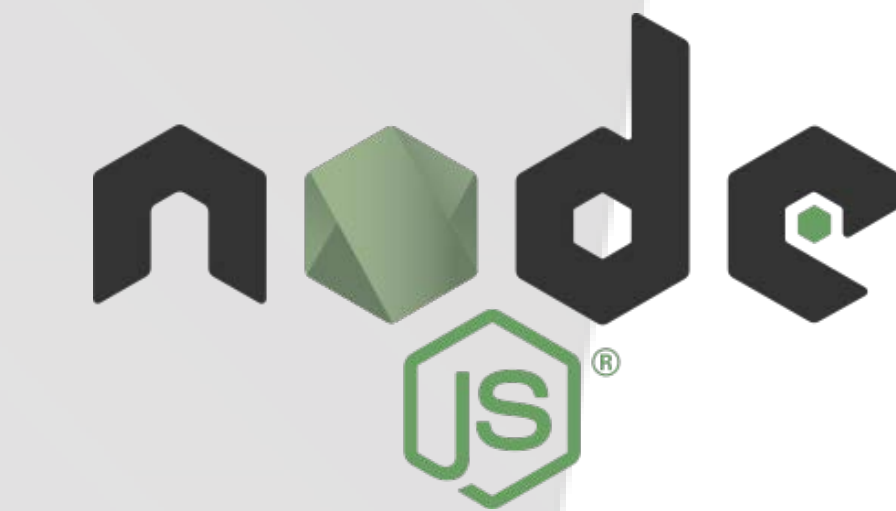
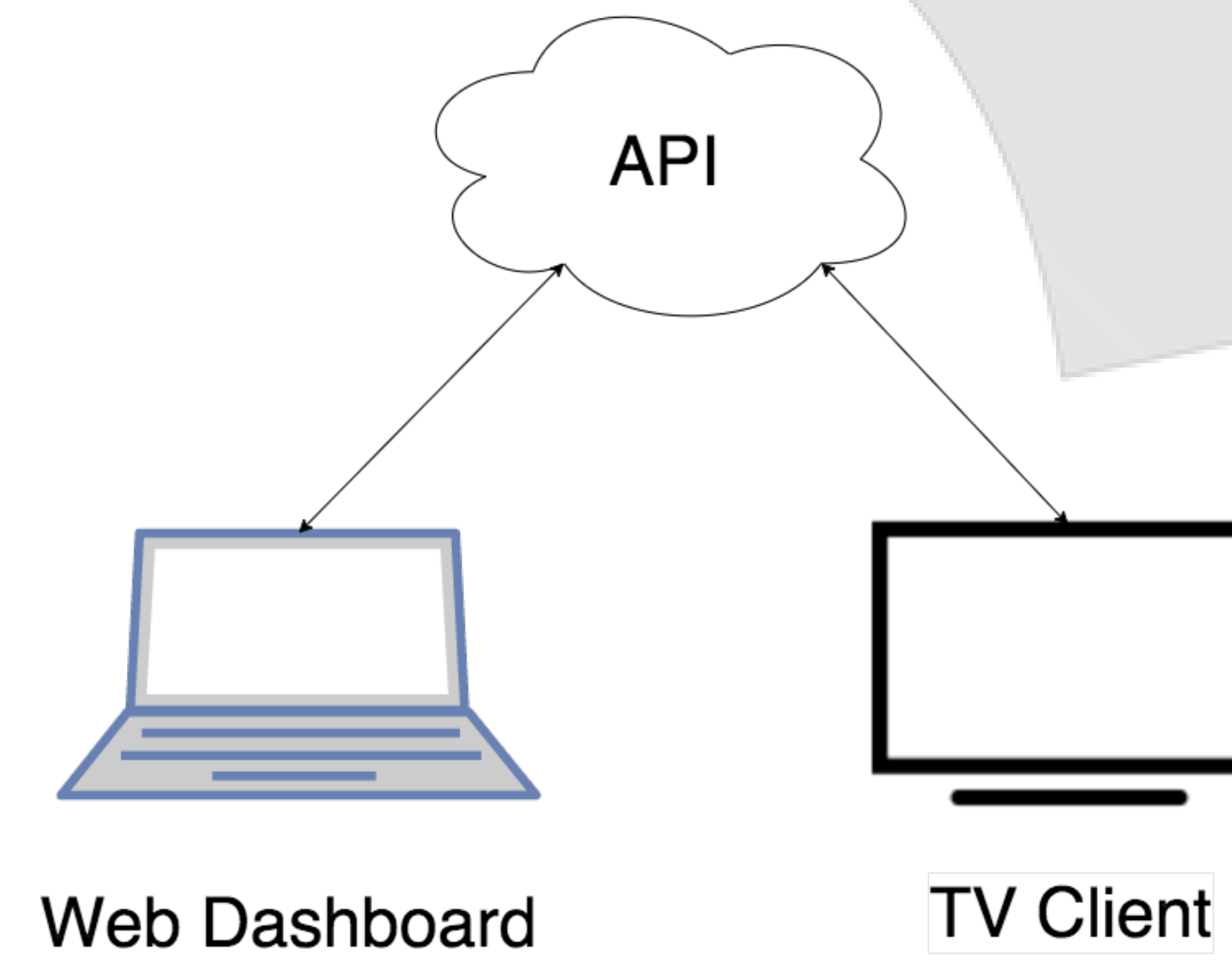
- Weather Widget
- Date/Time Widget
- Location Widget
- Social Media Widgets
- School of IT News Widget
- Shuttle Tracking Widget
- Advertising Widget
- Voice Interaction
- Notification Widget

### API

- Content curation through web scraper
- Full text search through content
- Location based advertisement
- Navigation Service
- Notification Service

### Web-based Dashboard

- Manage Advertisements
- View analytical data
- Push notifications to clients



## Technology

One of the big goals for this project was reusability and not limiting ourselves to a single platform. Because of these decisions, we decided to build our entire stack with JavaScript.

### TV Client

We built the TV client using GitHub's Electron and Facebook's React, which use HTML, CSS and JavaScript. This provides us an efficient way to manage many different small, reusable widgets.

### API

We built the backend API on Node.js with Restify, for HTTP, and Socket.io, for real-time communication, and using MongoDB for data storage, because of its non relational design which is suited for indexing our data for Elasticsearch.

### Web Dashboard

Our web based dashboard in Node.js, using Express and EJS for generating HTML using Twitter Bootstrap.

## Future Plans

The plans for this project is to find a permanent home in Teachers College once the renovations are complete. After the board is installed in its permanent location it will be able to connect those around it and provide up to date information about the college and relative information to the community.

## Acknowledgments

We would like to thank our advisors Professors Robin Carew, James Scott, and Patrick Kumpf. We would also like to thank our project sponsor, Dr. Hazem Said.

