



*Dwight Look College of*

**ENGINEERING**

TEXAS A&M UNIVERSITY

# ECEN 404 Final Presentation

## Team 25: Plant Attribute Extraction

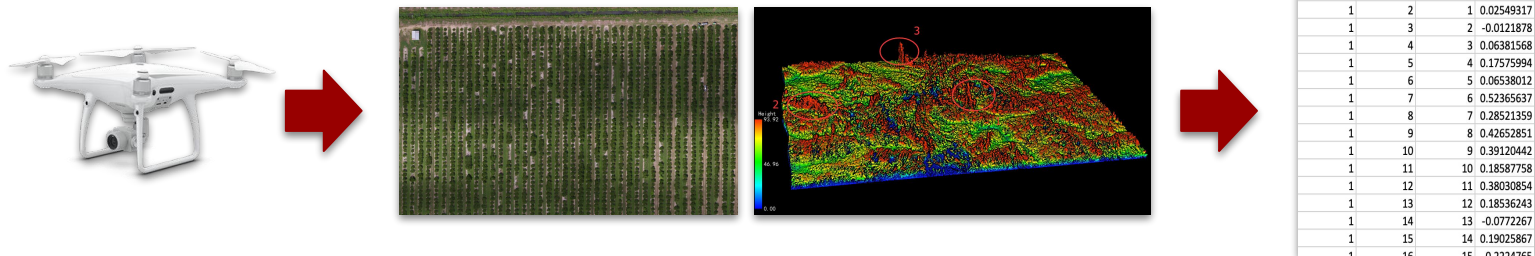
Ronald Batista, Campbell Motter, Rosendo Torres

TA: Dalton Cyr

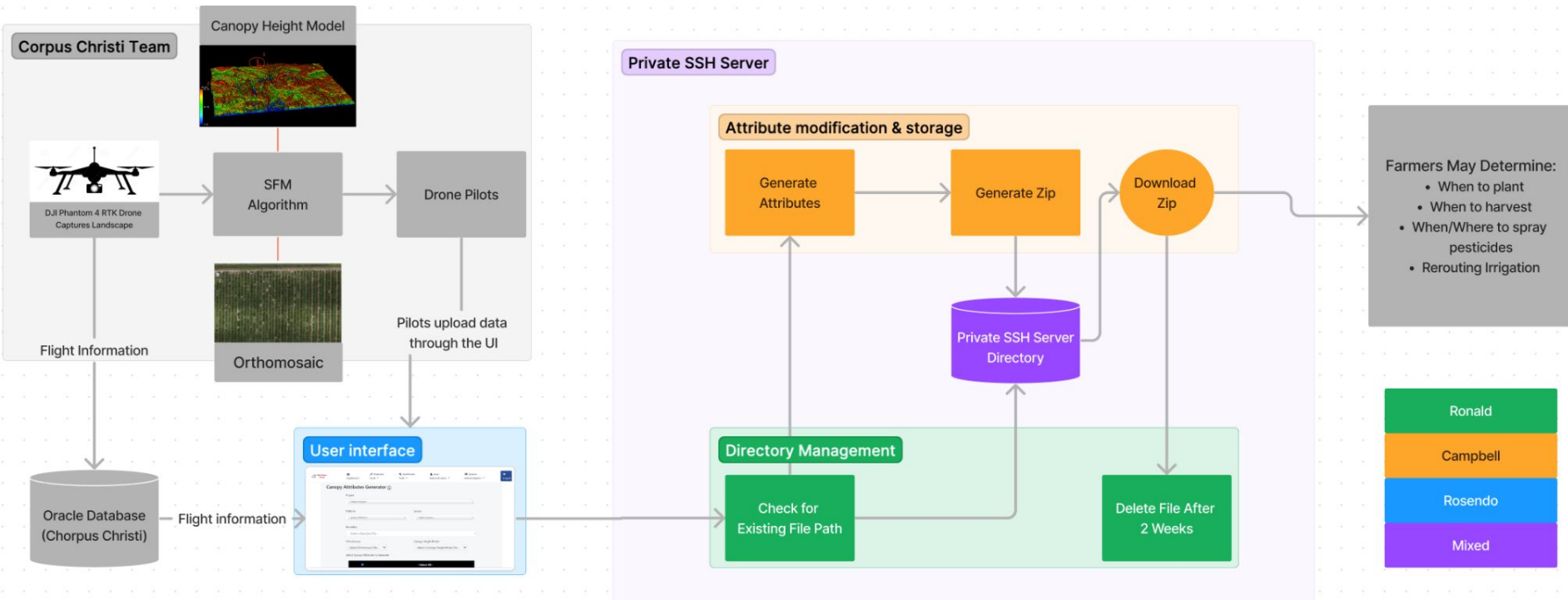
Sponsor: Texas A&M AgriLife Corpus Christi

# Problem Overview

- User-based website that generates crop growth data for the user to analyze crop growth between different dates.
- Website only generated data for one date at a time.
- Did not allow user to compare the data in one file.
  - Restricts user from comparing growth over time.
- Having a more flexible method of grabbing data from multiple dates to better compare and understand the best method for growing crops



