

# Secure Manufacturing

Tushar Himmat Dahibhate, Yang-Kai Chou, Rajshree Jain, Satanik Ray, Ankit Arvind Tiwari

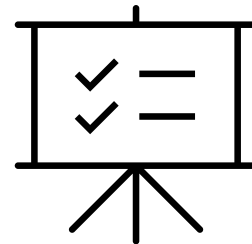


# /// Agenda

- Objective
- Problem
- Solution
- 5 stages
  - Research
  - Generate
  - Choose
  - Prototype
  - Evaluation
- Results and Observations
- Questions

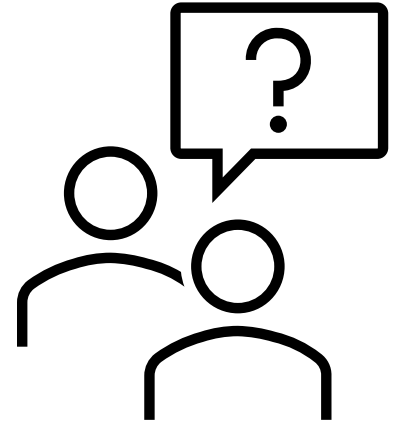
# Objective

- Design UI for monitoring tasks, providing updates, capturing the security aspects.
- Make security, scheduling jobs, etc. as user-friendly as possible.
- Help operators to perform their duties conveniently & securely.



# Problem

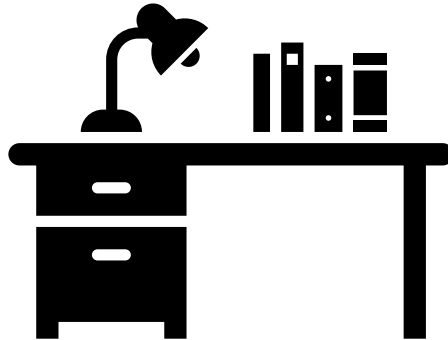
- Handling of errors/ Alerts
- Infrastructure Maintenance
- Paper Trail/ Reporting
- System Navigation



