

COST ESTIMATION – LCP VERSION

(1) Cost Estimation

The following conditions were used to estimate the cost of our system

1. This project has no budget for our development efforts.
2. The duration of the project is 12 weeks
3. There are seven developers contributing 4hrs/week i.e., a total of 336 hr.
4. There are three modules in this system.
 - a. Input module
 - b. Turf cutting module
 - c. Visualization module
 - d. Testing framework

The core functionality of the application being the turf cutting module to be implemented using Python and be integrated with mapbox/deck.gl for visualization.

The following is module listed in the system and its estimated size with Source Lines of Code (SLOC)

Module lists and SLOC of each module

No.	Module Name	Brief Description	SLOC
1	Input module	Provide an interface for the users to input voter and volunteer information	500
2	Turf cutting module	Clustering of voter data within the given precincts	1000
3	Output module (Visualization)	Provide an interface for the users to view the cut turfs visually in a map-based view	300
4	Testing framework (internal use)	Build a testing framework for validating the system for its effectiveness both module wise and integration with each other	1200

COCOMOII Scale Drivers

Scale Driver	Value	Rationale
PREC	HIGH	The development team has considerable familiarity with this type of tool. System implementation involves usage of several available algorithms and tools
FLEX	NOMINAL	The system needs to considerably conform to pre-established requirement from the client and external interface specifications, e.g. GIS. It should finally be plugged into the existing Field Progress's stack. However, the clients have given enough flexibility in choosing the technologies to be used for implementation of algorithm
RESL	HIGH	All critical risk items, schedule and internal milestones are identified. However, there is some uncertainty in compatibility of COTS products with each other
TEAM	HIGH	Each stakeholder has considerable consistency of objectives and willingness to accommodate others' objectives. Although the team consists of stakeholders both on and off site, good collaboration has been achieved via video conferencing and emails
PMAT	NOMINAL	The development team follows ICSM guidelines, and is under the guidance of course staff

COCOMOII Cost Drivers

Input Module cost driver rationale

Cost Driver	Value	Rationale
RELY	HIGH	Turf cutting and Visualization modules depend on this module. The effect of software failure is high, as without input other modules cannot function
DATA	NOMINAL	Input to the system includes thousands of entries of voter data consisting of latitudes, longitudes and precincts and volunteer information like no. of volunteers, availability, capability etc. Approx. 500 SLOC to provide an interface to take in this input data
DOCU	NOMINAL	Because the development process follows ICSM, the document for life-cycle needs is normal.
CPLX	NOMINAL	Simple UI component which takes in user input
RUSE	LOW	Interface to take the input is specific to the application being designed. May not be reused
TIME	NOMINAL	System should be able to take in user data in a considerable time

STOR	NOMINAL	Should have the capability to store the provided input as it in turn serves as an input to the algorithm
PVOL	HIGH	Voter information is critical to the project. Hence needs to be stored appropriately
ACAP	HIGH	Development team could communicate and co-operate with each other very well
PCAP	HIGH	Development team has shown themselves to be capable of analyzing, designing and implementing the feature
PCON	NOMINAL	Not quite risky as it is a 12-week project and team members are committed to course guidelines
APEX	NOMINAL	Development team has relevant professional/academic experience in building software applications
LTEX	NOMINAL	Input interface may be provided as an executable or web application. Development team has the required skills to build such an interface
PLEX	LOW	Team members have experience in building user interfaces
TOOL	NOMINAL	Team uses various project management tools like GitHub for maintaining repos, Jira for tracking the tasks and defects and MS Project for project planning
SITE	HIGH	Team consists of 6 on-campus and 1 off-campus student. Team collaboration has never been a problem as the team is proficient in using tools for video conferencing and exchanging emails for communication
SCED	NOMINAL	The schedule is fixed for 12 weeks in Fall semester

