TreeViz Presents

A User-Friendly Platform for Visualizing Tree Growth

TreeViz

- Clients
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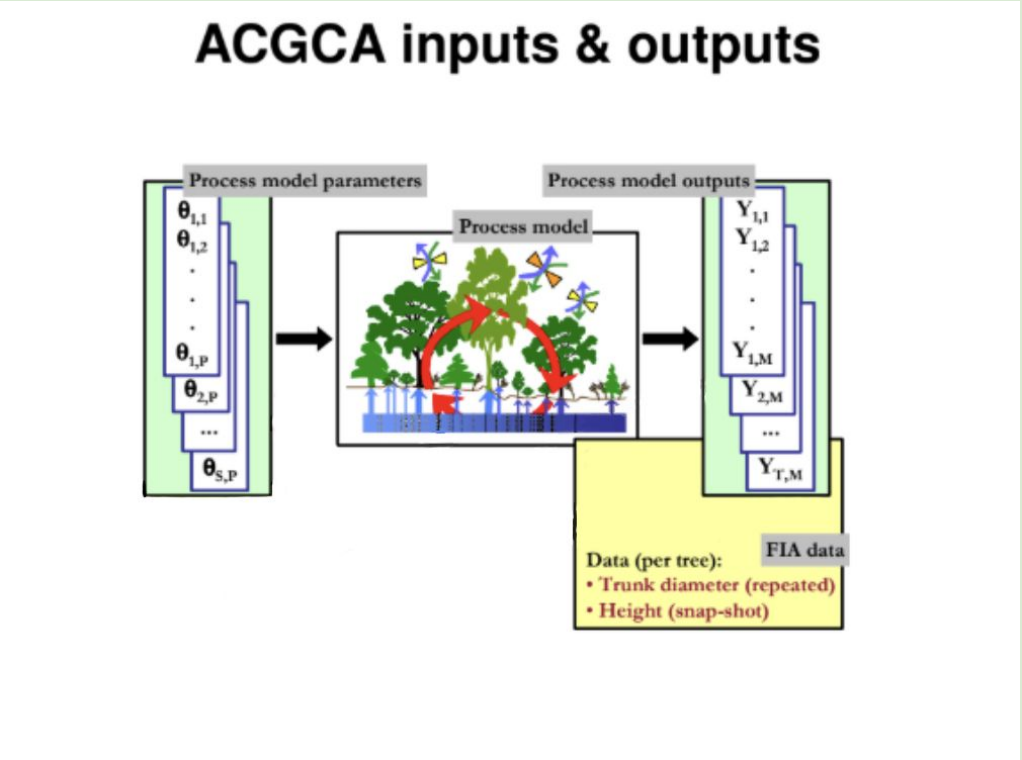
- Mentor
  - Isaac Shaffer
- Undergraduate Students
  - Riley McWilliams - Team Lead
  - Alex Bentley - Web Developer
  - Daniel Rustrumm - Architect
  - Haitian Tang - Database Manager
  - Qi Han - Server Manager

The Client's Business

Allometrically Constrained Growth and Carbon Allocation model (ACGCA)



ACGCA Model [1]

The Client’s Goal

- Larger user base
    - Specifically students

Problem

- Command line input (Programming)
- Need to know each of the 30+ parameters (Biology)
- Raw data output (Biology)

```
void growthloop(
    sparms *p, gparms *gp, double *Io, double *r0, int *t, double *Hc,
    double *LAIF, Forestparms *ForParms, double APARout[], double h[],
    double hh2[], double hC2[], double hB2[], double hBH2[], double r[],
    double rB2[], double rC2[], double rBH[], double sw2[], double vts2[],
    double vt2[], double vth2[], double sa2[], double la2[], double ra2[],
    double dr2[], double xa2[], double bl2[], double br2[], double bt2[],
    double bts2[], double bth2[], double boh2[], double bos2[], double bo2[],
    double bs2[], double cs2[], double clr2[], double fl2[], double fr2[],
    double ft2[], double fo2[], double rfl2[], double rfr2[], double rfs2[],
    double egrow2[], double ex2[], double rtrans2[], double light2[],
    double nut2[], double deltas2[], double LAI2[], int status2[],
    int errorind[], int growth_st[]
)
```

