Department of Computer Science & Engineering
The University of Texas at Arlington

Project Charter
CSE 4317: Senior Design II
Summer 2021

Laminar Workflow
Quick Quote

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Revision History

Revision	Date	Author(s)	Description
0.1	02.27.2021	EK, LM	document creation
0.2	02.27.2021	EK, LM	complete draft
1.0	02.27.2021	EK, NT	Sections 5,6,10, 11 completed
1.1	02.27.2021	EK, NT	Sections 14.1.1-4 completed and reviewed
1.2	02.28.2021	EK	Sections 14.3.1,2,3,7,8,9, completed
1.3	02.28.2021	AK,SP	Sections 4,9, 14.2.1-14.2.5 completed and reviewed
2.0	02.28.2021	EK	Final Draft read through and edits for sections 1, 2, 4, 5, 6, 7, 14.2 and 14.3
2.1	05.04.2021	SP, AK, LM	Read through all the sections to verify for version-2
2.1	08.01.2021	SP, AK, NT, LM, AK	Close Out Review

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1 Problem Statement

Manufacturing job shops that provide 2D cutting (laser, plasma, waterjet) take too long to provide customers with a quote; it takes roughly 2-4 days to get a quote. With online shopping being so popular the desire for instant results is expected by customers. Quotes done by a person are also not consistent due to the tedious process for creating a quote that allows a lot of room for error. By creating an automated instant quoting program, customers will be able to get an accurate quote instantly from companies that offer 2-D cutting services. This will help companies to get and retain customers as companies will have a reliable and easy to use process for getting accurate quotes for their desired product.

2 Methodology

We are going to develop a website that will automate quoting for job shops offering 2d cutting services (laser, plasma, waterjet) using a DXF file. At the moment, quoting is not consistent and takes up to 2 - 4 days. With our Quick Quote application we are looking to provide customers with instant, consistent, and reliable quotes. Each job shop will have their own branded landing page for customers to drop in DXF files and receive their pricing. Job shops will be allowed customize their pricing parameters as they please.

3 Value Proposition

Sponsor will be able to use the 'Quick Quote' system.The system we build for the sponsor will facilitate users with quick quoting facilities. The spontaneously generated quote will be helpful for both the business and its customers.

4 Development Milestones

All the broad phases and the main development stage of the project have been planned and broken down into more details. The milestone and completion dates are listed below.

- Project Charter first draft - February 29, 2021
- System Requirements Specification - March 2021
- Architectural Design Specification - March 2021
- Detailed Design Specification - April 2021
- CoE Innovation Day poster presentation - April 19, 2021
- Demonstration of parsing DXF files - May 2021
- Demonstration of online user interface- May 2021
- Demonstration of online interface for job shops - June 2021
- Demonstration of auto generate work orders - June 2021
- Demonstration of auto generate customer feedback and tracking process - July 2021
- Quality Assurance Testing and Deployment - July 2021
- Final Project Demonstration - August 2021

5 BACKGROUND

Along with the development of new tools and technologies, there are wide numbers of metal cutting shops that provide efficient and quick 2D cutting services to the customers. However, these shops are lacking an efficient price quoting service for customers. Currently, a customer has to wait a long time to get a price quote for their design. The current process uses manual price quoting services where a customer will send their design file to a company. This design is reviewed by an employee of the shop who estimates a price quote for the customer. This process will cause a significant delay to the customer as well as extra labor for the company. Moreover, the price quoted manually is not consistent or convenient, which adds further dissatisfaction for the customer. There are thousands of 2D cutting companies that are facing this problem in the US. Just in the DFW area, there are more than 50 companies trying to figure out a solution for this problem.

The 2D cutting companies need a solution to maintain a rapid flow in their cutting process. Providing instant price quotes ensures consistency in their price quotes. In order to achieve this goal, our team is developing a web based application "Quick Quote", which could be a primary tool for estimating prices. Quick Quote will provide an instant price quote for cutting processes based on the DXF files uploaded by customers. Moreover, customers can immediately place an order if the quoted price sounds convincing to them. The web application will focus on easy and secured online transactions for the customers.

