

# DLP Prototyping System

## P11552

**Team Members:**

Donald Gleason (Project Lead) – ISE  
Aun Kei Hong – CE  
Ronald Dalheim –ME  
Matt DeRosa –ME  
Steve Szklany – ME

**Faculty Guide:**

Dr. Denis Cormier



# Meeting Agenda

- **Materials Reviewed:**
- Project Description
- System Design
- Project Plan
- Complications
- Accomplishments
- Budget
- Customer Needs
- Future Steps



# Project Description

## Mission Statement

The aim of this project is to design and fabricate a projected image photopolymer curing R&D platform. The system will use a Texas Instruments digital light projector (DLP) development system to project black and white ultraviolet (UV) light images onto a film of UV curable photopolymer in order to selectively cure/harden the polymer. Students will therefore design and construct a liquid resin spreading system, an optics system capable of transmitting and focusing a suitably powered UV light source, and the software needed to slice a 3D CAD model into the individual black and white images to be cured.



# Major Deliverables

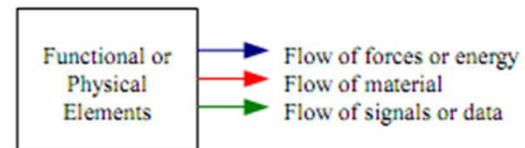
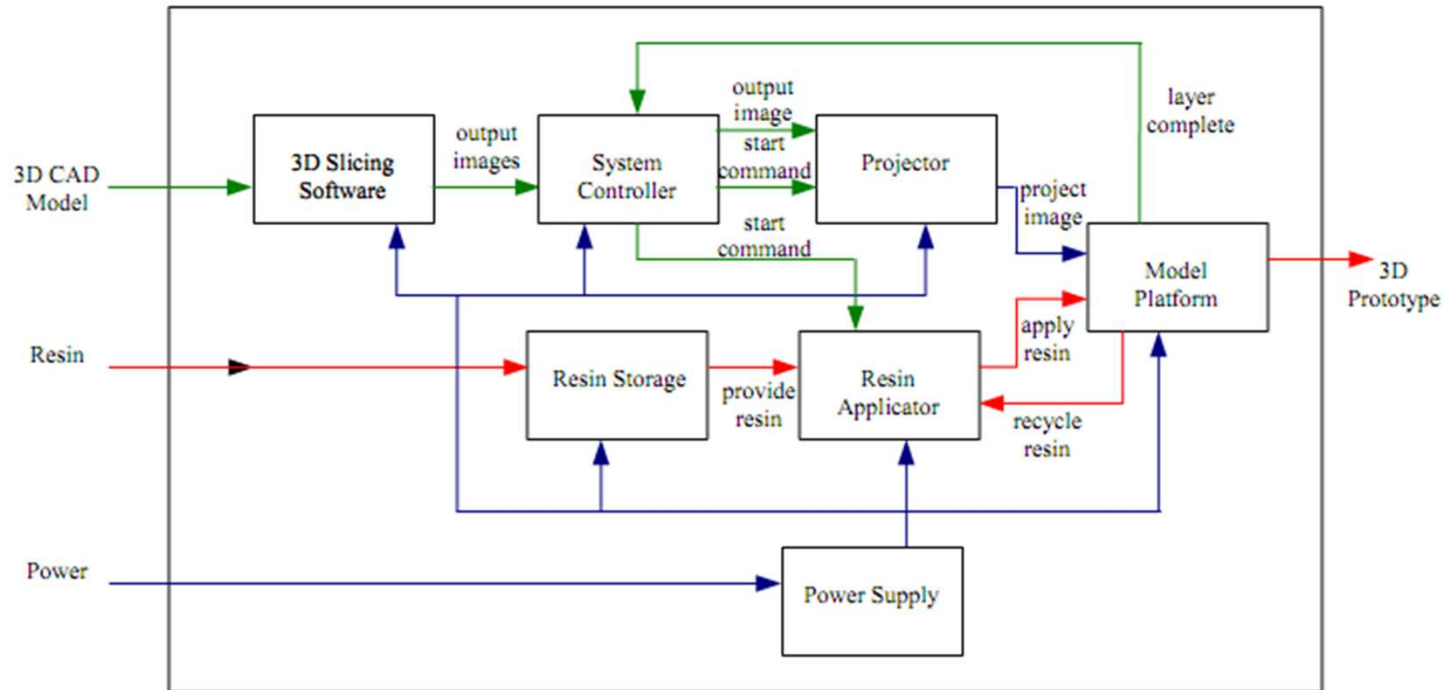
## 4 Major Expected Objectives