# Integrated Project Diagram



# Directory Management

- Code that reviews directory for previously generated data.
- If user is requesting for the generation of said data, then they will be notified and skip the generation process to then download.
- Validated test cases:
  - Code can distinguish between different orthomosaics generating the same attribute.
  - Code can distinguish between the same file generating different attributes.
  - Code can function with the selection of multiple files.
  - Code will pass when there is no files found.

```
\nThe temp results directory and zip file have already been generated, you can download the generated results.\n"]
```

Figure 1: Console Result

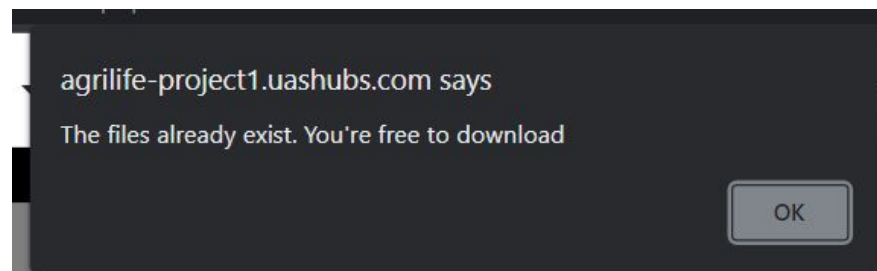


Figure 2: Pop-up Notification

# Directory Management

- EPSG: European Petroleum Survey Group
  - Coordinate system
- New Amarillo Project added to test EPSG
  - EPSG of Amarillo = 32613
  - EPSG of Corpus = 32614



Figure 1: Amarillo location in the bounds of the EPSG value 32613

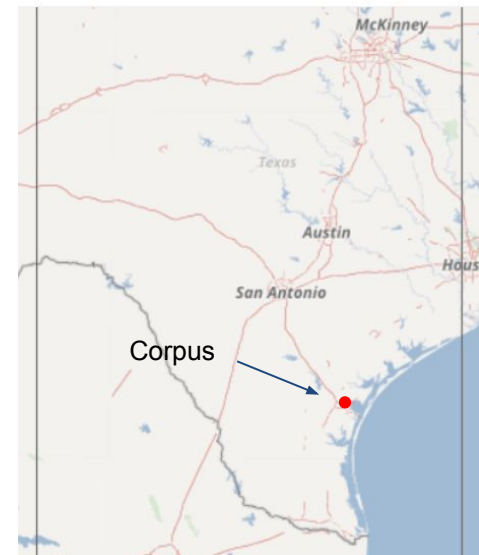


Figure 2: Corpus Location in the bounds of EPSG = 32614



# Directory Management

- Code that deletes the generated data after 2 weeks of existing in the database.
  - Can detect if file exists or not. Will end and not do anything if data does not exist.
  - Data is able to delete for a short portion of time.
  - Currently still validating deletion after a week.

```
20220523_cc_p4r_parking_mosaic  
20220523_cc_p4r_parking_mosaic_clipped  
20220523_cc_p4r_parking_mosaic_clipped 2022_cc_corn_boundary_clipped
```

Figure 1: File Paths in Project Directory

```
20220523_cc_p4r_parking_mosaic  
20220523_cc_p4r_parking_mosaic_clipped
```

Figure 2: Deletion of Project Path

```
"The temp results directory and zip file were deleted successfully!"
```

Figure 3: Validation of Deletion from Website

# Directory Management

- Challenges
  - Coming from working on power and controls, coding at a large scale was a challenge.
  - Debugging through the website.
- Solutions
  - Using a multitude of print statements to read results and catch where code stops.
  - Multitude of trial and error cases to improve the code over time.
  - Communicating with team members to understand their code to integrate properly.

# Attribute Modification and Storage

- Challenges/solutions:
  - File saving in ATOM
    - Solution: clear communication between group members, and multiple backup files for safety.
  - Primary validation source being the website
    - Solution: Using the ssh server for running individual scripts and checking the ssh server directory to try identify bugs and errors. this is to prevent waiting for a lengthy attribute generation. Clipped results also helped reduce lots of time.
- Designed:
  - The ability to generate plant attributes for multiple Orthomosaic files.
  - The ability to generate Canopy Cover(CC) and Excess Greeness(EXG) without a Canopy Height Model(CHM) file
  - The ability to generate results with less Canopy Height Model(CHM) files than Orthomosaic files. (This is for generating Canopy Height and Volume only for the Orthomosaics with the respective CHM selected)
  - Testing:

