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CSCI 577a
Team 4: Field Progress Webapp
2019 October 11

Cost Estimation V&V

Q1: COCOMO II Cost Estimation

- Estimated CSCI577a effort: 7 team members at 4 hours/week for 12 weeks = 336 W-Hs
- Estimated CSCI577b effort: N/A
- Total estimated effort: 336 W-Hs
- Budget information: No budget
- Project duration: 12 weeks (duration of CSCI577a)
- Component modules in development project:
  - Input module, 500 SLOC
  - Turf-cutting algorithm implementation, 1000 SLOC
  - Visual verification, 300 SLOC
  - Testing framework, 1200 SLOC
- Programming language used: Python, some Javascript and shell scripting

Scale Factor Values and Rationale

Scale Factor	Value	Rationale
PREC	HIGH	In general, the final product that we will be building is a combination of several existing algorithms. However, there are enough custom changes (including variable inputs of volunteers, precinct terrain, etc.) that make it different from anything else currently on the market.
FLEX	NOMINAL	The development team is given a lot of leeway in how they want to implement the project, but the final product must plug in to Field Progress's existing tech stack.
RESL	HIGH	RMP has been generally defined, as has the schedule.
TEAM	HIGH	Nikolaj and Evan are very responsive and answer all questions that we have. Frequently available via Zoom meetings and Slack.
PMAT	NOMINAL	Project is under guidance by CSCI577a staff.

Cost Driver Values and Rationale: Input module

Cost Driver	Value	Rationale
RELY	HIGH	If users are unable to provide the needed inputs to the algorithm, it will not be able to function at all.
DATA	NOMINAL	Standard input is 10s of thousands of lon, lat coordinates. Code base is 500 SCLK.
DOCU	NOMINAL	Consistently putting out reports, etc. per CSCI 577a schedule.
CPLX	NOMINAL	The module should accept as input the several pieces of precinct information needed to run and be able to pass that on to the algorithm module.
RUSE	LOW	This module is designed to be used specifically by the visualization and algorithm modules, and will not likely see any more reuse than that.
TIME	NOMINAL	User inputs should be handled efficiently and quickly.
STOR	NOMINAL	Temporary storage of the user's input to pass it on to the algorithm.
PVOL	HIGH	If the underlying storage mechanism changes that stores the input values, then there would have to be significant rework.
ACAP	HIGH	Mayank has shown themself to be capable of producing required documentation and is easy to communicate with.
PCAP	HIGH	Development team (consisting of all members) communicates and works well online.
PCON	NOMINAL	Little-to-no risk of team member turnover, due to limited duration of project and severe academic consequences.
APEX	NOMINAL	Nearly all team members have professional/academic experience with building applications and algorithm design.
LTEX	NOMINAL	Nearly all team members have professional/academic experience with Python programming.
PLEX	LOW	Few team members have experience working with GIS technologies.
TOOL	NOMINAL	Team uses Github, JIRA, and mature development tools (text editors, etc.)
SITE	HIGH	Although Kevin is a DEN student and is typically unable to meet in person, he lives in the Los Angeles area and could meet if necessary. Additionally, the team is fluent in video conferencing tools and e-mails.
SCED	NOMINAL	The schedule is set at 12 weeks.

Cost Driver Values and Rationale: Turf-cutting module

Cost Driver	Value	Rationale
RELY	HIGH	If the turf cutting fails, campaign managers will have to resort to cutting the turf by hand again. This could cost Field Progress quite a bit of money and reputation, as this functionality is a major piece of their offering.
DATA	NOMINAL	Standard input is 10s of thousands of lon,lat coordinates. Code base is 1K SCLK.
DOCU	NOMINAL	Consistently putting out reports, etc. per CSCI 577a schedule.
CPLX	HIGH	Algorithm itself is extended K-means with additional considerations for other external factors, including terrain and volunteer availability. K-means itself is fairly straightforward, but including additional variables such as these complicates the procedure significantly.
RUSE	HIGH	The code must be designed in a modular way so that it can be plugged easily into the rest of FP's tech stack.
TIME	NOMINAL	Execution time should be limited to short bursts of high-computation effort.
STOR	NOMINAL	Need to be able to store lon,lat coordinates, user settings, and previous runs.
PVOL	NOMINAL	Python applications tend to not be too dependent on the underlying platform.
ACAP	HIGH	Mayank has shown themself to be capable of producing required documentation and is easy to communicate with.
PCAP	HIGH	Development team (consisting of all members) communicates and works well online.
PCON	NOMINAL	Little-to-no risk of team member turnover, due to limited duration of project and severe academic consequences.
APEX	NOMINAL	Nearly all team members have professional/academic experience with building applications and algorithm design.
LTEX	NOMINAL	Nearly all team members have professional/academic Python development experience.
PLEX	LOW	The team has some experience working with GIS-related technologies.
TOOL	NOMINAL	Team uses Github, JIRA, and mature development tools (text editors, etc.)

