MAS
CHANGE IS COURAGE

SMART Spreader Machine

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BUSINESS CASE

The laying process is the first value adding activity of the complete production process. Given the importance of this activity, it has to be noted that the fabric layer operating the Spreader Machine has a very complex job role. And 90% of his job role consisting of non-value adding activities, the complexity of his job role brings about the following effects,

- Inability to cascade the activity into specific operations for performance measuring schemes.
- Difficulty of predicting standard movements due to the high number of abnormalities
- Hinders the continuity of the workflow
- May cause sudden delays which would result in waiting
- Inefficient and inaccurate data collection

Hence, the need to simplify and standardize the laying process is a burning need. Solving this would not only optimize the laying process but also improve the efficiency of all upstream processes.

PROBLEM STATEMENT

Value addition is the enhancement made by the company to its product. For a certain activity to be considered as a value adder, one of the following should be fulfilled.

1. Change in shape
2. Change in form
3. Change in function
4. Activities for which the customer is willing to pay

The Spreader is the value adder in the case of the laying process. And he therefore becomes the most important person in that activity. Given so, he should be exempted from all other duties and allowed to solely focus and perform value adding activities.

Everything except from cutting the laid fabric are considered to be non-value adding activities. The non-value adding activities can be categorized as follows.

1. Obvious waste – Should be removed

2. Necessary for processing – Should be minimized and simplified.

3. Provides valuable information – Should be exempted from value adders' duties.

PROBLEM ANALYSIS

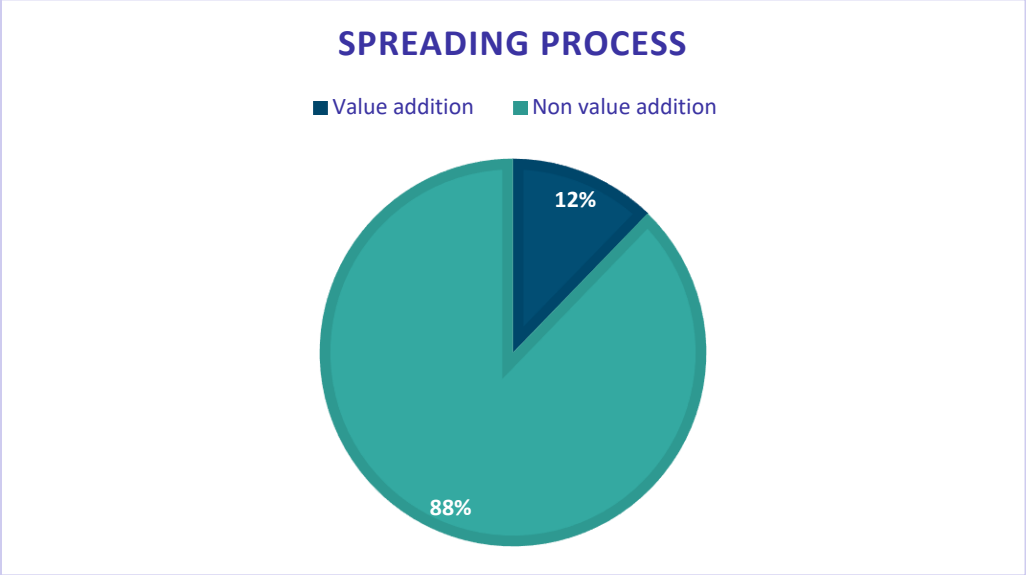
To understand the distribution of the activities, a work study performed for a lay length of 150cm and 100 plies with a 5% probability of joints or damages was analyzed,

Process	Activity	Time (sec)
Setting up	Verify docket	9
	Lay under paper	20
	Apply cello tape	19
	Loading fab role	20
	System update	16
	Width balancing	35
	Lay first ply	32
	Time for ply	13
	Measure length and width manually	28
	Laying (150cm lay length)	16
Joints	Stop machine	
	Apply tissue	7
	Measure Overlap	6
	Update docket	12
	Move to Overlap start location	10
Damage	Stop machine	
	Cut laid fabric	3
	Measure damaged length	12
	Update docket	12
	Remove damaged length	6
	Move to start location	30
Completion	Measure Used/ Ends	15
	Count plies manually	16
	Calculate roll shortage	31
	Update docket	12
	Unload return fabric	75

VA | NVA | NVA to be eliminated

PROBLEM IDENTIFICATION

A graphical representation of the VA and NVA activities associated with the laying process is as follows.



Understanding the need for the reduction of Non-Value adding processes, it was identified that by implementing a **Real-Time Data Measurement system** backed by **IOT capabilities**, the following NVA activities can be removed,

1. Measuring overlap
2. Updating overlap measurement on docket
3. Measuring damaged length
4. Updating damaged length measurement on docket
5. Measure Used/ End length
6. Measure Used/ Ends
7. Count plies manually
8. Calculate roll shortage
9. Update docket

PROJECT OVERVIEW

In terms of lean, the project was conducted with 5 main objectives to achieve the required optimization.

- Implementing basic lean (Removing 7 wastes)
- Increasing the value adding capacity
- Reduce touchpoints to support continuity
- Optimize problem solving capabilities
- Go Green!

The solution package has 3 main aspects to it,

Real-time Data Measurement

Here, the number of plies will be automatically counted in real time without any human effort. Further, the Damaged lengths, Overlap lengths, Used and End lengths are measured at the click of a button. And finally, the roll shortage will be automatically calculated.