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No CHM results

ccZip

merged\_shp\_cc\_rgb.shx

merged\_shp\_cc\_rgb.shp

merged\_shp\_cc\_rgb.dbf

merged\_cc\_boundary.csv

cc\_boundary\_20220523\_cc\_p4r\_parking\_mosaic\_clipped.xlsx

cc\_boundary\_20220523\_cc\_p4r\_parking\_mosaic\_clipped.shx

cc\_boundary\_20220523\_cc\_p4r\_parking\_mosaic\_clipped.shp

cc\_boundary\_20220523\_cc\_p4r\_parking\_mosaic\_clipped.geojson

cc\_boundary\_20220523\_cc\_p4r\_parking\_mosaic\_clipped.dbf

cc\_boundary\_20220523\_cc\_p4r\_parking\_mosaic\_clipped.csv

cc\_boundary\_20220427\_cc\_p4r\_parking\_mosaic\_clipped.xlsx

cc\_boundary\_20220427\_cc\_p4r\_parking\_mosaic\_clipped.shx

cc\_boundary\_20220427\_cc\_p4r\_parking\_mosaic\_clipped.shp

cc\_boundary\_20220427\_cc\_p4r\_parking\_mosaic\_clipped.geojson

cc\_boundary\_20220427\_cc\_p4r\_parking\_mosaic\_clipped.dbf

cc\_boundary\_20220427\_cc\_p4r\_parking\_mosaic\_clipped.csv

cc\_boundary\_20220408\_cc\_p4r\_parking\_mosaic\_clipped.xlsx

cc\_boundary\_20220408\_cc\_p4r\_parking\_mosaic\_clipped.shx

cc\_boundary\_20220408\_cc\_p4r\_parking\_mosaic\_clipped.shp

cc\_boundary\_20220408\_cc\_p4r\_parking\_mosaic\_clipped.geojson

cc\_boundary\_20220408\_cc\_p4r\_parking\_mosaic\_clipped.dbf

cc\_boundary\_20220408\_cc\_p4r\_parking\_mosaic\_clipped.csv

resultsZip.zip

--Select Orthomosaic File--	--Select a Canopy Height Model File--
<div><div><div><input checked="" type="checkbox"/>All</div><div><input checked="" type="checkbox"/></div></div><div>20220523_cc_p4r_parking_mosaic_clipped.tif</div><div><input checked="" type="checkbox"/></div><div>20220408_cc_p4r_parking_mosaic_clipped.tif</div><div><input checked="" type="checkbox"/></div><div>20220427_cc_p4r_parking_mosaic_clipped.tif</div></div>	<div><div><div><input type="checkbox"/>All</div><div><input type="checkbox"/></div></div><div>20220523_cc_p4r_parking_chm_clipped.tif</div><div><input type="checkbox"/></div><div>20220427_cc_p4r_parking_chm_clipped.tif</div><div><input type="checkbox"/></div><div>20220408_cc_p4r_parking_chm_clipped.tif</div></div>

Mismatching CHM results

ccZip

cc\_boundary\_20220408\_cc\_p4r\_parking\_mosaic\_clipped.csv

cc\_boundary\_20220408\_cc\_p4r\_parking\_mosaic\_clipped.dbf

cc\_boundary\_20220408\_cc\_p4r\_parking\_mosaic\_clipped.geojson

cc\_boundary\_20220408\_cc\_p4r\_parking\_mosaic\_clipped.shp

cc\_boundary\_20220408\_cc\_p4r\_parking\_mosaic\_clipped.shx

cc\_boundary\_20220408\_cc\_p4r\_parking\_mosaic\_clipped.xlsx

cc\_boundary\_20220427\_cc\_p4r\_parking\_mosaic\_clipped.csv

cc\_boundary\_20220427\_cc\_p4r\_parking\_mosaic\_clipped.dbf

cc\_boundary\_20220427\_cc\_p4r\_parking\_mosaic\_clipped.geojson

cc\_boundary\_20220427\_cc\_p4r\_parking\_mosaic\_clipped.shp

cc\_boundary\_20220427\_cc\_p4r\_parking\_mosaic\_clipped.shx

cc\_boundary\_20220427\_cc\_p4r\_parking\_mosaic\_clipped.xlsx

merged\_cc\_boundary.csv

merged\_shp\_cc\_rgb.dbf

merged\_shp\_cc\_rgb.shp

merged\_shp\_cc\_rgb.shx

ccZip.zip

chZip

ch\_boundary\_20220408\_cc\_p4r\_parking\_mosaic\_clipped.csv

ch\_boundary\_20220408\_cc\_p4r\_parking\_mosaic\_clipped.dbf

ch\_boundary\_20220408\_cc\_p4r\_parking\_mosaic\_clipped.geojson

ch\_boundary\_20220408\_cc\_p4r\_parking\_mosaic\_clipped.shp

ch\_boundary\_20220408\_cc\_p4r\_parking\_mosaic\_clipped.shx

ch\_boundary\_20220408\_cc\_p4r\_parking\_mosaic\_clipped.xlsx

chZip.zip

--Select Orthomosaic File--	--Select a Canopy Height Model File--
<div><div><div><input type="checkbox"/>All</div><div><input type="checkbox"/></div></div><div>20220523_cc_p4r_parking_mosaic_clipped.tif</div><div><input checked="" type="checkbox"/></div><div>20220408_cc_p4r_parking_mosaic_clipped.tif</div><div><input checked="" type="checkbox"/></div><div>20220427_cc_p4r_parking_mosaic_clipped.tif</div></div>	<div><div><div><input type="checkbox"/>All</div><div><input type="checkbox"/></div></div><div>20220523_cc_p4r_parking_chm_clipped.tif</div><div><input checked="" type="checkbox"/></div><div>20220408_cc_p4r_parking_chm_clipped.tif</div><div><input type="checkbox"/></div><div>20220427_cc_p4r_parking_chm_clipped.tif</div></div>