# Solution

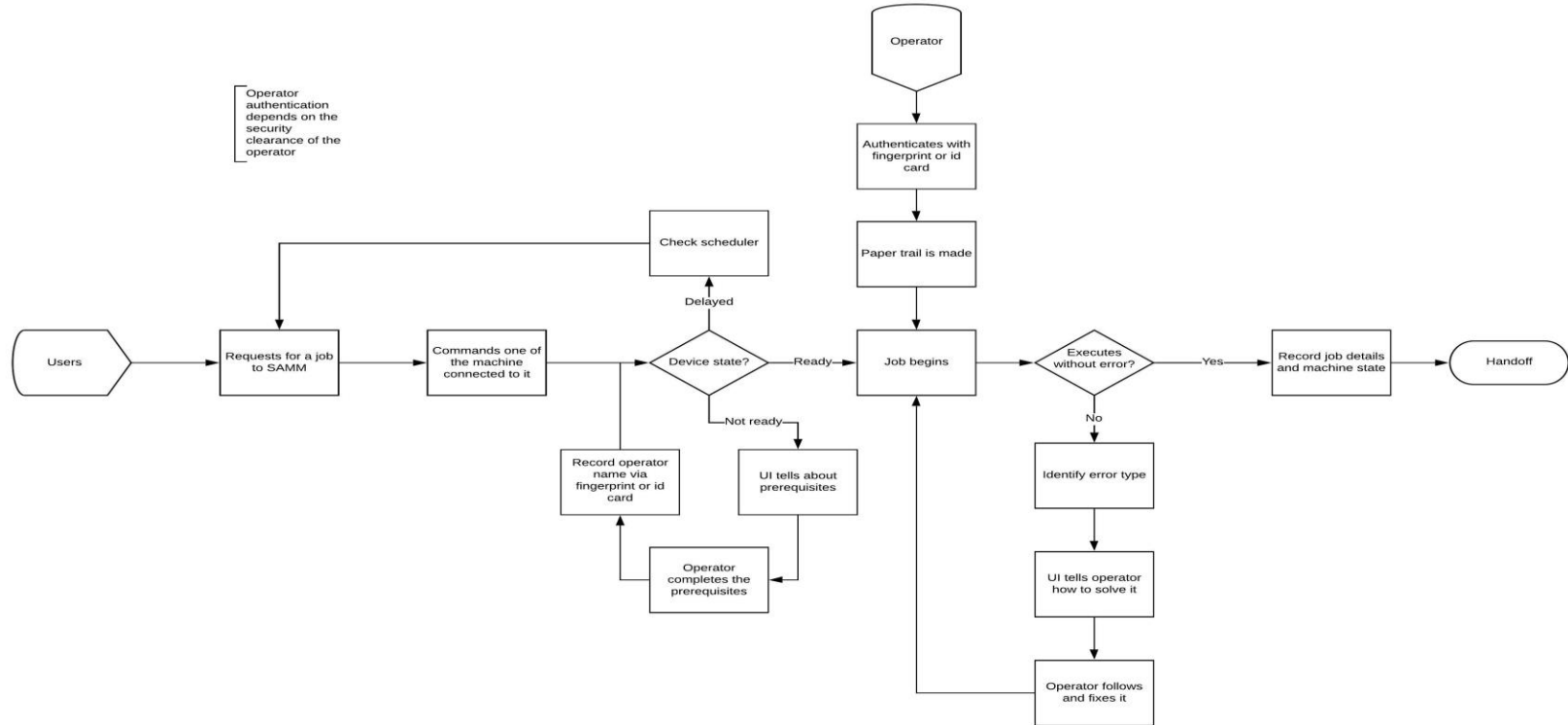
- Errors/ Alerts :
  - Handle errors/ alerts through proper messages and easy instructions for troubleshooting it
- Maintenance :
  - Design a scheduler to keep a tab on job type, machine it's running on, status, operator, settings, etc. Also KPI for machines
- Paper Trail :
  - Record operator details for present, past & future jobs
- Navigation :
  - Design an intuitive UI with navigation breadcrumbs and utility icons which are self-explanatory

# Stage 1: Research



- **Goals:**
  - capturing the security aspects related to the manufacturing process.
  - make security, scheduling jobs etc. as user-friendly as possible
  - helping the operators to use the machines without any struggle.
- **Challenges:**
  - to introduce a system controlling multiple machines that never existed before.
  - merge security without a need of major re-training.
  - intuitive workflow.
  - to incorporate the effect of time while using the UI.
  - incorporate “Industry 4.0” standards into present-day companies and factories.
  - abstract security-related jargon from the UI and to present them as a black box.

# Experience Map






- **Problem and Opportunities:**
  - Easy learning experience and UI:
    - Friendly, intuitive and consistent UI.
    - Easy onboarding by mapping security jargons to common terms.
  - Security:
    - Authentication.
    - Paper trail.
  - Installation and maintenance:
    - Adding and keeping a record of it.
    - Maintenance schedule.
    - Records of machines and technicians.

- **Target:**
  - Focus on user interface design.
  - Matching the mechanism to the terms which the operators are familiar with.
  - Deal with the security error exceptions and make it easy to understand for the operators.

# Stage 2: Generate

Crazy 8 & storyboards




12:07 SAMM Alerts 

Asset Management

Job Scheduling

User Management

...

12:07 SAMM Alerts 

Back ASSET MANAGEMENT


Machines

Add a Machine

Remove

Schedule Maintenance

Recent Logs


12:07 SAMM Alerts 

Back ASSET MANAGEMENT

Home / AM / Machine

Active Machines

Inactive machines

12:07 SAMM Alerts 

Back ASSET MANAGEMENT

Home / AM / Machines / Active

M1


M2


M3


M4


M5


M6









12:07 SAMM Alerts 

Back ASSET MANAGEMENT

Home / AM / Add

STEP 1: Add a Technician

STEP 2: Name :

STEP 3: ID :

SSN :


COMPANY :

CONTACT :

STEP N:

SAVE

CLEAR

12:07 SAMM Alerts 

Back ASSET MANAGEMENT

Home / AM / Add

STEP 1: Machine Details

STEP 2: Detail 1 :


STEP 3: Detail 2 :

...