- Resin Spreading Sub-System
- UV Image Projection Sub-System
- Control Sub-System
- System Enclosure

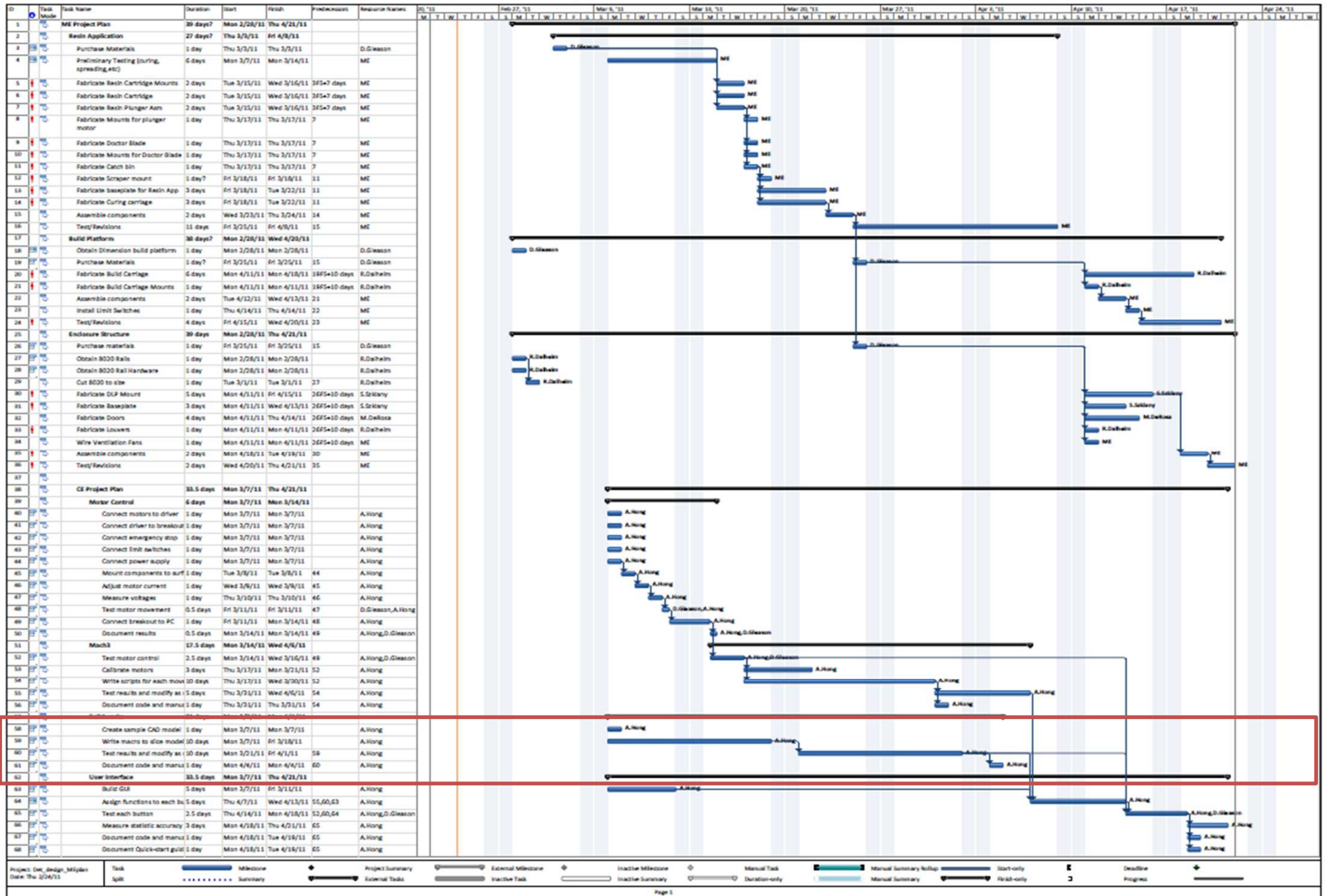


# Concept Overview

Level 1 Block Diagram  
DLP Prototyping System  
Team 11552








# Project Plan



# Solidworks Software

- Group was unable to gain access to software required to develop model slicing program

