Autodrop3D Project Summary

Problem

Designing and manufacturing low-volume and prototypical items requires training and access to special equipment and software. There are no low-cost easy-to-use customizable concept-to-consumption workflows.

Vision

Web-based, platform-agnostic software is key to lowering the barrier of entry for small businesses and individuals interested in making low-volume products or individually tailored goods.

Integration of model data into workflow and process will allow for automatic generation of tailored documentation. Step-by-step instructions and inspection criteria for human assembly of finished products will be generated automatically based on the views and attributes assigned to parts or surfaces in the model.

The mission of Autodrop is to bring low-cost, distributed manufacturing to the masses, through the creation of a web-based design workflow and the establishment of a network of fabrication locations in communities across the United States.

Background / Project History

At our local makerspace, we faced a problem. We had a sizeable contingent of individuals interested in 3D printing, but few who were versed in printer configuration. With so many individuals trying to print and learn how the printers worked, we regularly found ourselves with printers that were misconfigured, jammed, or otherwise out of order. When printers worked, productivity would come to a standstill as completed prints waited to be removed from the printers.

To solve this problem, we developed a web-based queue for managing print jobs and slicing 3D models into machine-interpretable code. Over the past year, we automated the process of printer configuration and print ejection. The Autodrop team has built six prototypes, each improving both results and reliability. They are currently building two latest-generation prototypes that will prove new concepts for ejection and sporting reduced machine footprints. Also in development is a detailed production package (documentation, models, drawings, BOM) that would allow for production of the 3D printer with ejection mechanism.

Last summer, one of our developers discovered Valentin Erastov's project JS.Sketcher, a parametric 3d B-Rep modeler implemented purely in Javascript. We opened communications with Valentin and integrated JS.Sketcher into our toolchain, completing a major milestone in developing a fully web-based tool chain for designing and 3D-printing objects. Our developers have continued to work closely with Valentin on feature development, and he intends to work with our team to extend this functionality with support for assemblies and annotated 3d views. These additions will allow for the input of data necessary in manufacturing, generation of assembly documentation, and other downstream activities.

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Where do we go from here?

Our team has recognized the potential application of the technology to other types of automated manufacturing processes including CNC routers, XY cutters (laser, waterjet, plasma), and lathes. The team is also considering the application of the technology to automated PCB production including both board fabrication and component population. We have acquired a CNC router and are actively procuring parts to build an automatic ejection system and integrate it into the greater Autodrop ecosystem.

In support of the expansion of the Autodrop platform, continued improvement of the JS.Sketcher modeling engine will occur to add features necessary for a complete fabrication toolchain.

These will include:

- Implementation of assemblies with a unified BOM structure and assembly constraints, which will allow streamline downstream processing of project data.
- STEP file import and export, which will support data exchange between a variety of widely-used CAD applications and access to substantial pre-existing model libraries.
- STL and DXF output formats, which will enable downstream usage of project data by the G-Code generator(s) for each supported machine type.
- Support for user-defined views (zoom/camera position relative to model), which will provide support for 3D-annotations & visualization of dimensions.
- Support for user-defined attribute/tag assignment to surfaces and edges, which will streamline downstream instructions for operations such as automated welding, painting, adhesive application or inspection steps.

The key to adding additional processes to the Autodrop system is complete automation on the manufacturing side. Similar to the automatic part removal system of the 3D printers, we aim to make operating the machine tools, loading and unloading stock, and managing jobs as tasks that should require zero human interaction.

At this time, the team is entirely unpaid, part-time, and is personally funding the development of the project. Team members are spending their free time working on prototype development outside of their normal workday. With funding, the opportunity exists for team members to dedicate themselves to this project full-time, the acquisition of the additional hardware required for prototyping, and the overhead necessary to bring this project to mass production.