Turf-cutting Module cost driver rationale

Cost Driver	Value	Rationale
RELY	HIGH	Failing to cut turfs automatically is quite risky. Although the user can cut turfs manually in case of system failure, the main aim of this project is to provide an algorithm to cut turfs automatically. So, providing a reliable algorithm is quite important
DATA	NOMINAL	Input to the system includes thousands of entries of voter data consisting of latitudes, longitudes and precincts and volunteer information like no. of volunteers, availability, capability etc. Approx. 1000 SLOC to process the input and cut turfs
DOCU	NOMINAL	Because the development process follows ICSM, the document for life-cycle needs is normal.
CPLX	HIGH	This involves implementation of extended k-means algorithm. Extended because client specifications like volunteer availability, terrain, walkability and certain others needs to be considered
RUSE	HIGH	Algorithm should be designed in such a way that it could be plugged into Field Progress' existing stack
TIME	NOMINAL	Algorithm should be designed such that the execution time is short

STOR	NOMINAL	Should be able to process and transform the data into required format
PVOL	NOMINAL	As we are using Python libraries for implementation of algorithm, it may not be too dependent on the underlying platform
ACAP	HIGH	Development team could communicate and co-operate with each other very well
PCAP	HIGH	Development team has shown themselves to be capable of analyzing, designing and implementing the feature
PCON	NOMINAL	Not quite risky as it is a 12-week project and team members are committed to course guidelines
APEX	NOMINAL	Development team has relevant professional/academic experience in building software applications
LTEX	NOMINAL	Development team has prior experience of building applications in Python
PLEX	LOW	Development team has considerable experience working on PostGIS and Postgres technologies
TOOL	NOMINAL	Team uses various project management tools like GitHub for maintaining repos, Jira for tracking the tasks and defects and MS Project for project planning
SITE	HIGH	Team consists of 6 on-campus and 1 off-campus student. Team collaboration has never been a problem as the team is proficient in using tools for video conferencing and exchanging emails for communication
SCED	NOMINAL	The schedule is fixed for 12 weeks in Fall semester

Visualization Module cost driver rationale

Cost Driver	Value	Rationale
RELY	NOMINAL	Visualization is important as it provides the user to view the output of the algorithm i.e. turf cutting in a map view. Plan is to plugin the data into visualization tools like mapbox/deck.gl
DATA	NOMINAL	Around 300 SLOC for integration with above mentioned tools
DOCU	NOMINAL	Because the development process follows ICSM, the document for life-cycle needs is normal.
CPLX	HIGH	Quite complex to integrate with visualization tools/libraries
RUSE	LOW	Required for verification during development cycle. May or may not be required after integrating with actual output module
TIME	NOMINAL	As we are using existing libraries, execution time will be less
STOR	NOMINAL	No additional storage is required
PVOL	HIGH	Browser upgrades could be a possible risk
ACAP	HIGH	Development team could communicate and co-operate with each other very well
PCAP	HIGH	Development team has shown themselves to be capable of analyzing, designing and implementing the feature

PCON	NOMINAL	Not quite risky as it is a 12-week project and team members are committed to course guidelines
APEX	NOMINAL	Development team has relevant professional/academic experience in building software applications
LTEX	NOMINAL	Development team has prior experience of building applications in Python
PLEX	LOW	Development team has considerable experience working on the visualization tools/libraries mentioned above
TOOL	NOMINAL	Team uses various project management tools like GitHub for maintaining repos, Jira for tracking the tasks and defects and MS Project for project planning
SITE	HIGH	Team consists of 6 on-campus and 1 off-campus student. Team collaboration has never been a problem as the team is proficient in using tools for video conferencing and exchanging emails for communication
SCED	NOMINAL	The schedule is fixed for 12 weeks in Fall semester

