Project Based Computer Aided Design from an Industry Perspective

Presented By: Ian John Kavuma

Qualifications

- **MSc Lean Manufacturing, Kettering University Michigan, 2017**
- BSc Mechanical Engineering, Makerere University, 2016
- Level II, UVQF Welding Certification, LVTI, Kampala, 2018
- Certificate in Automotive Virtual Product Development (CAE Methods), BETA CAE Systems Inc. Michigan, 2014

Projects

- **Kayoola Diesel Coach**
- **Kayoola EVS**
- **Kiira EVS**
- **Kayoola Solar Bus**

Work Experience

- **Quality, Inspection and Testing Manager, KMC, 2021-Date**
- Senior Production Planer, KMC, 2018- 2021
- Support Product Quality Officer, KMC, 2018 - Date
- Production Planner, KMC, May 2016 – June 2018
- Mechanical Systems Engineer, KMC, 2015 - 2016

Project Based Computer Aided Design from an Industry Perspective

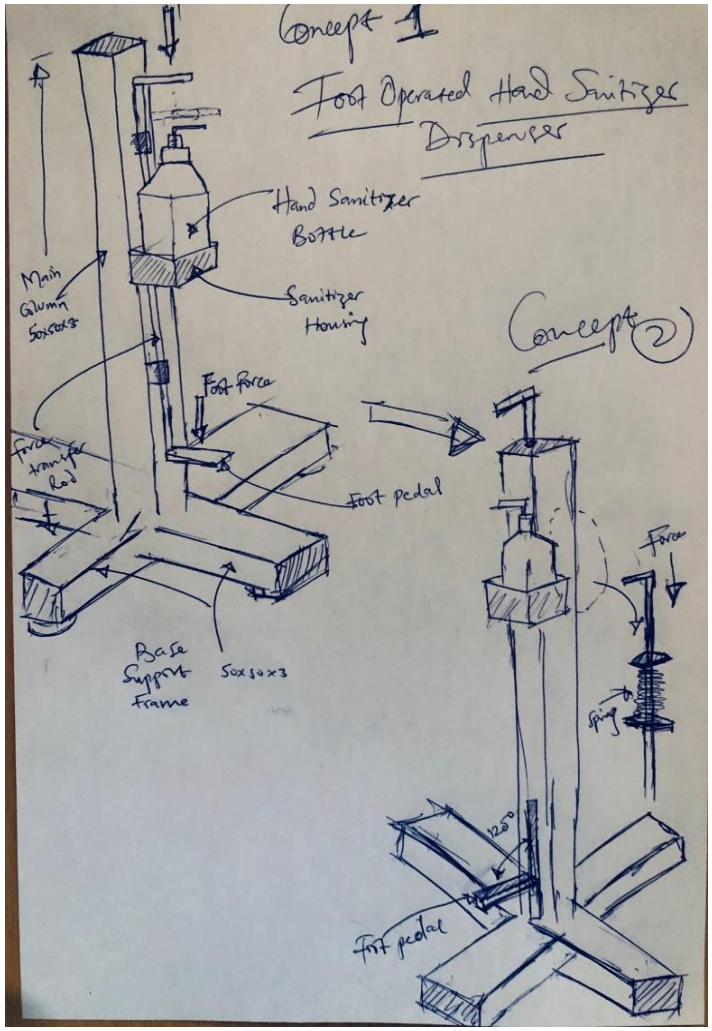
DEFINITION
Computer Aided Design (CAD) involves creating of 3D computer models of parts and systems defined by geometrical and material parameters. (Inc., 2021)

WHY CAD ?
-Representation of systems and products in 3D space
-Simulation of system/product performance in real-world conditions

ENGINEERING APPLICATIONS (MECHANICAL, CIVIL & ELECTRICAL)
-Product/system Design
-System/Product performance simulation
-Product development and implementation
-Product/system optimization