Current Input Example [2]

```
p: sparms, input parameters
gp: Vector: (timestep, years, tolerance, breast.height,parmax)
r0: The starting radius (m).
h: A time series of tree height from the simulation for each time step. The length is steps*
       years+1 due to the initialization (time 0) (m).
hh: Height at which trunc transitions from a paraaboloid to a cone. Also the height to the
       base of the crown (m).
r: A time series of tree radius (m) from the simulation for each time step. The length is
       steps*years+1 (time 0).
rB: Radius at the tree's base (m).
rBH: Radius at breast height (3.37 m).
sw: Sapwood width which has a maximum of SWmax (m).
vts: Volume of trunk sapwood (m^3).
vt: Volume of trunk (m^3).
vth: Volume of trunk heartwood (m^3).
sa: Sapwood area at base of trunk (m^2).
la: Total one-sided leaf area (m^2).
ra: Fine root area (m^2)
dr: incremental increase in radius
```

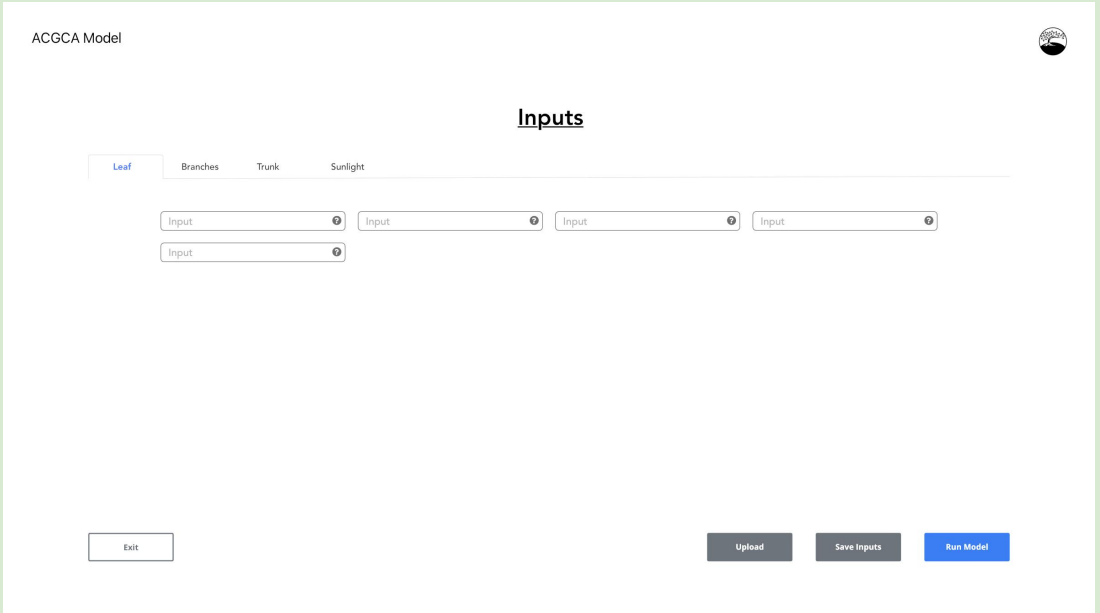
Output Variables [3]