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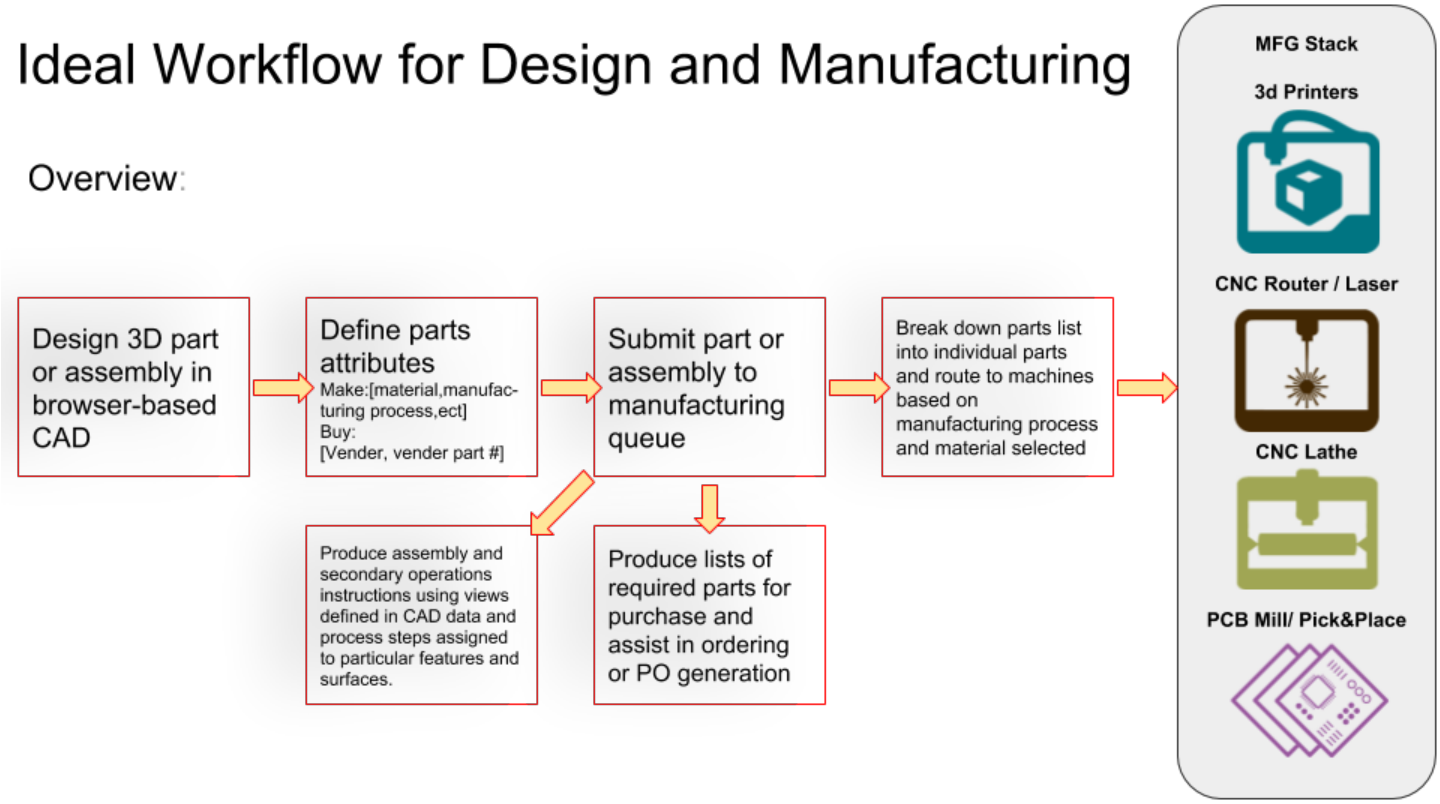
Ideal Workflow for Design and Manufacturing

Overview:



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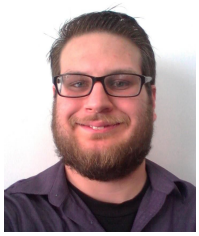
The Team



Autodrop began as the brain-child of Michael Molinari, a decade-long 3D designer and tinkerer with a love of automated manufacturing technology.

Valentin Erastov is the developer behind JS.sketcher, the 3D parametric modeler package that has been integrated into this project. He is a software developer with experience working on enterprise-grade GIS systems.

Drew Gates is a systems administrator who has worked tirelessly making the toolchain work on linux servers. He has also participated heavily in the build process of the last four prototypes.

John Scimone is an electrical engineer with ten years of experience in product fabrication and power systems management. He has contributed heavily to the browser-based toolchain.

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