Project: Foot Operated Hand Sanitizer Dispenser

CONCEPT



PRODUCT

Product Development Process

1. Product Specification(customer requirements, benchmarking, materials specification, dimensions, design objectives)
2. Project Costing (BOM, cost of materials, labour costing, supplier identification)
3. Numerical Analysis (hand calculations, engineering equations and principles)
4. Concept Design (hand drawn or computer generated)
5. CAD Model Generation and Rendering (solid edge, Solidworks, Catia, Keyshot, Photoview 360, etc)
6. Design Validation (CAE Methods, system performance simulations, set targets and constraints)
7. Engineering/production drawings (dimensions, standard views, annotations notes,
8. Project Implementation (in-house or contracted)
9. Project Deployment (collect feed back on product performance)
10. Product/system optimization (using collected performance data with set constraints & objectives)

Costed Bill of Materials and Quantities

No.	Item Description	Description	Quantity	Unit Cost (Ug Shs.)	Total Cost (Ug Shs.)
1.	SHS 50x50x3	5.8 Meters	1		
2.	Flat Plate (5mm thickness)	2 Meters	1		
3.	Flat Plate (2mm Thickness)	2 Meters	1		
4.	Cutting Discs	D= 4.5Inches, Thickness = 1mm	2		
5.	Under Support Stands (Rubber) with adjustable height	50mm Diameter	4		
6.	Plastic End Caps	50x50mm	4		
7.	Coil Spring	H= 100mm, D= 25mm, d = 1mm	1		
8.	Welding Electrodes (Box)	D= 2.5mm 60-95 Amps	1		
9.	Paint Off-white	Automotive White	1 Liters		
10.	Filler Paste	Automotive Filler	1 Tin		
11.	Primer	Fast Dry	1 Liters		
12.	Sanding Paper	60 Grit	1 Meters		
		320 Grit	1 Meter		
13.	Paint Thinner	Primer Thinner	1 Liter		
		Paint Finishing	1 Liter		
14.	Auto Putty	Automotive Paint Putty	1 Kg		
15.	Hardener	Fast Dry Automotive Paint Hardener	1 Tin		
TOTAL					

Product Specification

Functionality:
Mechanically Operated Foot Operated Hand Sanitizer Dispenser

Parts quantity

Geometry and dimensions

Material specification

Performance parameters (F.o.S, maximum load, max deflection, failure points)

Colour (beauty engineering)

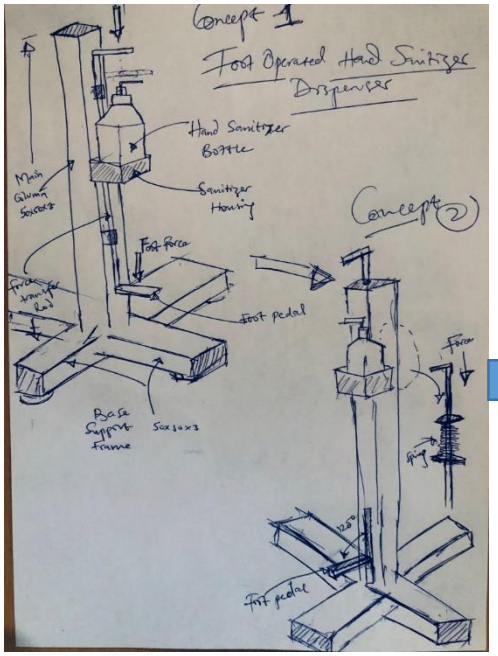
Numerical Analysis

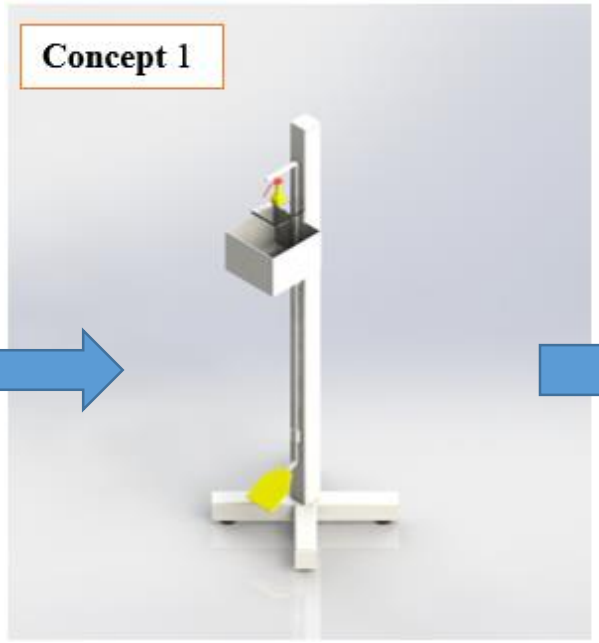
Design Objective:
Optimal Spring displacement (maximum load)
Optimal foot pedal displacement