Solution

- Web application
- Hosted online
- User-friendly

Solution - Input

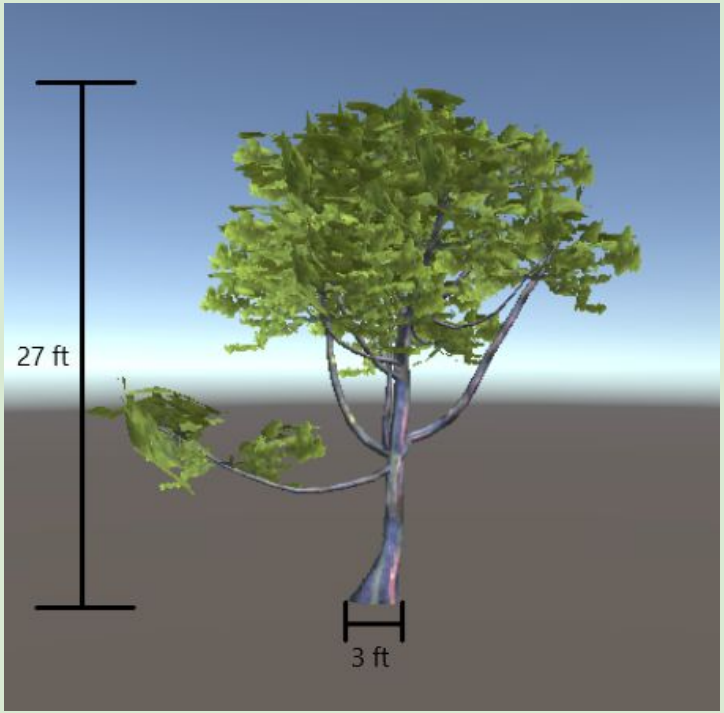
- User-friendly platform
- 30+ inputs made easy to enter
- Grouping of similar inputs
- Text boxes and sliders
- NO command line
- Input descriptions



Projected Example for User Interface [4]

Solution - Output

- Tree Visualization
- Tree created from ACGCA outputs
- Example outputs:
  - Tree height
  - Trunk radius



Example Tree from Technology Demo [5]

Requirements Acquisition (how we got them)

- Requirements have been acquired in many ways
- Documentation supplied by client
- Frequent meetings with client
- Extensive research in technology chosen to complete task