STEP N:

SAVE

CLEAR


12:07 SAMM Alerts 

Back ASSET MANAGEMENT

Home / AM / Recent Logs

ID	ACTIVITY	M-ID	U-ID	TIME
1	ADD	24	JOHN DOE	22:00
2	MAINTAIN	2	JOHN DOE	1:00
...				
N				

Page 1 of 20

12:07 SAMM Alerts 

Back ASSET MANAGEMENT

Home / AM / Recent Logs / 1

ID: 1

USER: JOHN DOE

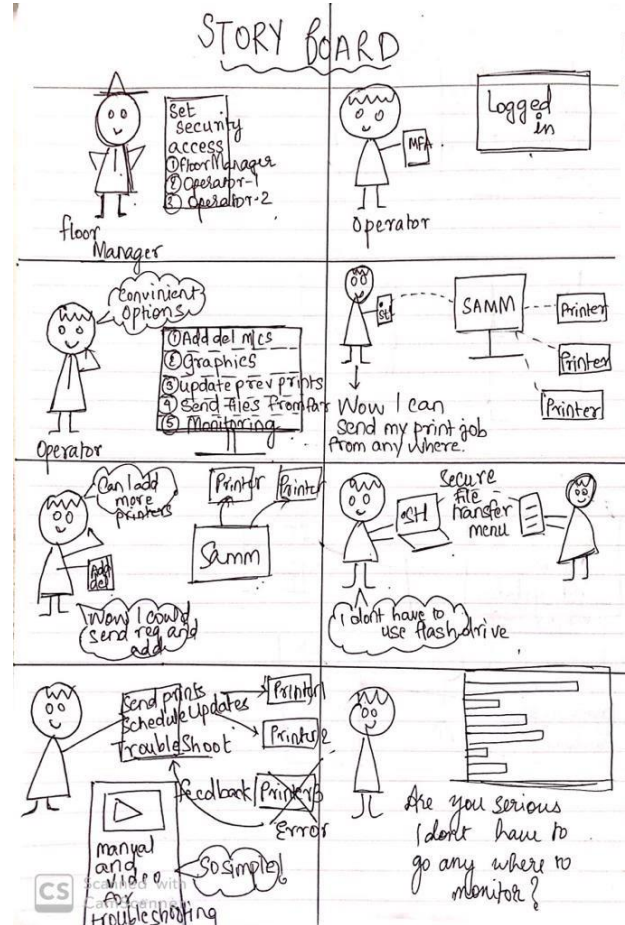
MACHINE: Formlabs form 3 L

Machine id: 1234ESX

Technician: JOHN WICK

VIEW

View Activity Log

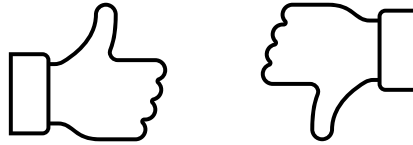


## Ideas we generated:

- Asset management
- Logs
- Configuration
- Calendar
- Dashboard
- Assigning security boards
- Secure File Transfer
- Troubleshooting wizard
- Security Levels
- Remote SAMM
- Multifactor authentication
- Over the top animations
- Multiple level of abstraction
- On-body authentication

## Stage 3: Choose

Voting on which area to focus on



The video conference interface shows two participants in separate windows at the top. The left participant is a man with glasses and a headset. The right participant is a man with a headset. Below them is a large window displaying a Google Docs document titled "UX Generate Phase". The document content is a storyboard for a mobile application. The storyboard is titled "Storyboard:" and contains the following text: "It was a fine monday when suddenly A NEW JOB ARRIVES (with notification sound) \*at floor manager's screen\*". Below this text are two mobile app screens. The left screen shows a notification for "(Job name) (Job info)" with two buttons: "Open scheduler" (with a green checkmark icon) and "Reject" (with a red X icon). The right screen shows a calendar for "10th June" with a grid of dates. Below the screens is a sequence of two speech bubbles. The first bubble says "As floor manager: I configure all settings for a job." and the second bubble says "As machine operator: I verify all the settings.".

