Damage Tracker

A Cloud and Mobile System for Collecting Damage Information after Natural Disasters

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Outline

Motivation and Background

Implementation

Deploying in the Cloud

Demo

Future Work

Motivation and Background

Motivation

- Tornado outbreaks in April-May 2011
  - Tornadoes hit cities across the states of Alabama and Mississippi
  - Tuscaloosa County devastated (43 lives lost, 12% of city damaged[1])
- Other geographically-distributed disasters (e.g. Gulf oil spill)

[1] Tuscaloosa county death toll from tornado increases to 43. Tuscaloosa News, 1 June 2011.

Background

- Researchers collect data after tornadoes
  - Researchers take photos, sync GPS data later
  - Hand-written notes
- Enhanced Fujita Scale
  - Ratings between 1 and 5
  - 28 Damage indicators, each with several degrees
  - Indicator & Degree $\rightarrow$ Wind Speed Range $\rightarrow$ EF Rating

Design Requirements

- Allow users to report damage indicators & degrees
  - Estimate wind speed / EF rating automatically
  - Take textual notes (Speech-to-text a plus)
- Provide the ability to upload data from the web and from mobile phones in the field
- Support many concurrent users
- Allow users to collaborate and see each other's data on the web

Implementation

Play

MVC web framework for Java/Scala

- Templating system
- Routes
- Database Evolutions
- ORM alternative library for queries
- Deploys as zip archive of jars with a launch script
- Encourages stateless server applications
- Code hot-swapping and in-browser errors

Scala

Statically-typed, Functional, Object-oriented language on JVM

- Pragmatic: enables multiple programming styles
- Type inference
- Great collections
- Great concurrency features
  - Monadic Futures (we used them heavily)
  - Actors (Play uses them internally)
- Simple Build Tool (SBT) offers Maven-like dependency management

Additional Technologies

H2	In memory database of domain-specific data
T2V Auth	Authentication module for Play
Twitter Bootstrap	Site theme
Metadata-Extractor	GPS data extraction
Imgscalr	Server-side image manipulation
JBCrypt	Password hashing
Android SDK	Mobile application

Deploying in the Cloud

Amazon EC2

Elastic Compute Cloud

- Provides virtual machines, in which the user has root access (Virtual Private Server)
- Standard Linux machines
- Pay by hour

Amazon EBS

Elastic Block Storage

- Provides raw (mass) storage volumes for EC2 instances
- Allowed us to start running our application in Amazon's cloud with no modifications
- Severely limited scalability: can only be connected to a single EC2 instance at a time

Amazon RDS

Relational Database (as a) Service

- MySQL database in the cloud
- Completely drop-in replacement for a self-managed database (just update configuration file)