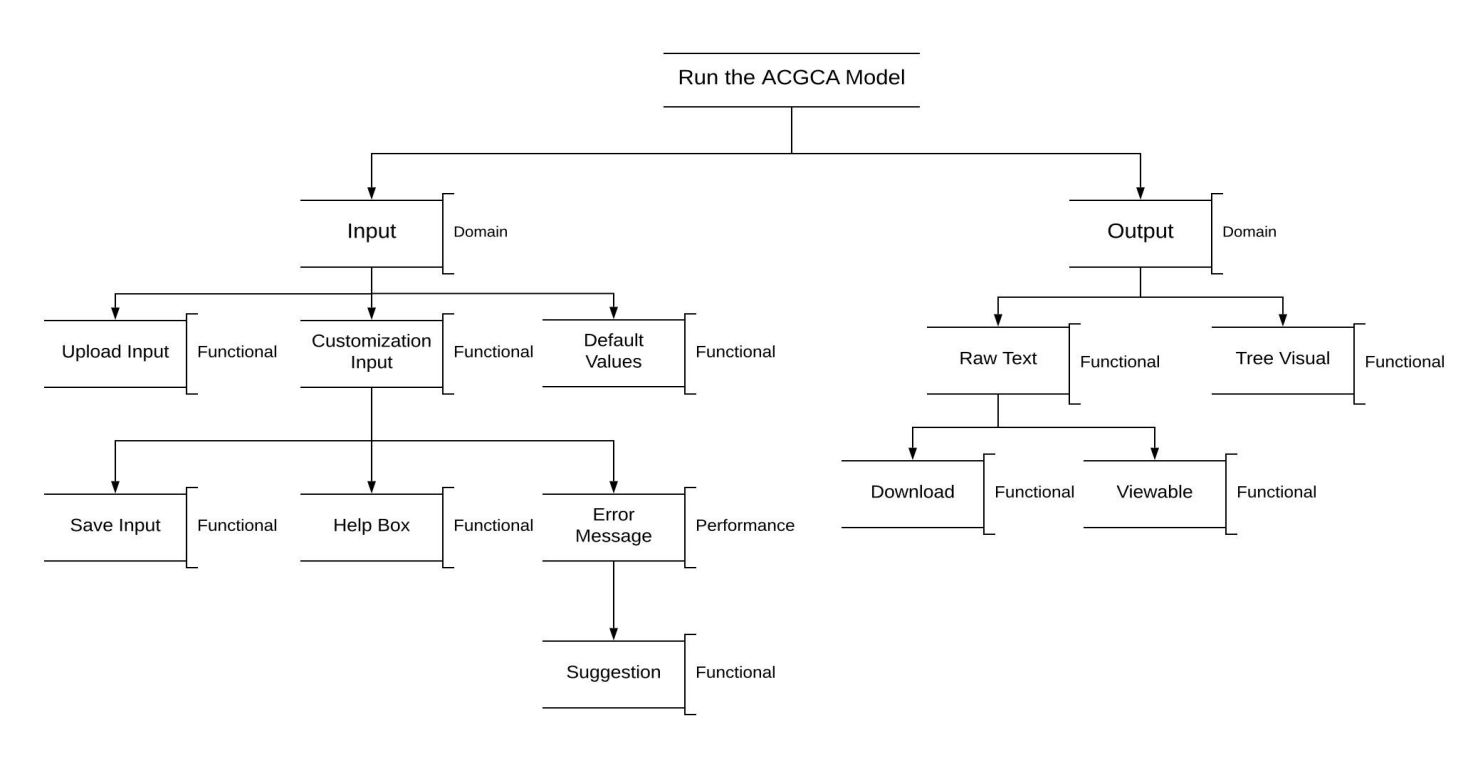
Environmental Requirements

- Internet accessible
- Provide access to model
- User-friendly

Key Requirements

- **Database storage** (Functional)
- **Visualization software for ACGCA model** (Functional)
- **User surveys** (Functional)
- **ReST API** (Functional)
- **Parallelization** (Performance)

Requirement Breakdown



Requirement Breakdown [6]

Requirements Summary

- Requirements may evolve as the project progresses
- We are confident in the requirements we have acquired

Local desktop [7]

Heroku [8]

Firebase [9]

Risks Assessment

Risk	Likelihood of Happening	Impact
Steep Scalability Curve	30%	Moderate
Low User Retention	50%-60%	High
No Funding	95%	Low
Complex Input	80%	Moderate

Risks and Mitigations

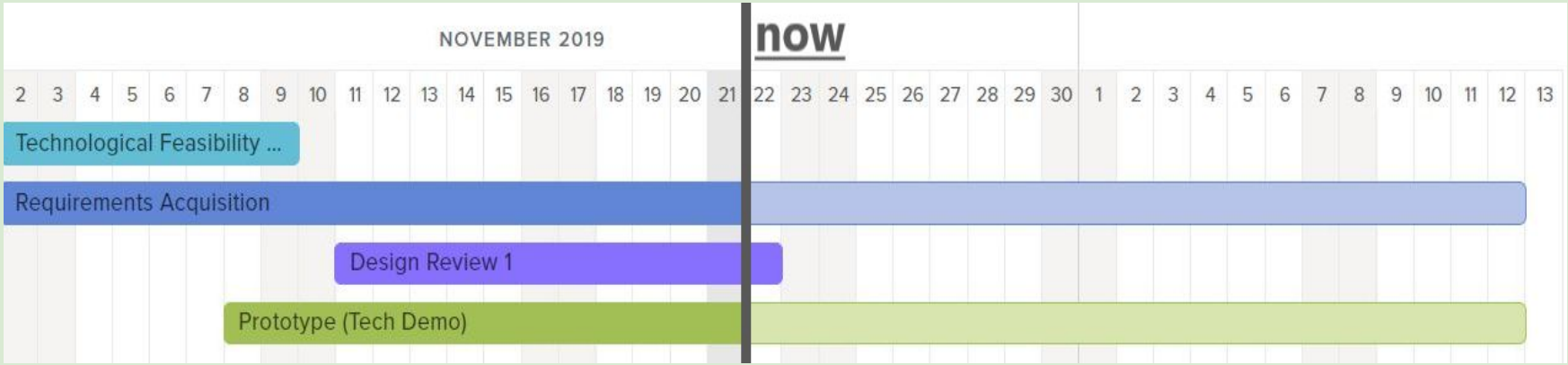
- Steep Scalability Curve
  - Solution: Rate Limiting
    - Max queue size
    - Limit amount of inputs per user
- User Retention
  - Solution: UX Consulting
    - Create mockups for the GUI
    - Seek out advice from professionals about mockups