57		<b>Solidworks</b>	<b>21 days</b>	<b>Mon 3/7/11</b>	<b>Mon 4/4/11</b>		
58		Create sample CAD model	1 day	Mon 3/7/11	Mon 3/7/11		A.Hong
59		Write macro to slice model	10 days	Mon 3/7/11	Fri 3/18/11		A.Hong
60		Test results and modify as r	10 days	Mon 3/21/11	Fri 4/1/11	59	A.Hong
61		Document code and manual	1 day	Mon 4/4/11	Mon 4/4/11	60	A.Hong



# Project Plan Complications

- Resin
  - Inability to cure resin during testing
- Projector
  - Malfunctioned during week 3 of MSD I
- Circuit Board
  - Malfunctioned during week 9 of MSD II
    - Motion controls no longer worked





# Design Issues

- Resin Cartridge Issues
  - Leaking issues
  - Accuracy
- Resin Platform Clearance
  - Scraper blade required redesign/remanufacture in order to provide clearance



# Testing

- Due to the state of the project, the majority of engineering specifications were unable to be tested
- Motor Control Testing
  - Resin Platform and Build Platform motors passed testing

Motion Control Testing		
Stepper Motor	Acceptable Accuracy	Measured Accuracy
Resin Platform (x-axis)	.0010 in	.000625 in
Build Platform (z-axis)	.0010 in	.00015625 in



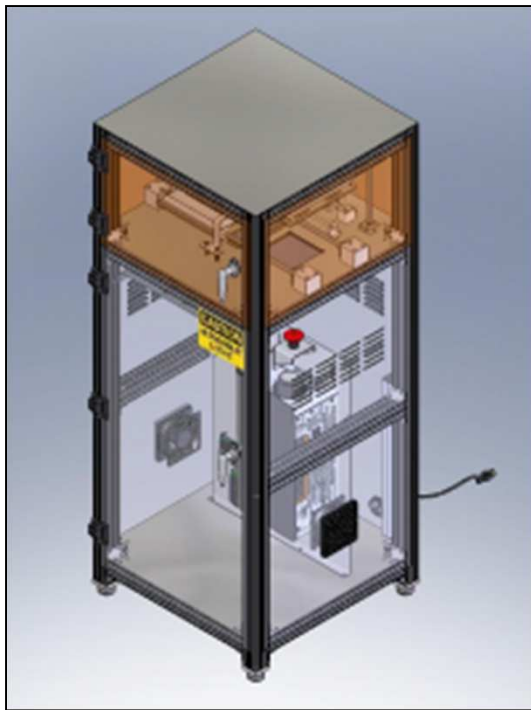
# Accomplishments

- Functioning components in Resin-Spreader Sub-System
  - functioning build platform (Z axis)
  - functioning resin platform/resin removal system (X axis)
    - X and Z axis motors have acceptable accuracy
- Graphic User Interface developed
- Frame for DLP system constructed