# Attribute Modification and Storage

- Designed:
  - Results of each attribute stored in its own folder and zipped.
  - A results zip file containing the zipped results of each selected attribute.
  - Testing:

```
ubuntu@bhub:/var/www/html/uas_data/download/product/2022_Corpus_Christi_Cotton/20220523_cc_p4r_parking_mosaic_clipped_2022_cc_corn_boundary_clipped$ ls
cc_boundary  ch_boundary  exg_boundary  results  resultsZip.zip
```

```
ubuntu@bhub:/var/www/html/uas_data/download/product/2022_Corpus_Christi_Cotton/20220523_cc_p4r_parking_mosaic_clipped_2022_cc_corn_boundary_clipped/results$ ls
ccZip.zip  chZip.zip  exgZip.zip
```

- Designed:
  - Merged attribute tables for the shapefile results of each Orthomosaic file, a merged file is created for each attribute selected.
  - Merged CSV file containing the results of each Orthomosaic file, a merged file is created for each attribute selected.
  - Testing:

(Next Slide)





# Attribute Modification and Storage

A1										A1										A1																																							
	A	B	C	D	E	F	G	H	I		A	B	C	D	E	F	G	H	I		A	B	C	D	E	F	G	H	I	J																													
1		id	left	top	right	bottom	20220408	20220427	20220523	1		id	left	top	right	bottom	20220408	20220427	20220523	1		id	left	top	right	bottom	20220408	20220427	20220523																														
2	0	9	641748.7	3073982	641758.7	3073980	5.70164	30.96348	27.92963	2	0	9	641748.7	3073982	641758.7	3073980	-0.006421	0.516701	0.614994	2	0	9	641748.7	3073982	641758.7	3073980	0.016754	0.778081	0.902052																														
3	1	10	641748.7	3073980	641758.7	3073978	6.875839	30.55226	28.2634	3	1	10	641748.7	3073980	641758.7	3073978	0.035266	0.509318	0.715342	3	1	10	641748.7	3073980	641758.7	3073978	0.015598	0.784338	0.976982																														
4	2	11	641748.7	3073978	641758.7	3073976	5.40923	19.50614	27.87629	4	2	11	641748.7	3073978	641758.7	3073976	-0.001503	0.312489	0.618331	4	2	11	641748.7	3073978	641758.7	3073976	0.01389	0.725447	0.994453																														
5	3	12	641748.7	3073976	641758.7	3073974	7.164422	31.28146	33.90216	5	3	12	641748.7	3073976	641758.7	3073974	0.04812	0.626583	0.737728	5	3	12	641748.7	3073976	641758.7	3073974	0.016896	0.842167	1.150672																														
6	4	13	641748.7	3073974	641758.7	3073972	7.229369	31.74586	34.16534	6	4	13	641748.7	3073974	641758.7	3073972	0.043335	0.634314	0.673615	6	4	13	641748.7	3073974	641758.7	3073972	0.018278	0.846724	1.088762																														
7	5	16	641758.7	3073982	641768.7	3073980	6.044373	34.0429	36.57354	7	5	16	641758.7	3073982	641768.7	3073980	-0.02611	0.706548	0.910386	7	5	16	641758.7	3073982	641768.7	3073980	0.006797	0.731845	0.934732																														
8	6	17	641758.7	3073980	641768.7	3073978	6.216978	32.82315	41.79056	8	6	17	641758.7	3073980	641768.7	3073978	-0.013455	0.649442	1.081129	8	6	17	641758.7	3073980	641768.7	3073978	0.006794	0.773701	0.955759																														
9	7	18	641758.7	3073978	641768.7	3073976	7.440752	22.90906	43.3089	9	7	18	641758.7	3073978	641768.7	3073976	0.034984	0.420661	1.19566	9	7	18	641758.7	3073978	641768.7	3073976	0.007307	0.794439	1.074013																														
10	8	19	641758.7	3073976	641768.7	3073974	9.309707	31.80009	48.42425	10	8	19	641758.7	3073976	641768.7	3073974	0.107204	0.716387	1.258754	10	8	19	641758.7	3073976	641768.7	3073974	0.011292	0.783522	1.169409																														
11	9	20	641758.7	3073974	641768.7	3073972	7.588147	25.63565	33.88303	11	9	20	641758.7	3073974	641768.7	3073972	0.055862	0.558159	0.781602	11	9	20	641758.7	3073974	641768.7	3073972	0.010201	0.705987	1.11635																														
12	10	23	641768.7	3073982	641778.7	3073980	5.547346	29.73226	41.36542	12	10	23	641768.7	3073982	641778.7	3073980	-0.021827	0.519566	0.952603	12	10	23	641768.7	3073982	641778.7	3073980	0.006452	0.723834	1.048257																														
13	11	24	641768.7	3073980	641778.7	3073978	5.697518	23.12142	41.78983	13	11	24	641768.7	3073980	641778.7	3073978	-0.012449	0.348665	1.011191	13	11	24	641768.7	3073980	641778.7	3073978	0.006135	0.737712	1.080687																														
14	12	25	641768.7	3073978	641778.7	3073976	6.790392	25.51787	43.60346	14	12	25	641768.7	3073978	641778.7	3073976	0.033839	0.411454	1.114378	14	12	25	641768.7	3073978	641778.7	3073976	0.007281	0.777502	1.129211																														
15	13	26	641768.7	3073976	641778.7	3073974	6.847489	33.44071	41.47059	15	13	26	641768.7	3073976	641778.7	3073974	-0.000619	0.627437	0.963096	15	13	26	641768.7	3073976	641778.7	3073974	0.006974	0.834796	1.158324																														
16	14	27	641768.7	3073974	641778.7	3073972	4.677842	35.15551	22.2596	16	14	27	641768.7	3073974	641778.7	3073972	-0.077127	0.634603	0.454075	16	14	27	641768.7	3073974	641778.7	3073972	0.008149	0.83309	0.941573																														
17										17										17																																							
18										18										18																																							
merged_cc_boundary										merged_exg_boundary										merged_ch_boundary																																							
20220408										20220427										20220523										20220408										20220427										20220523									
1	5.701640009...			30.9634809...			27.92962799...			2	-0.02611033...			0.706548452...			0.910385847...			1	0.016754484...			0.778081274...			0.902051734...																																
2	6.875838974...			30.55225696...			28.26340326...			3	-0.02182666...			0.519566416...			0.952602863...			2	0.015598297...			0.784338283...			0.976981544...																																
3	5.409229639...			19.50614026...			27.87629037...			4	0.035265769...			0.509318113...			0.715342104...			3	0.013890266...			0.725447463...			0.994453382...																																
4	7.1644221310...			31.28145567...			33.90215735...			5	-0.01345494...			0.649442255...			1.0811291933...			4	0.016895723...			0.842166900...			1.150671958...																																
5	7.229369494...			31.74585721...			34.16534445...			6	-0.01244870...			0.348665028...			1.0111906528...			5	0.018277502...			0.846724128...			1.088761997...																																
6	6.044372921...			34.04289630...			36.57354169...			7	-0.00150326...			0.312488943...			0.618331253...			6	0.006796884...			0.731844711...			0.934732437...																																
7	6.216978364...			32.82315169...			41.79056237...			8	0.034984279...			0.420660525...			1.195659637...			7	0.006793880...			0.773700714...			0.955758762...																																
8	7.440752338...			22.90906158...			43.3088969...			9	0.033839311...			0.411453932...			1.1143779754...			8	0.007307100...			0.794439315...			1.074012756...																																
9	9.309706875...			31.80008619...			48.42424689...			10	0.048120114...			0.626582920...			0.737728476...			9	0.011292266...			0.783521842...			1.169408941...																																
10	7.588146601...			25.63565016...			33.88302873...			11	0.107204169...			0.716386675...			1.258754253...			10	0.010200834...			0.705986785...			1.1163501739...																																
11	5.547345850...			29.73226074...			41.36542336...			12	-0.00061918...			0.627437412...			0.963096320...			11	0.006451606...			0.723833656...			1.048256874...																																
12	5.697518220...			23.12142102...			41.78982781...			13	0.043335210...			0.634314000...			0.673614561...			12	0.006135225...			0.737711524...			1.080687284...																																



## Test Cases:

- The first large chunk of test cases was for ensuring that every case of mismatching Orthomosaics and CHMs was working correctly.
- The next chunk were official test cases given to us by our sponsor. I added a few extra test cases in case the user inputs a CHM when unnecessary.
- Each test case passes by correctly generating results, correctly generating all zip files including the parent zip, each attribute has all selected files and merged files(if applicable).