As a developer, the major goal of our project is to uplift the business value of the 2D cutting companies by focusing on rapid and consistent price quoting and transactions. As the result of this project, customers will get the instant and consistent price quote, which will make their experience better. On the other hand, the cutting company will receive an automated "price quoting" application which will take their business to next level.

6 RELATED WORK

Virtually every company that offers 2D cutting has some type of quoting process. Most of them take several days but there are several companies that have their own "instant quote" technology. For example the company Xometry has a quick quoting service that seems to be very Robust. Their website allows you to upload a large range of file types and is intended to return an instant quote [5]. Our goal would be to replicate this process. Our client wants to offer a quick quoting service that can be utilized by any company. Our goal is to create an open platform with a state of the art instant quote that can offer value to the customers and a marketable product to our client.

Currently there are open source programs available that can parse a DXF file in java [4]. As this is the heart of our product we may end up adopting one of these methods and making any adjustments as needed. Where our product will set itself apart is by offering a landing page for customers to be able to use this instant quoting technology in a way that represents it as their own. Our goal will be to make a platform similar to Myspace that allows for companies to have a page designated to them and that is customizable and offers their customers the instant quoting service.

With several companies such as 3Dhubs [1], 3erp [2], Fictiv [3], and Xometry already offering instant quoting, it is clear that any company that does not have access to such a service is at a disadvantage. The aforementioned companies all have proprietary technology when it comes to their instant quote service with the intention of keeping them ahead of the competition. Our goal is to offer a product that can level the playing field for those companies who do not yet have access to the needed technology to keep up with the growing demand for instant results.

Another added factor is that our intended product will only parse DXF files. All of the aforementioned companies that offer a similar product can give an instant quote on an array of file types. For our product to be relevant and marketable it seems clear that our end goal will be to try and include the following file types in our instant quote service: STEP (.stp, .step), SOLIDWORKS (.sldprt), STL (.stl),

Parasolid, Autodesk Inventor (.ipt), Dassault Systems (.edxml, .catpart), CADKEY (.prt), PTC, Siemens (.prt), ACIS (.sat), DXF (.dxf) [6].

The difficulty of this task is not yet fully understood, but without such features it seems our product would lack significant market value for companies.

7 System Overview

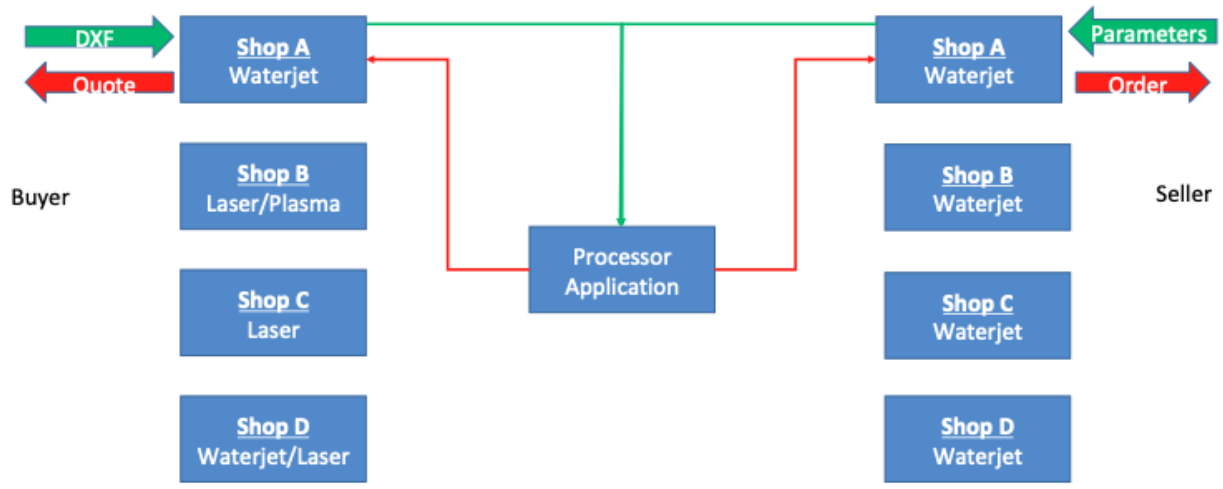

Figure 1: System Overview

The way we plan on implementing this Quick Quote program which will be run on a cloud based server, is by first creating a parsing algorithm. This will take in a DXF file and output the total length of cut, number of pierce points, and total area/volume of the material. Once that is taken care of, the online user (customer/job shop) interface is next.