# Accomplishments

Solidworks Model



Fabricated System



# Accomplishments

Resin Platform



Doctor Blade / Scraper



Build Platform

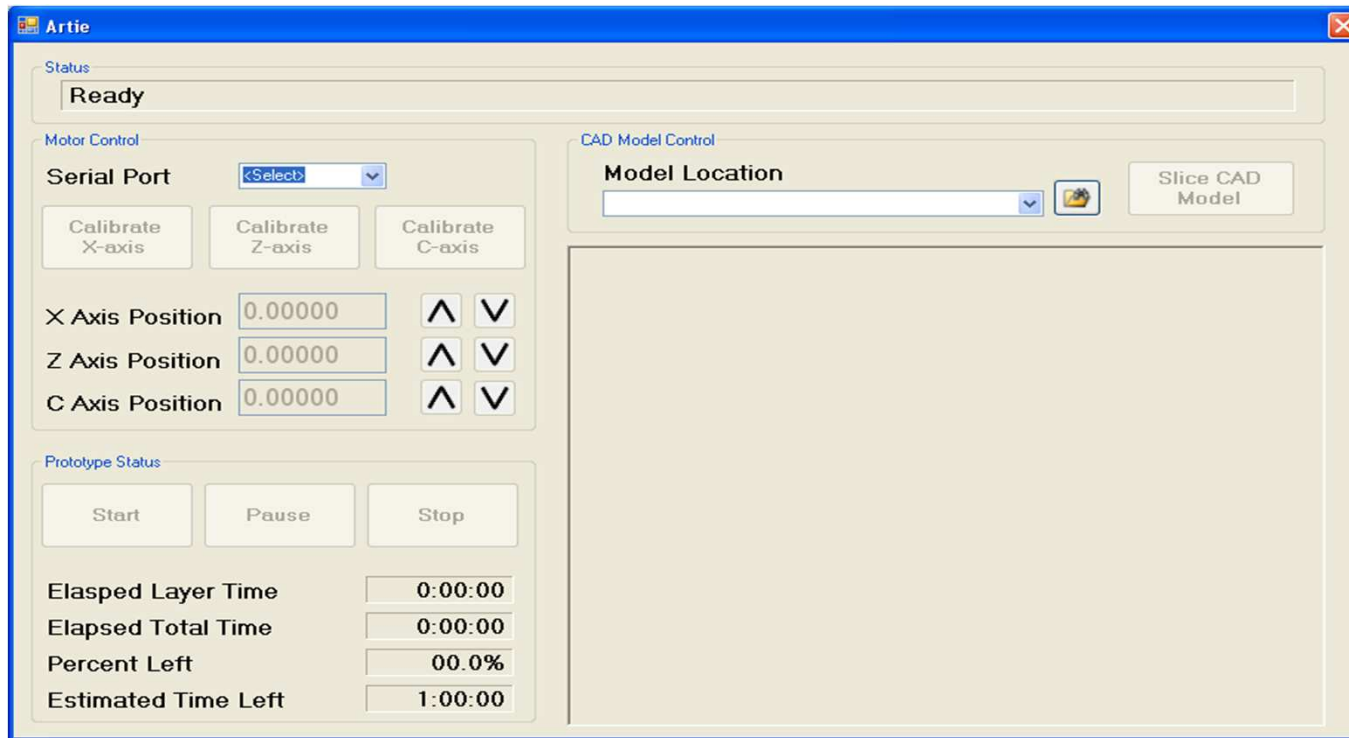


Resin-Spreading Sub-System



# Accomplishments

- Graphical User Interface



# Budget

- Project Budget
  - \$2000
- Budget Used
  - Approximately \$1800
- Budget reduced through use of Fab-At-Home components as well as material from Peko Precision

Part Ordered	Quantity	Total Cost
Aluminum Baseplate	1	135
24" Teflon Film (per foot)	4	71.72
UV Lens	1	111
IDC26/DB25 Female Cable	1	17.73
DB25 Male Breakout Board	1	23.39
Steel Shafts	2	32.03
Neoprene Blade	1	6.18
Bearings	2	14.67
Micrometer Heads	2	104.99
Rubber T-Handle Draw Latch	2	18.29
Surface Mount Hinge	5	41.3
80/20 Aluminum Stock	4	175.53
8-Hole Right Angle Brackets	8	16.05
12-Hole Gussets	8	32.4
T-Nuts	420	33.075
Econ T-Nuts	100	185.92
Quartz Plate	1	176.2
Aluminum Sheets (side panels)	1	115
Top Panels	1	160
Resin	1	121.85
Circuit Board	1	200
	Total	\$ 1,792.33



# Customer Needs

Customer: Dr. Denis Cormier

<b>CUSTOMER NEEDS</b>			
<b>P11552 - DLP System</b>			
Date 5/11/2011			
Customer Need #	Importance	Description	Title
CN1	9	Device utilizes a DLP Projector	Utilized DLP Projector
CN2	9	Utilize a 3D software model for replication by prototype	3D Model Slicing Software
CN3	9	Fully automated after the command to print is sent	Fully Automated
CN4	9	Use a photosensitive polymer resin as a medium	Utilized Photopolymer
CN5	1	Ability to use multiple types of curing resins	Device Functionality
CN6	9	Thorough documentation of design	Prepare for Future MSD
CN7	9	The system is safe to operate	Device Safety Features
CN8	3	Device adheres to budgetary constraints	Device Cost
CN9	9	Acceptable quality of final prototype part	Quality Prototype
CN10	3	Device has simple user interface	Operator Satisfaction
CN11	3	Reasonable fabrication time	Prototype Creation Time
CN12	9	Reasonably sized finished prototype	Prototype Size
CN13	1	Reasonably sized DLP system	Device Size





# Future Work

- Improve upon cartridge design to allow for greater control of resin
- Develop model slicing program to allow for fully automated DLP system
- Develop increased feedback capabilities to improve build accuracy
  - flow rate of resin, build height of part, etc.
- Develop resin filtration system to allow for reuse of uncured resin and reduce waste
- Modify resin dispensing technique to allow for use of multiple resin