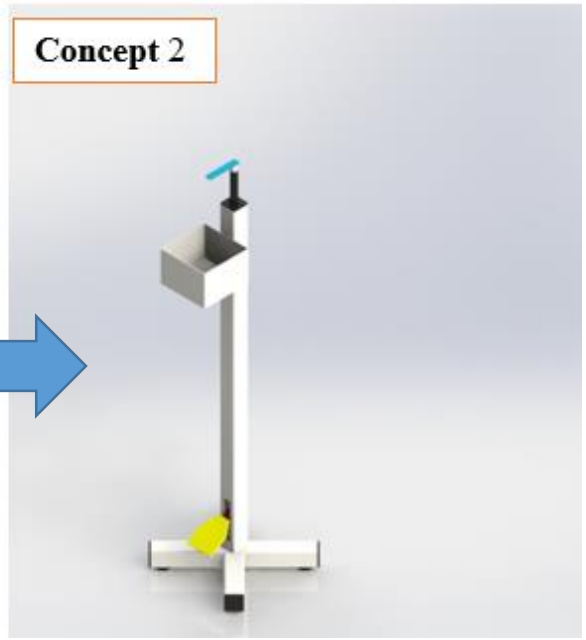
Engineering Equations:
Spring Equation
Area Moment of Inertia
Maximum Bending Moment
Maximum Bending Stress
Maximum Shear Stress
Maximum Deflection

Failure Criteria:
1. Maximum von Mises Stress Criterion
2. Maximum Shear Stress (Tresca) Theory