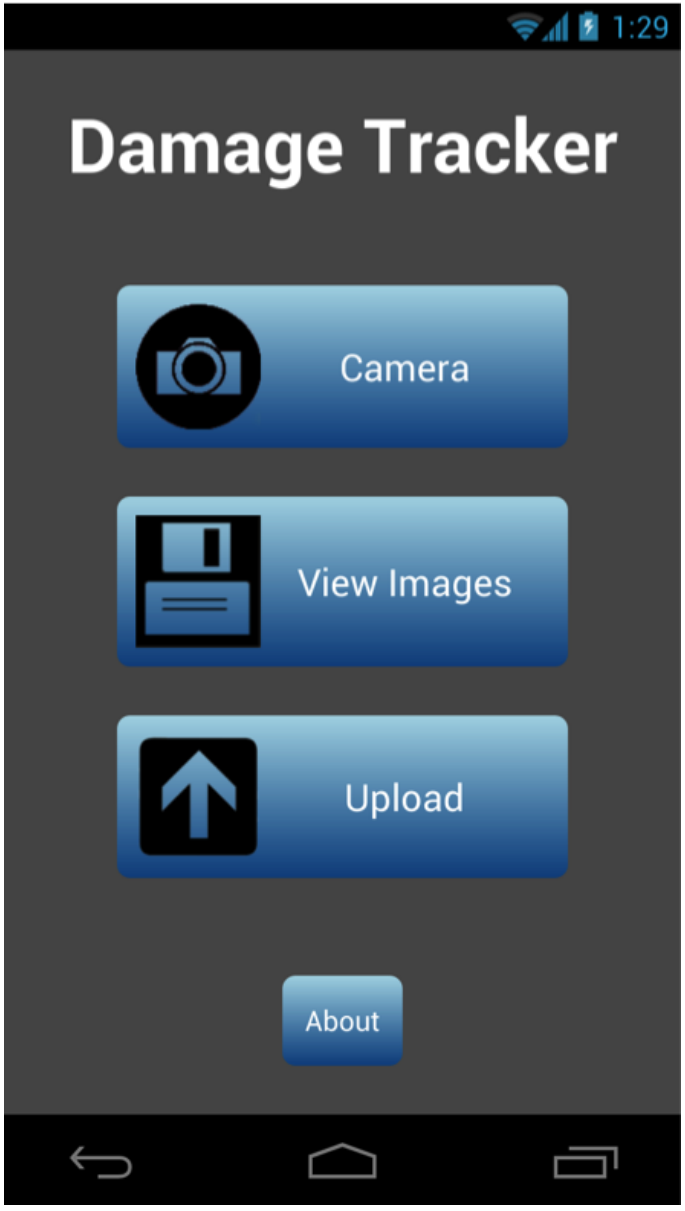
Amazon S3

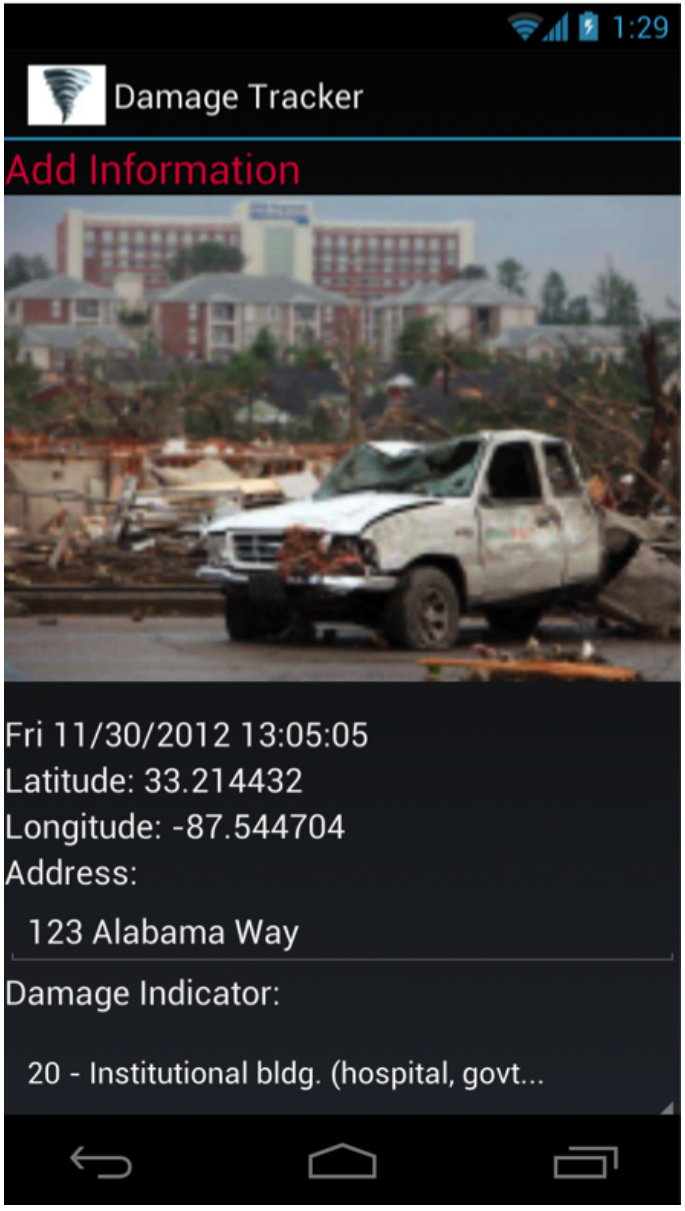
- Simple Storage Service
- Scalable storage in ‘buckets’
- Web API for reading and writing files
- Allowed us to overcome the limitations of EBS
- Use Rhinofly library to interface with S3 from Scala code