UX Generate Phase

File Edit View Insert Format Tools Add-ons Help Last edit was 5 days ago

Storyboard:

It was a fine monday when suddenly  
A NEW JOB ARRIVES (with notification sound)  
\*at floor manager's screen\*

(Job name)  
(Job info)

Open scheduler

Reject

10th June

After verifying all the settings, the machine operator gives some kind of ID for verification.

As floor manager: I configure all settings for a job.

As machine operator: I verify all the settings.

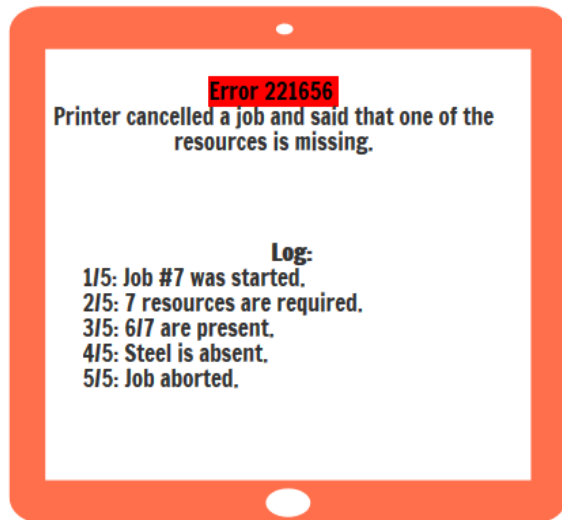


14:52:09	From Ben Watson : 1) calendar
14:52:12	From Ben Watson : 2) alert
14:52:15	From Ben Watson : 3) wizard
14:52:28	From Ben Watson : 4) two factor auth
14:52:47	From Ben Watson : 5) configure/audit
14:54:37	From Tushar Himmat Dahibhate: 3
14:54:39	From Yang-Kai : 1
14:54:42	From Ankit Arvind Tiwari : 3
14:54:48	From Satanik Ray: 5
14:54:51	From Elijah Morgan : 2) 1
3) 1	
5) 1	
14:54:56	From rjain27 : 3.
14:55:33	From Ben Watson : 1: 1
14:55:37	From Ben Watson : 2: 0
14:55:44	From Ben Watson : 2: 1
14:55:55	From Ben Watson : 3:4
14:56:06	From Ben Watson : 4: 0
14:56:13	From Ben Watson : 5: 2

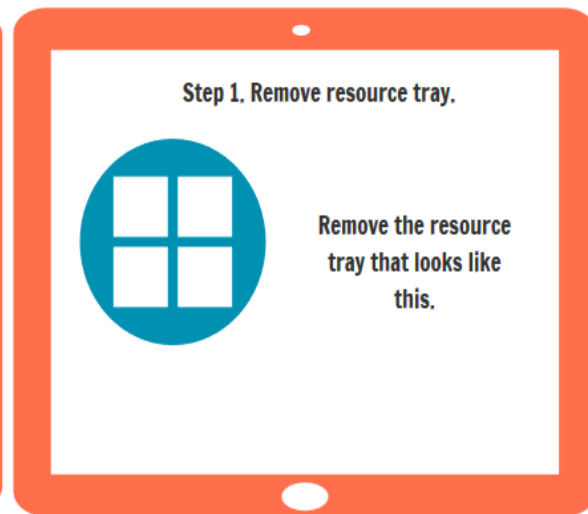
As seen, option 3 and 5 got the most votes.