The job shop will set the price they want on the different cutting processes they provide. They will also be about to customize the website template to best fit their shop theme. This way the customer will still believe that the application they are using is the same store they are looking to buy from. Finally shops need to be able check user metrics to see what is selling the best or the worst, to better adjust their prices. The customer will get to our Quick Quote program by clicking a link from the shops website. They will be asked to provide the following information: Type of cutting process (if job shop provides multiple methods), type and thickness of materials, lead time, and most importantly the DFX file. We will also ask for some personal information like their name, email and phone number to contact the customer.

Once the shop's parameters and the customers info is filled in, the program will send the DXF file and the cutting/material information to the parsing algorithm. The algorithm will parse the DXF file and output the total length of cut, number of pierce points, and total area/volume of the material. These values and the shops parameters will be used to calculate the quote, which will be sent to the customer in a matter of minutes. If the customer likes the price and wants to place the order, they will be asked for their credit card information and proceed to payment. The order is now finalized and an order confirmation will be sent to the user and shop.

8 Roles & Responsibilities

The stakeholders of this project will be our sponsor Robert Gullette and his customers who require quick-quoting facilities. Our sponsor will be our point of contact. Team members working for this project include Sindhu Parajuli, Laith Marzouq, Alisha Kunwar, Nishan Thapa and Eric keng.Laith Marzouq will be our team leader who will be responsible for leading the team towards meeting the project goals.Eric Keng will be responsible for handling communications with the Sponsor or other required party. We will rotate the responsibility of scrum master and product owner among the team members throughout various sprints so each of us can keep our team in check and learn how to handle those roles.

9 Cost Proposal

This budget proposal include all of the necessary cost involved with the Laminar Workflow project. Our project is sponsored by Robert Gullette. We will have a 800 dollars budget from the CSE Department. The cost associated with the project have been broken down and itemized.As our project is software-based our major expenses seems to be for software license.

9.1 Preliminary Budget

We have roughly estimated the budget. The final budget will be updated later. The rough assumption is below in the table.

Item	Percentage
Software Licenses/Frameworks	70
Other	30

Table 1 : Assumption of preliminary budget

9.2 Current & Pending Support

The current funding source for the project is from UTA CSE Department. The funding amount of eight hundred dollars will be provided and it is secured. This project is web based so we might not need any external funding. In case if any additional funding is required, our sponsor will provide necessary expenses.

10 Facilities & Equipment

Our project is mainly software-based. So, we won't be needing any physical lab space or any equipment. Team members will use their own devices for developing and testing the application. Most of the tools like IDE, database server, testing tools are available online without any cost. Our team will take full advantages of those tools and technologies.

In case of failure of personal laptops or computer, team members might borrow laptops from UTA library. Due to COVID 19 pandemic, all of the team meeting are virtually done.Our team might utilize the UTA lab spaces only if there is an emergency need to conduct in-person meetings.

For the better understanding of project, at some point we might need to have good idea of tools and machines that are used to do the cutting process. For example, we might need to have some idea of the machine that does laser cutting. If any such thing is required, our sponsor will give us a tour to the cutting shop to better understand the tools and the cutting process.

For testing purpose, we might utilize the automated testing tools like JUnit. All of the required DXF files and test cases will be provided by our sponsor.

11 Assumptions

The following list contains critical assumptions related to the implementation and testing of the project.

- DXF parsing is not a new concept and there will be software/code available that we can use and/or learn from in our development
- Our team will all be able to code from their personal computers at home
- There will not be any major purchases such as licensing or software that is needed for the implementation of our product design
- Our client will provide sufficient input and output variables to be used during the testing phase
- No current copyrights or patents exist that would interfere with the development of our product
- Our client will be able to provide the means to access a sufficient database service to be able to support the final product when it goes live

12 Constraints

The following list contains key constraints related to the implementation and testing of the project.