Demo

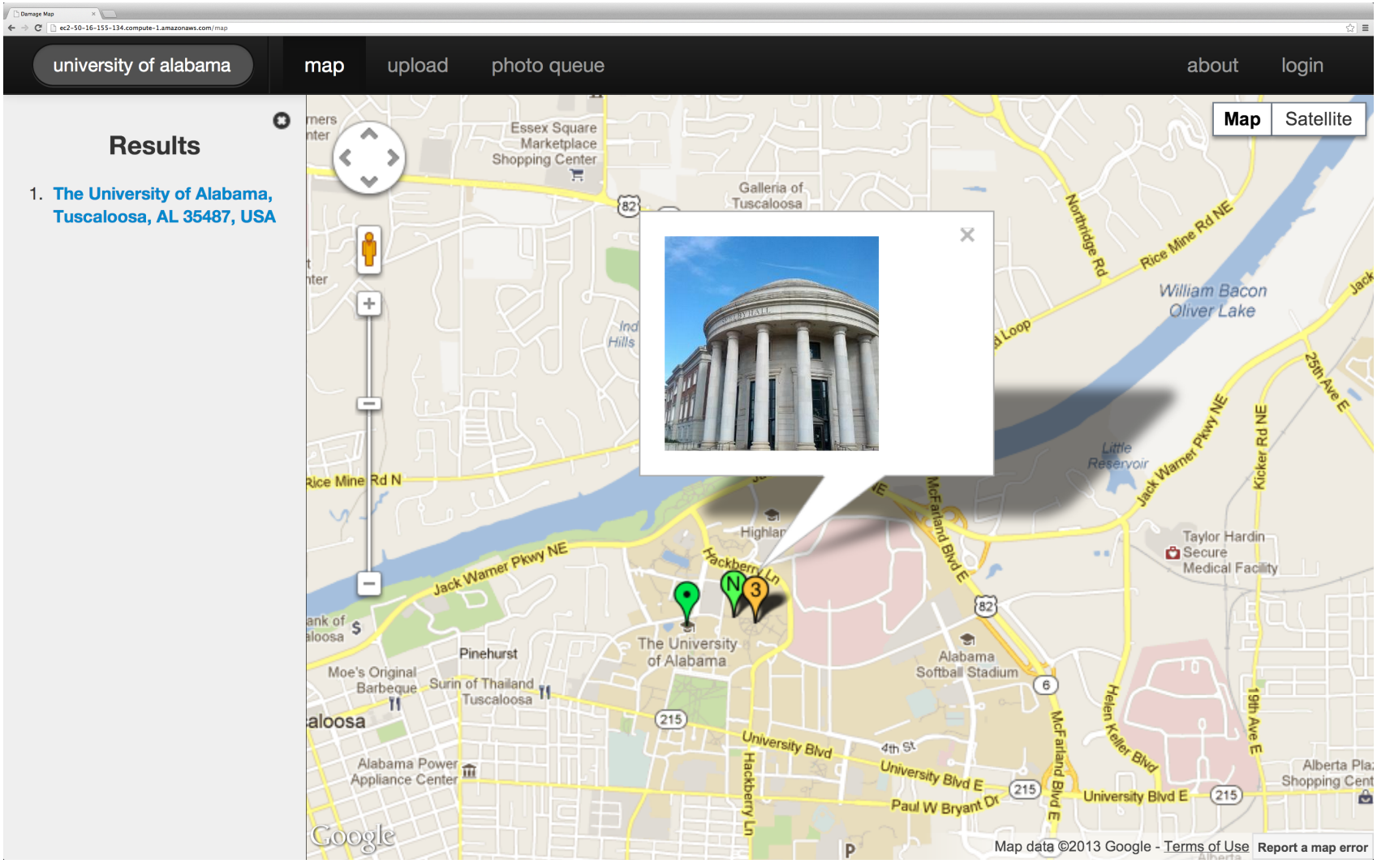
http://ec2-50-16-155-134.compute-1.amazonaws.com