## CAPSTONE TEST CASES:

(P/F) (pass/fail)

### Mismatching Ortho/CHM

- [408,427,523] , [408,427,523](P)
- [408,427,523], [408,427](P)
- [408,427,523], [408,523](P)
- [408,427,523], [427,523](P)
- [408,427,523], [408](P)
- [408,427,523], [427](P)
- [408,427,523], [523](P)
- [408,427], [408,427](P)
- [408,523], [408,523](P)
- [408,427], [408,427](P)
- [408,427], [408](P)
- [408,427], [427](P)
- [408,523], [408](P)
- [408,523], [523](P)
- [427,523], [427](P)
- [427,523], [523](P)
- [408], [408](P)
- [427], [427](P)
- [523], [523](P)

### RGB DEMO TEST CASES:

- (P)Corpus Clipped [408,427,523] CC
- (P)Corpus Clipped [408,427,523] CC, EXG, CH
- (P)Amarillo [408] EXG
- (P)Amarillo [408] CC, EXG, CH
- EXTRAS:
  - (P)Corpus Clipped [408,427,523] CC, EXG, CH (only ch for 408)
  - (P)Corpus Clipped [408,427,523] (ortho and CHM) CC, EXG
  - (P)Corpus Clipped [408,427,523] CC, EXG, CH (only ch for 408 & 523)
  - (P)Corpus Clipped [408,427,523] CC, EXG, CH (only ch for 408 & 427)
  - (P)Corpus Clipped [408,427,523] CC, EXG, CH (only ch for 427 & 423)
  - (P)Amarillo [408] (ortho and CHM) CC, EXG



# User Interface

- Designed
  - Improved UI to become more friendly and easily manageable
  - Ability to select multiple Orthomosaics and Canopy Height Model files in order to make attribute generation faster
  - Warnings and pop ups in order to let the user know what is going on error wise and generation wise
- Designing
  - Progress bar during both generation and downloading in order to update on progress