Design Concept Generation







Benchmarking

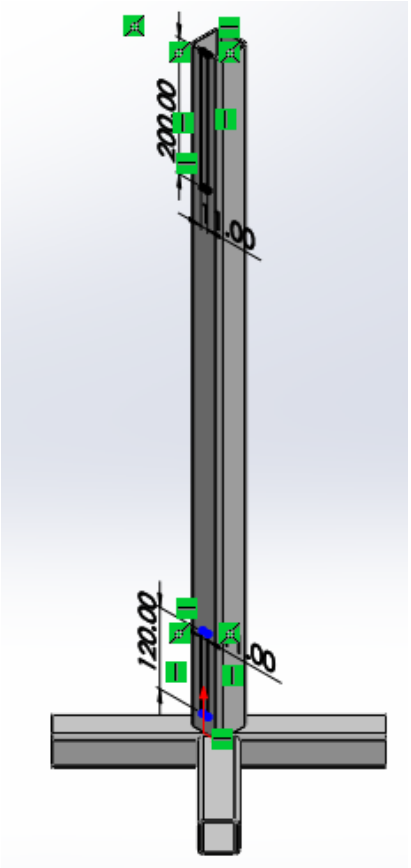
Governing Principles

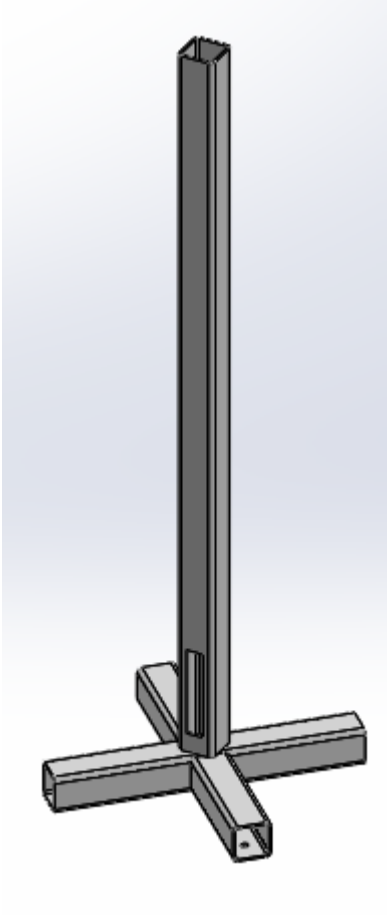
Shape development

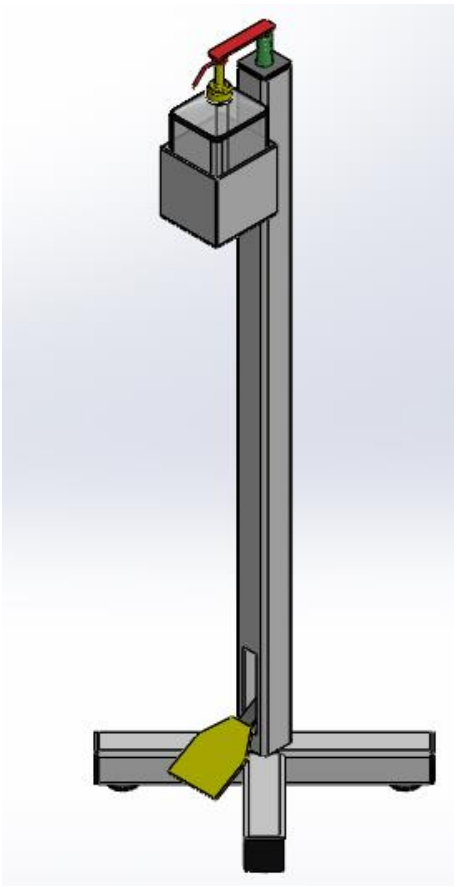
Constraints (material, available technologies, cost)

CAD Model Generation & Rendering

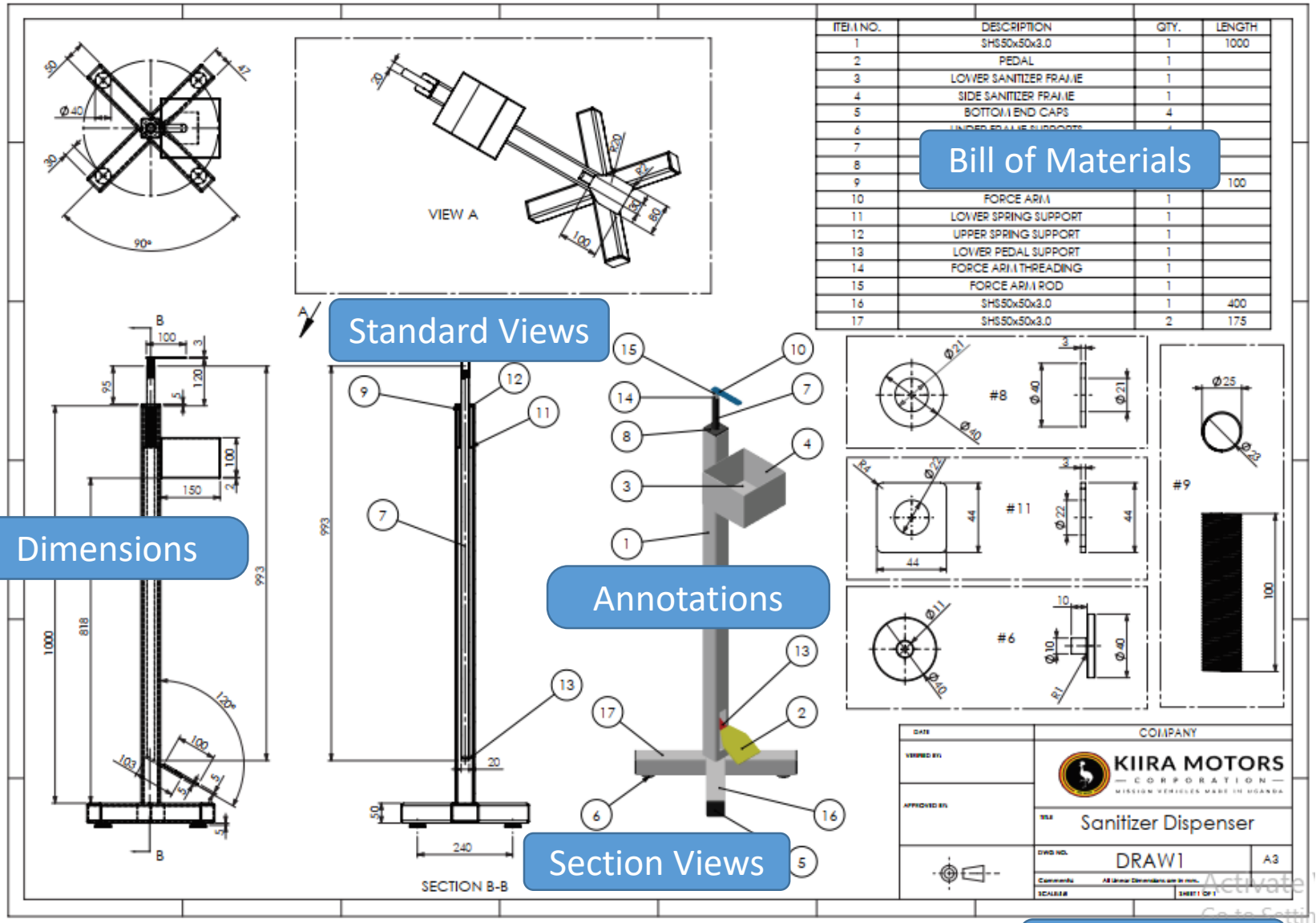
Sketching and Dimensioning	Parts Development	Product Assembly	Product Rendering (Materials & Colour)