- Final prototype demonstration must be completed by August 10th, 2021
- Total development costs must not exceed $800
- Testing can only be accessible by the development team
- Development team can only meet online via teams, Because of COVID 19 restrictions
- Sponsor is not a CSE major and doesn't have any development experience

13 Risks

As most concepts and requirements of the project are new ideas and concepts, there are certain risks. The following high-level risk census contains identified project risks with the highest exposure. Mitigation strategies will be discussed in future planning sessions.

Risk description	**Probability**	**Loss (days)**	**Exposure (days)**
Lack of skills and knowledge of required technology	0.50	30	15
Change in requirements and rework by the Sponsor	0.50	15	7.5
Loss of a team-member	0.15	40	6
Lack of communication between the team members	0.20	15	3
Correctness of the System's algorithms and calculations	0.10	10	1.0

Table 2 : Overview of highest exposure project risks

14 Documentation & Reporting

14.1 Major Documentation Deliverables

14.1.1 Project Charter

The project charter will be edited in parts by each team member. Each team member will add their revision history when a revision is made. The initial version of the product charter will be completed and presented by the end of our Sprint 1, March 1st. The document will be updates as new information comes to light and the final version will be delivered with our final product.

14.1.2 System Requirements Specification

This document is a detailed documentation of the features and behaviour of our application. The initial version will be delivered will be delivered on March 22, 2021. Team will review this document on bi-weekly basis and also after the end of each sprint. Further, team will update the document if there is any change needed on the system. The final version will be delivered with our final product on August 10, 2021.

14.1.3 Architectural Design Specification

This document includes the detailed architectural design of our application. Our team will be working in detail on domain models, Class diagrams, use cases, sequence diagrams and come up with the best possible design. The team will be in touch with the sponsor to figure out the perfect architectural design for our application. The initial version will be submitted on April 12, 2021. Team will review this document on bi-weekly basis and also after the end of each sprint. Further, team will update the document if there is any change needed on the system. The final version will be delivered with our final product on August 10, 2021.

14.1.4 Detailed Design Specification

This document includes a detailed documentation of the design of our application. First of all, an initial version of this document will be submitted. Team will review this document on bi-weekly basis and also after the end of each sprint. Further, team will update the document if there is any change needed on the system. The final version will be delivered with our final product on August 10, 2021.

14.2 Recurring Sprint Items

14.2.1 Product Backlog

The functional requirements mentioned by the sponsor will be added to the product backlog from the system requirements specification. We will build this project from scratch using agile methodology. The items will be prioritized on the basis of importance for the product backlog. The group vote will make the decision regarding the project. We will use Trello to maintain and share product backlog with team members and stakeholders.

14.2.2 Sprint Planning

We will have a team meeting before each sprint for planning the upcoming sprint. For senior design I, there are approximately 8 sprints. The sprint durations will be managed according to the timeframe for the spring and summer semester.

14.2.3 Sprint Goal

During the sprint plan meeting, the scrum master will decide the sprint goal. As we are using agile methodology, meetings will be held with our client to update the progress and receive feedback at each phase.

14.2.4 Sprint Backlog

In a sprint plan meeting, the scrum master will decide which product backlog items to add into the sprint backlog by a group vote. The backlog will be maintained using Trello.

14.2.5 Task Breakdown

The scrum master will divide and assign tasks to the team members from the sprint backlog. Each team member will use their Engineering Notebook to track the time spent on each task. The product owner will be communicating with each team member to document the total time spent on tasks.

14.2.6 Sprint Burn Down Charts

The scrum master will be responsible for generating the burn down charts for each sprint. Every meeting, hours will be noted down. The time spent on working will also be kept in track by each individual on Trello so it's easier for the scrum master to use it on the burn down chart.