Testing Framework Module cost driver rationale

Cost Driver	Value	Rationale
RELY	HIGH	Testing is a fairly important component as it defines the quality of the product. Testing framework must be good enough to catch any bugs and ensure that the product is working as expected
DATA	HIGH	Requires good amount of test data to test all modules of the product individually and integration between them. Around 1200 SLOC including both unit and integration test cases
DOCU	NOMINAL	Because the development process follows ICSM, the document for life-cycle needs is normal.
CPLX	HIGH	Unit tests to verify working of each module separately and integration with one another to test the end to end functionality
RUSE	NOMINAL	Could be reused/extended by maintainer if there comes a need to verify any issues or test any additional functionality
TIME	NOMINAL	Doesn't take much time for test execution
STOR	NOMINAL	No additional storage is required
PVOL	NOMINAL	Test scripts are not too dependent on the underlying platform
ACAP	HIGH	Development team could communicate and co-operate with each other very well
PCAP	HIGH	Development team has shown themselves to be capable of analyzing, designing and implementing the feature
PCON	NOMINAL	Not quite risky as it is a 12-week project and team members are committed to course guidelines
APEX	NOMINAL	Development team has relevant professional/academic experience in building software applications
LTEX	NOMINAL	Development team has prior experience of building and verifying applications in Python

PLEX	LOW	Development team has considerable experience working on testing frameworks
TOOL	NOMINAL	Team uses various project management tools like GitHub for maintaining repos, Jira for tracking the tasks and defects and MS Project for project planning
SITE	HIGH	Team consists of 6 on-campus and 1 off-campus student. Team collaboration has never been a problem as the team is proficient in using tools for video conferencing and exchanging emails for communication
SCED	NOMINAL	The schedule is fixed for 12 weeks in Fall semester

COCOMO Estimation Result

USC-COCOMO II.2000.3 - Untitled

File Edit View Parameters Calibrate Phase Maintenance Help

Project Name: Scale Factor: Schedule

Project Notes Development Model:

X	Module Name	Module Size	LABOR Rate (\$/month)	EAF	Language	NCM Effort DEV	EST Effort DEV	PROD	COST	INST COST	Staff	RISK
	Input Module	S:500	0.00	0.91	High Level La	1.6	1.4	348.6	0.00	0.0	0.1	0.0
	Turf Cutting	S:1000	0.00	1.04	High Level La	3.1	3.3	304.2	0.00	0.0	0.3	0.0
	Visualization	S:300	0.00	0.97	High Level La	0.9	0.9	327.8	0.00	0.0	0.1	0.0
	Testing Module	S:1200	0.00	1.11	High Level La	3.8	4.2	285.5	0.00	0.0	0.4	0.0

		Estimated	Effort	Sched	PROD	COST	INST	Staff	RISK
Total Lines of Code:	3000	Optimistic	7.9	9.1	381.1	0.00	0.0	0.9	
Hours/PM:	152.00	Most Likely	9.8	9.7	304.9	0.00	0.0	1.0	0.0
		Pessimistic	12.3	10.4	243.9	0.00	0.0	1.2	

Report Is Saved To File : C:\Users\madha\Documents\MS\Fall 2019\CSCI 577A SE\Project\cost-estimation-lcp.rpt

COCOMO II Analysis Interpretation

We are on a 12-week schedule which drives the development of a set of core capabilities and the above estimates show the effort required for the project.

According to COCOMO II estimates for CSCI 577 for a 12-week schedule, one team member effort=1.67 COCOMO II person months. The pessimistic effort from the COCOMO estimation above is 12.3, so the total team members needed for this project = $12.3/1.67 = 7.36$

Since there is only a fractional difference ($7.36 - 7 = 0.36$) between the actual number of people in the team and the pessimistic effort estimation above, we would be able to finish the project in time.

(2) Differences rationale

We had few differences in driver ratings between the versions of cost estimation provided by LCP and V&V.

Driver	LCP	V&V	Reasoning	Resolution
PVOL for Input module	HIGH	NOMINAL	LCP thinks it is HIGH because input data is critical for the product functionality and it needs to be securely stored. Any upgrades/changes to the database/server may cause loss of data	Upon discussion, V&V agreed to the rationale provided by LCP
TOOL in all modules	LOW	NOMINAL	V&V thinks that team needs to have good knowledge in using the tools used for project management	Upon discussion, LCP agreed to the rationale provided by V&V