Cost Driver	Value	Rationale
SITE	HIGH	Although Kevin is a DEN student and is typically unable to meet in person, he lives in the Los Angeles area and could meet if necessary. Additionally, the team is fluent in video conferencing tools and e-mails
SCED	NOMINAL	The schedule is set at 12 weeks.

Cost Driver Values and Rationale: Visual verification module

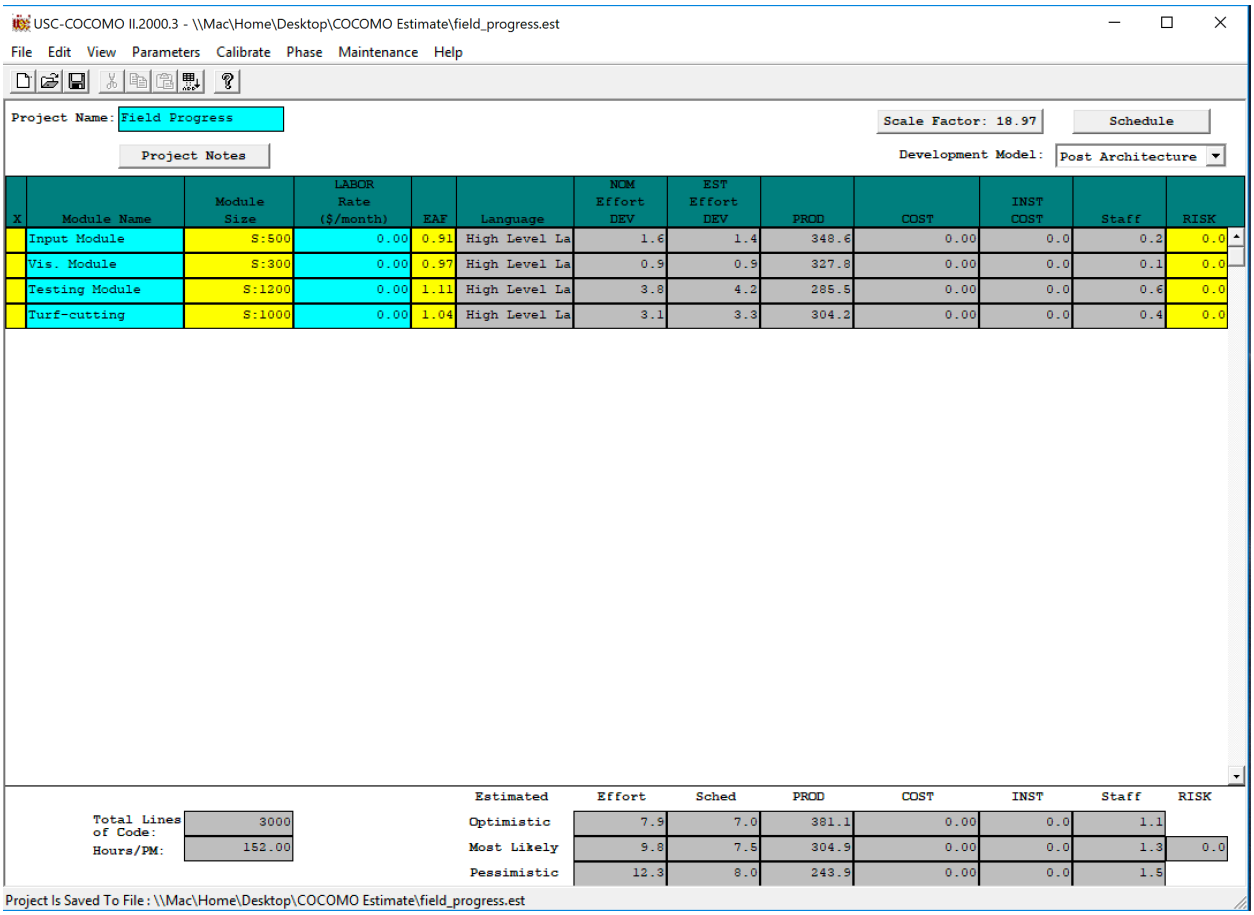
Cost Driver	Value	Rationale
RELY	NOMINAL	If the visualization module is not functioning properly, volunteers can still be told where to go without the visual aid it's supposed to provide. However, confusion can arise and result in volunteers knocking on the wrong doors.
DATA	NOMINAL	Standard input is 10s of thousands of lon, lat coordinates. Code base is 300 SCLK.
DOCU	NOMINAL	Consistently putting out reports, etc. per CSCI 577a schedule.
CPLX	HIGH	The algorithm outputs are multifaceted, and involve multiple paths for different sets of volunteers. Plugging these results into visualization libraries will be difficult, even if we don't need to write most of it from scratch.
RUSE	LOW	Verification is only to be used during development and there will be no need for it afterward.
TIME	NOMINAL	Rendering algorithm results takes little to no execution time with available libraries.
STOR	NOMINAL	Little to no additional storage is required to render a map.
PVOL	HIGH	Web browsers change quite frequently, often with app-breaking changes that must be stayed on top of.
ACAP	HIGH	Mayank has shown themself to be capable of producing required documentation and is easy to communicate with.
PCAP	HIGH	Development team (consisting of all members) communicates and works well online.
PCON	NOMINAL	Little-to-no risk of team member turnover, due to limited duration of project and severe academic consequences.
APEX	NOMINAL	Nearly all team members have professional/academic experience with building applications and algorithm design.
LTEX	NOMINAL	Nearly all team members have professional/academic Javascript development experience.
PLEX	LOW	A few team members have experience working with GIS frontend technologies.
TOOL	NOMINAL	Team uses Github, JIRA, and mature development tools (text editors, etc.).
SITE	HIGH	Although Kevin is a DEN student and is typically unable to meet in person, he lives in the Los Angeles area and could meet if necessary. Additionally, the team is fluent in video conferencing tools and e-mails.
SCED	NOMINAL	The schedule is set at 10 weeks.