# Final storyboard

\* operator clicks on error (in red) to trouble shoot \*



\* a more detailed wizard opens \*

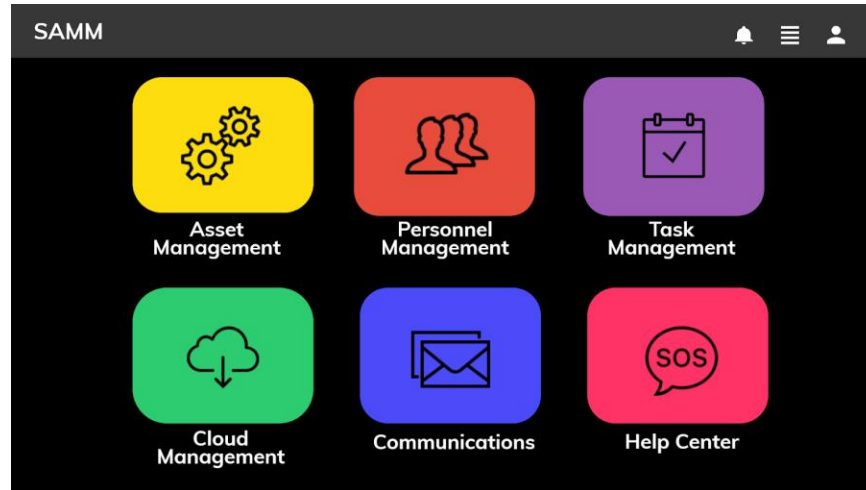


# Tools used

- Adobe XD
- InvisionApp
- Balsamic
- Powerpoint/ gslide

# Stage 4: Prototype

<https://projects.invisionapp.com/share/SGX16C64RJX#/screens/415197214>



# Stage 5: Interview and Evaluation



# What were we looking in our participants?




- **Want:**
  - Age group 20-50. Most of the operators will fall into this category.
  - Basic proficiency in using applications.
  - Some prior knowledge of industrial and mechanical engineering.
  - Some background in using 3D printers/CNC machines.
  - Some background in working with machines in general.
- **Don't want:**
  - Someone with prior knowledge of this project
  - Sensitive age groups


Home x + You are viewing Participant 1's screen View Options

projects.invisionapp.com/share/SGX16C64RUX#/screens/415197214

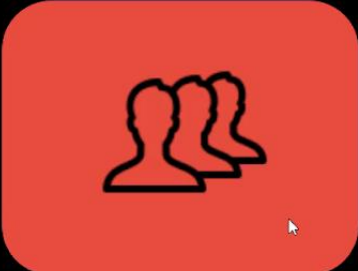
Apps Hello World · GitHub... Amazon University... Operating Systems... Enrollment Wizard Oracle Resource W... Introduction (2): Da... Design Pattern What is Machine Le... Seminar Attendance Facebook »

## SAMM

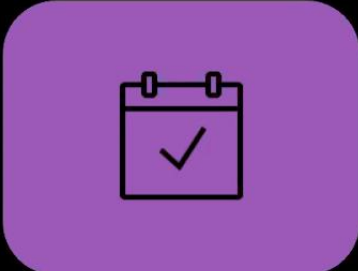
  




**Asset Management**





**Personnel Management**







**Task Management**



 Made in InVision





Mute Start Video Security Manage Participants Polls Chat Share Screen Record Breakout Rooms Reactions **End Meeting**

# Results and Observations

- Aesthetically pleasing color combinations
- Inefficient navigation to go back
- Valuable information represented very conveniently
- Difficulty in perceiving few color combinations
- Expectation for sorting option
- Design viewed as compact & consolidated
- Concern with editing machine settings while job-in-progress
- Improvement requested to look up information (filters & consolidation)
- Efficient navigation breadcrumbs
- Wizard seems a good way to present the help function



# Questions?