Engineering/Production Drawings



ITEM NO.	DESCRIPTION	QTY.	LENGTH
1	SHS50x50x3.0	1	1000
2	PEDAL	1	
3	LOWER SANITIZER FRAME	1	
4	SIDE SANITIZER FRAME	1	
5	BOTTOM END CAPS	4	
6	UNDER FRAME SUPPORTS	4	
7			
8			
9			100
10	FORCE ARM	1	
11	LOWER SPRING SUPPORT	1	
12	UPPER SPRING SUPPORT	1	
13	LOWER PEDAL SUPPORT	1	
14	FORCE ARM THREADING	1	
15	FORCE ARM ROD	1	
16	SHS50x50x3.0	1	400
17	SHS50x50x3.0	2	175

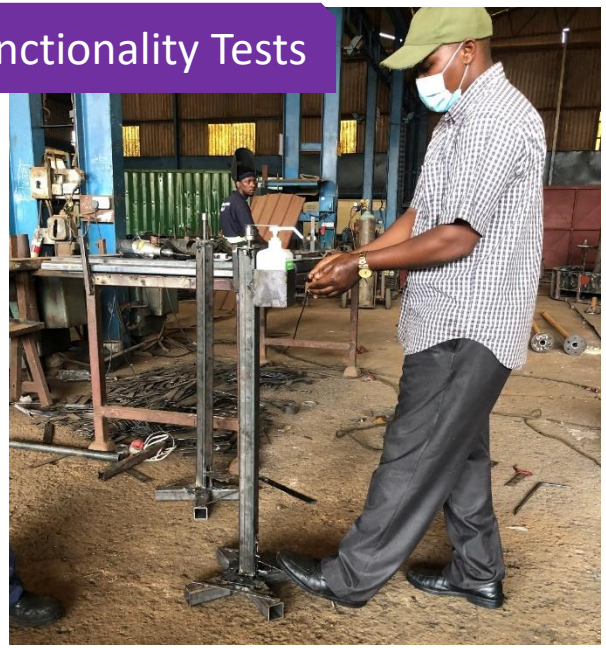
Project Implementation

Design Reviews

Fabrication Works

Finished Product

Functionality Tests



-Standards and Design Guides
-Regulations (Local & Int'l)
-Materials Testing
-Production Technologies
-Production Quality
-Budget Control
-Safety Rules and Guidelines
-Implementation report

Project Deployment

Kiira Motors Corporation

Ministry of Energy and Mineral Development

THANK YOU
&
QUESTIONS