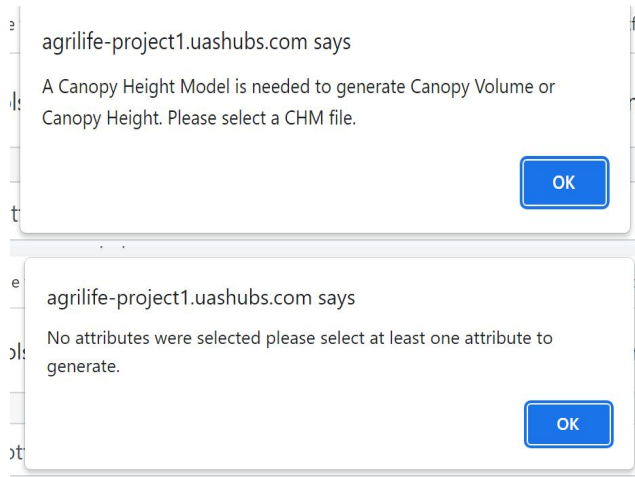


Figure 1: Warning Examples

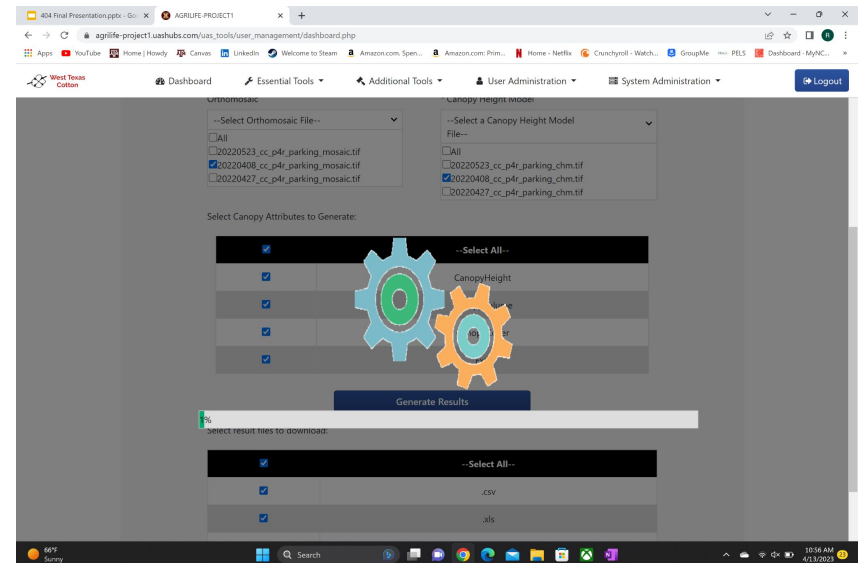


Figure 2: Progress Bar





# User Interface

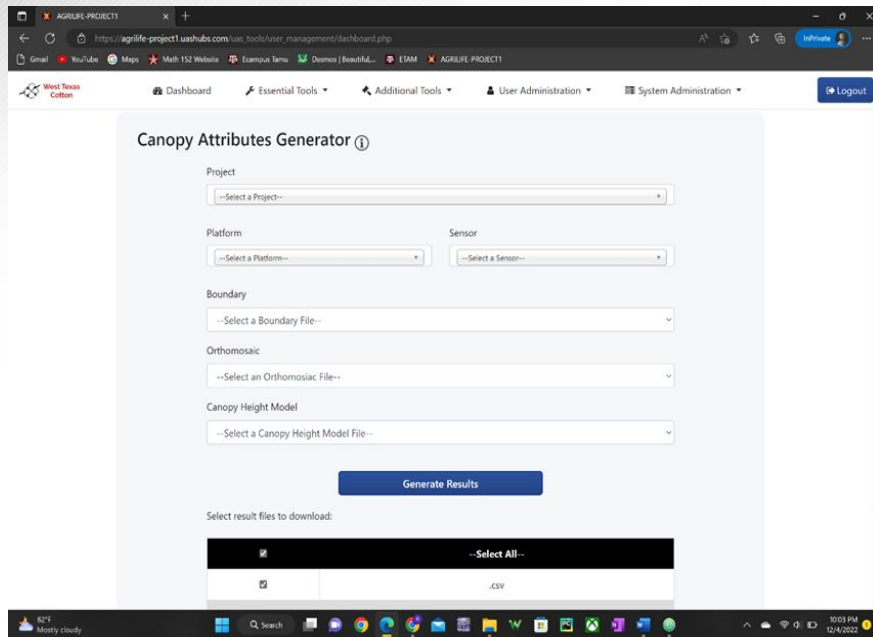


Figure 1: Website at the beginning of ECEN 404

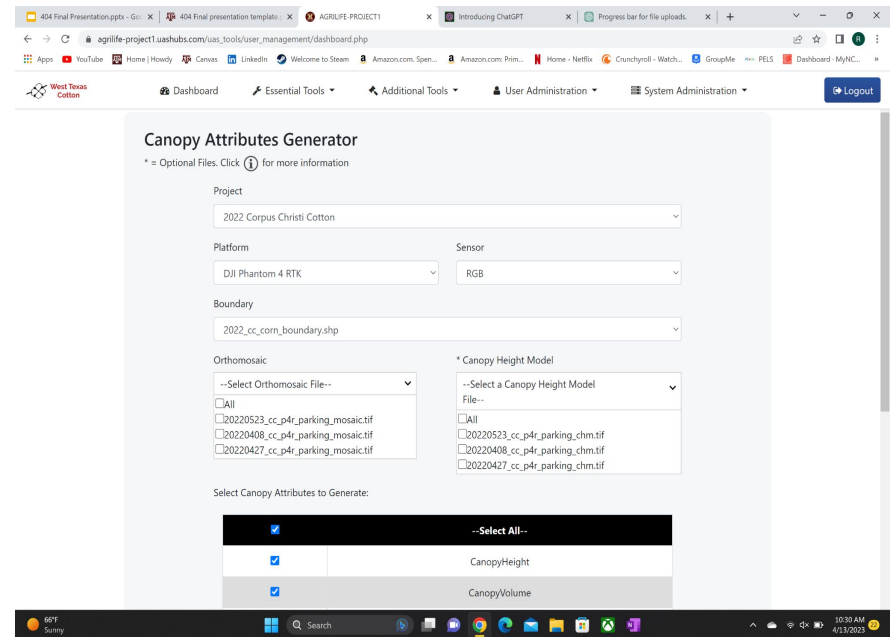


Figure 2: Most recent website UI

# User Interface

- Challenges/Solutions
  - Website would not update on normal browser due to cache and network issues so couldn't visually see any updates.
    - Used incognito windows instead of normal windows which allowed the website to update right away
  - No website development background/experience and learning how everything from front end to back end is connected. Starting the project definitely needed more effort than later on in the project
    - Clear communication between team members and explaining our subsystems to each other in order to understand what exactly might be giving us issues
- Test Cases
  - Make sure the dropdown menus populate correctly depending on what project and boundary is selected
  - Make sure all data that is populate has the correct IDs, names, directories and values attached to it
  - The pop ups and warnings are displayed based on the correct errors and displays the error message correctly
  - User Interface testing in order to test how easily manageable the website overall is



# end-to-end

Step One: Select project and respective files

Step Two: Select plant attributes and generate results