Cost Driver Values and Rationale: Testing framework module

Cost Driver	Value	Rationale
RELY	HIGH	Broken unit and integration tests are typically the first indicator that the application in development is not performing as expected. Therefore, if these tests fail, the application itself will likely fail, at significant cost to campaigns and Field Progress itself.
DATA	HIGH	Standard input is 10s of thousands of lon, lat coordinates. Code base is 1200 SCLK.
DOCU	NOMINAL	Consistently putting out reports, etc. per CSCI 577a schedule.
CPLX	HIGH	Navigating the nuances of testing the application sufficiently on multiple different platforms (mobile, Mac, Windows) is quite complex.
RUSE	NOMINAL	Each unit/integration test will apply to a specific function point in the algorithm and so will not apply to other parts of the Field Progress webapp.
TIME	NOMINAL	Unit tests run nearly instantaneously, and integration tests take only slightly longer.
STOR	NOMINAL	Unit and integration tests require nearly no additional storage to run.
PVOL	NOMINAL	Python applications tend to not be too dependent on the underlying platform.
ACAP	HIGH	Mayank has shown themself to be capable of producing required documentation and is easy to communicate with.
PCAP	HIGH	Development team (consisting of all members) communicates and works well online.
PCON	NOMINAL	Little-to-no risk of team member turnover, due to limited duration of project and severe academic consequences.
APEX	NOMINAL	Nearly all team members have professional/academic experience with building applications and algorithm design.
LTEX	NOMINAL	Nearly all team members have professional/academic experience with Python and Pytest.
PLEX	LOW	A few team members have experience working with GIS database technologies.
TOOL	NOMINAL	Team uses Github, JIRA, and mature development tools (text editors, etc.).
SITE	HIGH	Although Kevin is a DEN student and is typically unable to meet in person, he lives in the Los Angeles area and could meet if necessary. Additionally, the team is fluent in video conferencing tools and e-mails.

Cost Driver	Value	Rationale
SCED	NOMINAL	The schedule is set at 10 weeks.

COCOMO II Analysis Interpretation



In the most ***pessimistic*** case, all of the modules would need **12.3 person-months** to complete (according to COCOMO estimate).

According to EC-13, slide #27, a CSCI 577 (single semester) student's effort is equivalent to **1.67 COCOMO II person-months**.

By dividing 12.3 by 1.67, we determine that we would need **7.37 students** to complete this effort on time.

This is fractionally more than the actual number of people on the team (7 students), so we need to be productive and ensure that all modules are completed. Worst case, one or two team members may be able to intern for Field Progress during the summer.

We may also be able to cut back somewhat on the testing module to further bring down the effort required, as needed.

Q2: Differences between V&V and LCP versions of this analysis

In general, V&V and LCP found agreement on the ratings for the various cost drivers and scale factors. In two cases, however, some discussion was had to clarify what each other meant with their rating, and each conflict was resolved and documented as follows:

- PVOL for Input module
  - LCP: HIGH
  - V&V: NOMINAL
  - Rationale: LCP felt that the input module's ability to function properly was heavily dependent on the backend data store. Any changes to the data store would likely have a large impact on the code base, and would require a large amount of rework.
  - Resolution: After some explanation, V&V agreed with LCP's rating.
- TOOL for all modules
  - LCP: LOW
  - V&V: NOMINAL
  - Rationale: V&V felt that the large amount of tooling that is available to us as CSCI 577a students–including JIRA, Github, Winbook, ICSM EPG–gives us a NOMINAL TOOL rating.
  - Resolution: After some discussion, LCP agreed with V&V's rating.