Risks and Mitigations

- Funding
  - Solution: Find the Cheapest Options
    - Localhost development
    - Minimal-cost Release
- Complex Input
  - Solution: Filtering and Defaults
    - Provided Defaults for unassigned values
    - Filter based on constraints and unrealistic outputs

Schedule - What We're Doing Now

- Technological Feasibility - Completed
- Design Review - Completed
- Requirements Acquisition - In Progress
- Prototype - In Progress



Fall Semester Schedule [10]

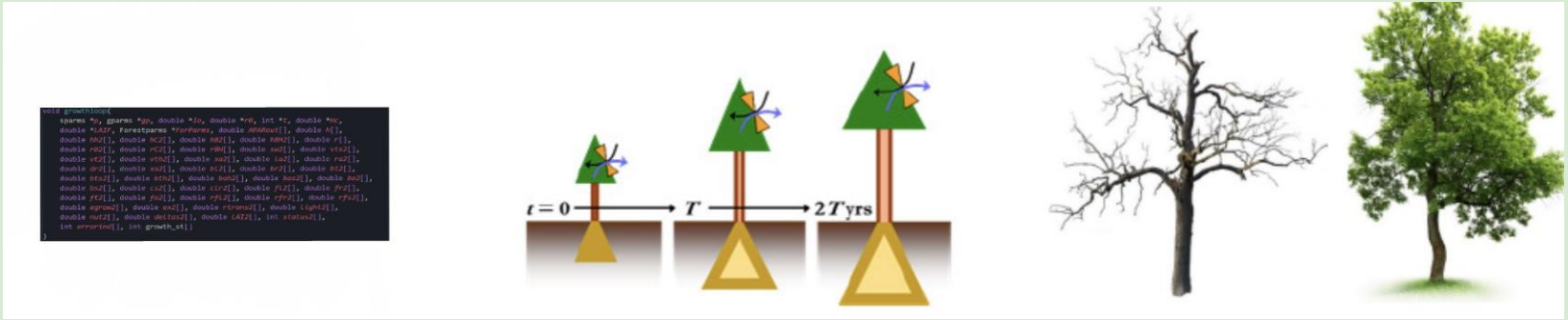
Schedule - What We Will Do

- Post-prototype development
  - User testing
  - Improve application
  - Repeat

Spring Semester Schedule [11]

Conclusion

- Problem
  - Input requires professional knowledge
  - Output is complex to understand
- Solution
  - Interface allows users to easily enter input
  - Tree visualization that is based on model output



Transition from Bad Output to Good Output [12]

Reference

[1] Dr. Ogle's representation of the ACGCA model screenshot

[2] ACGCA input screenshot

[3] ACGCA output screenshot

[4] Early mock-up of UI screenshot

[5] Technology demo tree visualization screenshot

[6] Visualization requirement breakdown screenshot

[7] http://www.clker.com/clipart-3651.html

[8] https://freebiesupply.com/logos/heroku-logo/

[9] https://dribbble.com/shots/3140440-Firebase-Logo

[10] Gantt chart screenshot

[11] Gantt chart screenshot

[12] Evolution of output screenshot