Step Three: Select the file types you would like to download and download the results

	id	left	top	right	bottom	20220408	20220427	20220523
0	9	641748.677	3073991.88	641758.677	3073979.88	5.70164001	30.963481	27.929628
1	10	641748.677	3073979.88	641758.677	3073977.88	6.87583897	30.552257	28.263403
2	11	641748.677	3073977.88	641758.677	3073975.88	5.40922964	19.5061403	17.8762904
3	12	641748.677	3073975.88	641758.677	3073973.88	7.16442113	31.2814517	33.9021574
4	13	641748.677	3073973.88	641758.677	3073971.88	7.22936849	31.7458572	34.1653445
5	16	641758.677	3073981.88	641768.677	3073979.88	6.0437292	34.0428963	36.5735417
6	17	641758.677	3073979.88	641768.677	3073977.88	6.21697816	32.8231517	41.7905624
7	18	641758.677	3073977.88	641768.677	3073975.88	7.44072514	22.9090616	43.308897
8	19	641758.677	3073975.88	641768.677	3073973.88	9.30970888	31.8000862	48.4242469
9	20	641758.677	3073973.88	641768.677	3073971.88	7.5881466	25.6356502	33.8830287
10	23	641768.677	3073981.88	641778.677	3073979.88	5.54734545	29.722607	41.3654234
11	24	641768.677	3073979.88	641778.677	3073977.88	5.69751833	23.121424	41.7898278
12	25	641768.677	3073977.88	641778.677	3073975.88	6.79039175	25.5178737	43.6034554
13	26	641768.677	3073975.88	641778.677	3073973.88	6.8474895	33.4407056	41.4705882
14	27	641768.677	3073973.88	641778.677	3073971.88	4.67784152	35.1555088	22.2396031

Step Four: View and analyze the plant attribute data

Time to generate is around 5 - 15 minutes depending on how many files and attributes are selected.