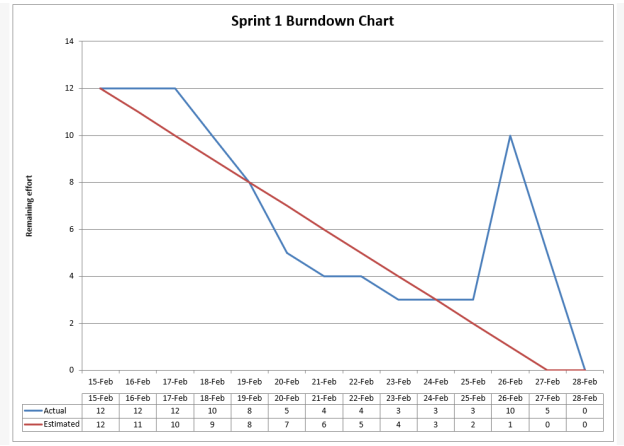

Figure 2: Example sprint burn down chart

14.2.7 Sprint Retrospective

A sprint retrospective will be conducted after the completion of every sprint. It will be conducted a day after the sprint is finished between the team-members. Mainly the progress, challenges and backlog of the past sprint will be discussed. One team-member will be designated to note important discussed points as a summary and upload it on Teams for everyone as a reference.

14.2.8 Individual Status Reports

The individual status report will have the tasks completed, in progress, and left to do by each member on a weekly basis. It will also have the challenges faced and the strategies to overcome the challenges.

14.2.9 Engineering Notebooks

Engineering notebooks will be updated each week after every team-meetings. It's required to note down the meetings, sponsors feed-back, individual progress, and the team's progress. Each member should write down a page in their notebook weekly. The members will have to take a picture of their notebook and upload it under the 'Notebook' folder of the Laminar Team in Microsoft teams. Each member will be the witness of the weekly engineering notebook page.

14.3 Closeout Materials

14.3.1 System Prototype

The final prototype will be a web page that allows a drag and drop feature to upload a DXF file. The web page will be supported by software that returns a quoted price based on the DXF file. Our client will do the final testing of the prototype website and will give any feedback as necessary. Client will also provide input parameters (DXF files) and desired output variables. Final testing will be done by the client by presenting the prototype to his potential customers.

14.3.2 Project Poster

At this time we need further information on what will be expected and required for the Project Poster. Client and College requirements need to be reviewed.

14.3.3 Web Page

Web page will be accessible via a subscription base for customers. A functioning web page is expected by June with room for edits and revisions as needed and as desired by the client. Web page will be sent out to the client as soon as we have a prototype. There will be an estimated two month period for making updates and revisions to the web page before we expect a final product.

14.3.4 Demo Video

Demo video shows the step by step process of our program, from the point of view of a customer and job shop. It will show how a customer will upload a DXF file and get a quote within minute, and it will also show how job shops will be able to customize their own quoting web page. To do all this the demo video should be approximately 10 minutes long.

14.3.5 Source Code

Source code maintenance will be done using Github, our version control system will also be done with Github. Source code will only be provided to our customer upon finishing the project, at the moment we plan on turning over the code via Github. Finally, this is a private project and will not be shared with the general public.

14.3.6 Source Code Documentation

Source code will be updated and maintained via Github. Final document will be a self contained web page for the client. As the client wants a black box approach, sharing source code with the client is not of concern.

14.3.7 CAD files

Project will not require any mechanical designs aside from test case files that will be in a DXF format. More file types may be added and supported if time permits once initial prototype is released.

14.3.8 Installation Scripts

Website will be run from a server so no software will be needed as our current understanding. Possible revisions to this plan may occur in the future.

14.3.9 User Manual

As the product will be a self contained website all instructions needed to navigate will be provided inside the website.

REFERENCES

[1] 3Dhubs. Website. https://www.3dhubs.com/cnc-machining/, February 2021.

[2] 3erp. Website. https://www.3erp.com/request-a-quote/, February 2021.

[3] Fictiv. Website. https://www.fictiv.com/, February 2021.

[4] Open Source MIT. Dxf parser. https://openbase.com/js/dxf-parser, February 2021.

[5] Xometry. Cnc machining service. https://www.xometry.com/, February 2021.

[6] Xometry. Cnc machining service. https://support.xometry.com/hc/en-us/articles/216858757-What-file-types-do-you-support-for-instant-quotes-, February 2021.