Android Application

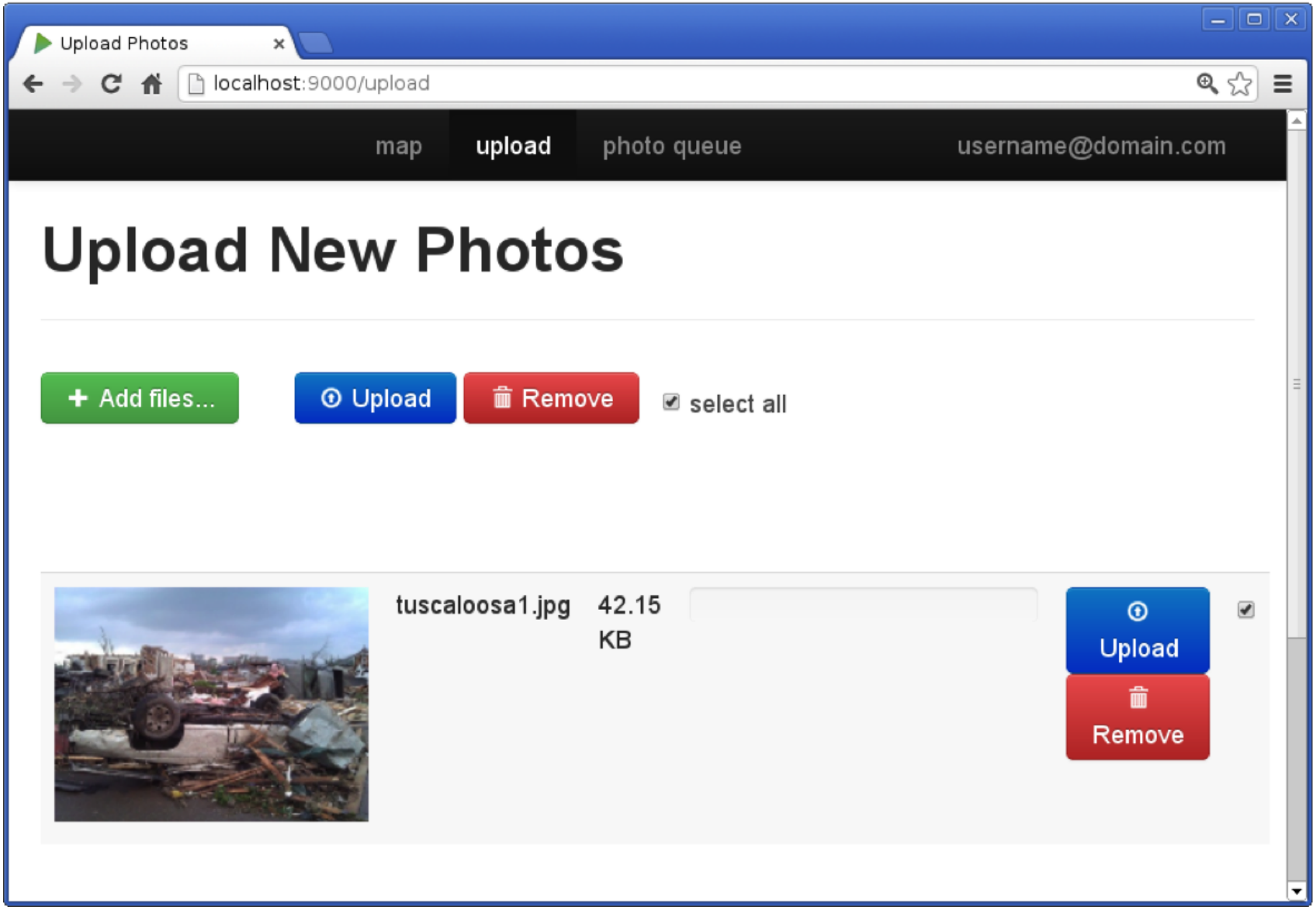




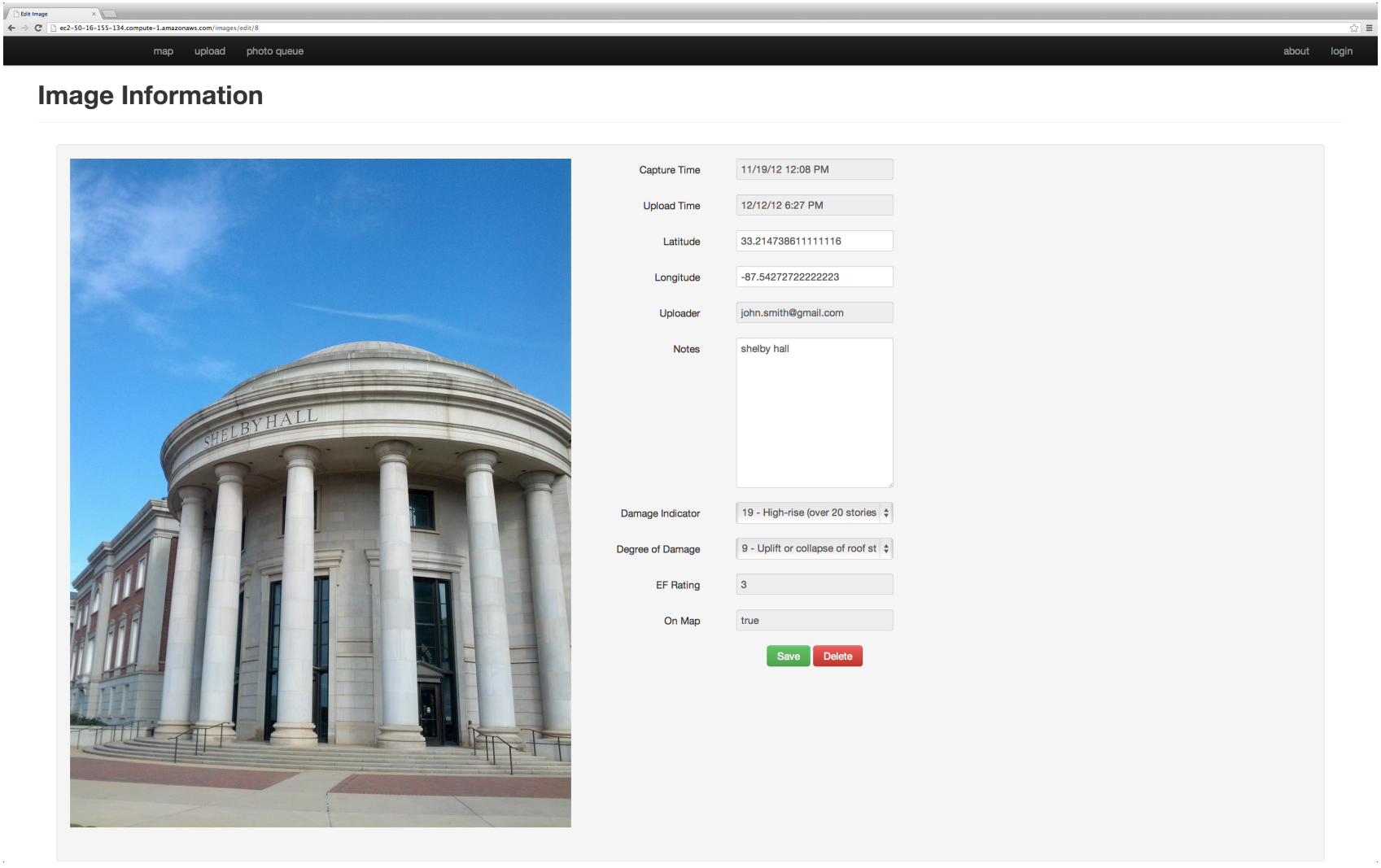
Map Screen


university of alabama
map
upload
photo queue
about
login
Results
1. The University of Alabama, Tuscaloosa, AL 35487, USA
Map
Satellite
Essex Square Marketplace Shopping Center
Galleria of Tuscaloosa
Northridge Rd
Rice Mine Rd NE
William Bacon Oliver Lake
Rice Mine Rd N
Jack Warner Pkwy NE
Hackberry Ln
McFarland Blvd E
Little Reservoir
Kicker Rd NE
25th Ave E
Taylor Hardin Secure Medical Facility
The University of Alabama
Alabama Softball Stadium
Pinehurst
Moe's Original Barbeque
Surin of Thailand Tuscaloosa
University Blvd
4th St
Helen Keller Blvd
19th Ave E
Alabama Power Appliance Center
Paul W Bryant Dr
Google
Map data ©2013 Google - Terms of Use
Report a map error

Upload Screen



Edit Screen


Edit Image
ec2-50-16-155-134.compute-1.amazonaws.com/images/edit/8
map
upload
photo queue
about
login
Image Information
SHELBY HALL
Capture Time
11/19/12 12:08 PM
Upload Time
12/12/12 6:27 PM
Latitude
33.214738611111116
Longitude
-87.54272722222223
Uploader
john.smith@gmail.com
Notes
shelby hall
Damage Indicator
19 - High-rise (over 20 stories
Degree of Damage
9 - Uplift or collapse of roof st
EF Rating
3
On Map
true
Save
Delete

Future Work

- Deployment
  - Host a canonical instance?
  - Release source code?
- Evaluate after a tornado
  - How much does the app help researchers?
  - How does the app deal with load?

Questions