**FULL SYSTEM TEST CASES:**

**Corpus:**

- Mismatching Orthomosaic/CHM
  - [408,427,523] ,[408,427,523](P)
  - [408,427,523], [408,427](P)
  - [408,427,523], [408,523](P)
  - [408,427,523], [427,523](P)
  - [408,427,523], [408](P)
  - [408,427,523], [427](P)
  - [408,427,523], [523](P)
  - [408,427], [408,427](P)
  - [408,523], [408,523](P)
  - [408,427], [408,427](P)
  - [408,427], [408](P)
  - [408,427], [427](P)
  - [408,523], [408](P)
  - [408,523], [523](P)
  - [427,523], [427](P)
  - [427,523], [523](P)
  - [408], [408](P)
  - [427], [427](P)
  - [523], [523](P)

**Amarillo:**

- Standard:
  - [408], [408] {CC, EXG, CH}
  - [408], [408] {CH}
  - [408], {CC, EXG}
  - [408] {CC}
  - [408] {EXG}
- Unnecessary CHM:
  - [408], [408] {CC, EXG}
  - [408], [408] {CC}
  - [408], [408] {EXG}

**Success/Fail Scenarios:**

- Success:
  - (Previously listed test cases)
- Fail:
  - Selecting Canopy Height or Volume without selecting a CHM
  - Error reading image file
  - Error reading the SHP file
  - Project/Orthomosaic results do not exist
  - The specified canopy attributes do not exist

● Mix of Orthomosaics and CHMs:

- [408,427,523] ,[408,427,523] {CC, EXG, CH}
- [408,427,523] ,[408,427,523] {CH}
- [408,427,523] {CC, EXG}
- [408,427,523] {CC}
- [408,427,523] {EXG}
- [408,427], [408,427] {CC, EXG, CH}
- [408,427], [408,427] {CH}
- [408,427] {CC, EXG}
- [408,427] {CC}
- [408,427] {EXG}
- [408,523], [408,523] {CC, EXG, CH}
- [408,523], [408,523] {CH}
- [408,523] {CC, EXG}
- [408,523] {CC}
- [408,523] {EXG}
- [408], [408] {CC, EXG, CH}
- [408], [408] {CH}
- [408] {CC, EXG}
- [408] {CC}
- [408] {CC}
- [427], [427] {CC, EXG, CH}
- [427], [427] {CH}
- [427] {CC, EXG}
- [427] {CC}
- [427] {CC}
- [523], [523] {CC, EXG, CH}
- [523], [523] {CH}
- [523] {CC, EXG}
- [523] {CC}
- [523] {CC}

- These are the Full test cases for the project including both projects.
- In order to pass each test case must correctly generate results, correctly generate all zip files including the parent zip, each attribute has all of the selected files and respective merged files(if applicable)

# User application

- CC = Canopy Cover
  - Analyzes the total coverage of crops in the boundary
- EXG = Excess Green
  - Analyzes the amount of crop greenery in the boundary
- CH = Canopy Height
  - Analyzes the height of the boundary
- CV = Canopy Volume
  - Analyzes the volume of the boundary
- All attributes are important in understanding the growth of the crops and with the use of comparing multiple dates simultaneously, helps the user discover new methods to grow crops faster.

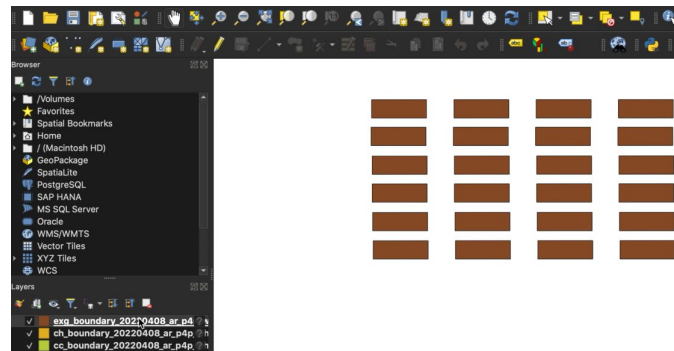


Figure 1: Example of Crop Boundaries



# Conclusions

- Issues Encountered:
  - Expectation of receiving multispectral data for project at an earlier date.
  - Addition of the Amarillo project that involved more testing and greater adaptation of the code.
  - Hard coding certain areas of code that restricted more than improved.
- Current status: Validations have been completed for RGB data for both Corpus Christi Crops and Amarillo Crops. Will continue to test, validate, and integrate multispectral.