Real-time Database Management

The measured data will be stored in a Database in real time for future analysis.

Dashboard

The Dashboard supports visual communication on the machine parameters and has real-time production tracking capabilities.

PROJECT IMPLEMENTATION

The steps of the methodology are as follows,

1) **Understanding and gathering of information** to achieve the required objectives were carried out during the frequent visits to the factory. Further, already existing data and information was obtained from the plant for the purpose of analysis.

2) **The analysis of information and data** drew a clear picture on the scope of the project and the areas to be focused on.

3) **Brainstorming sessions** mapped out the existing solutions, best practices, opportunities and challenges in carrying out the project. The main consideration was to harness machine data in the most convenient manner. Although the Spreader Machine had built in encoders and other sensors, we were unable to gain access to them.

4) **The hardware development** was carried out upon arriving at a finalized plan to carry out the project. The sensor used to gather information was an encoder through which the project relied on. The circuit was enclosed in a box designed and cut using a laser cutting machine.

   The hardware components used are listed below,
   - An Encoder (Sensor)
   - Microcontroller with built in Wifi module
   - Buck Converter (To regulate voltage)
   - 4x4 Matrix Membrane Keypad
   - 16*2 lcd display
   - Potentiometer (For contrast adjustment)
   - Switches
   - DC power input

Hardware components

Encoder

Microcontroller

Buck Converter

4x4 Matrix
Membrane Keypad

16*2 lcd display

Potentiometer

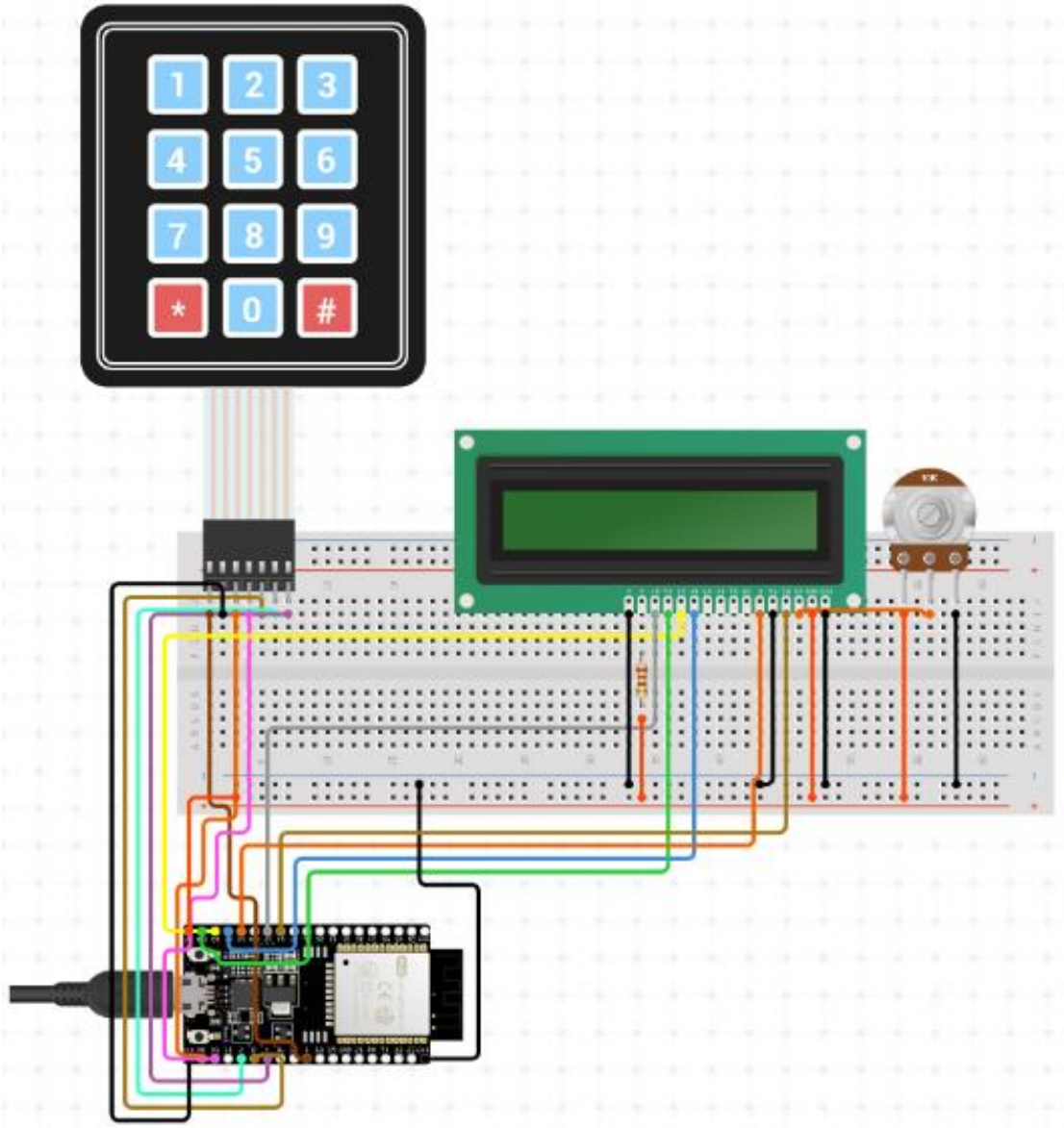
Switches

DC power input

DC power input

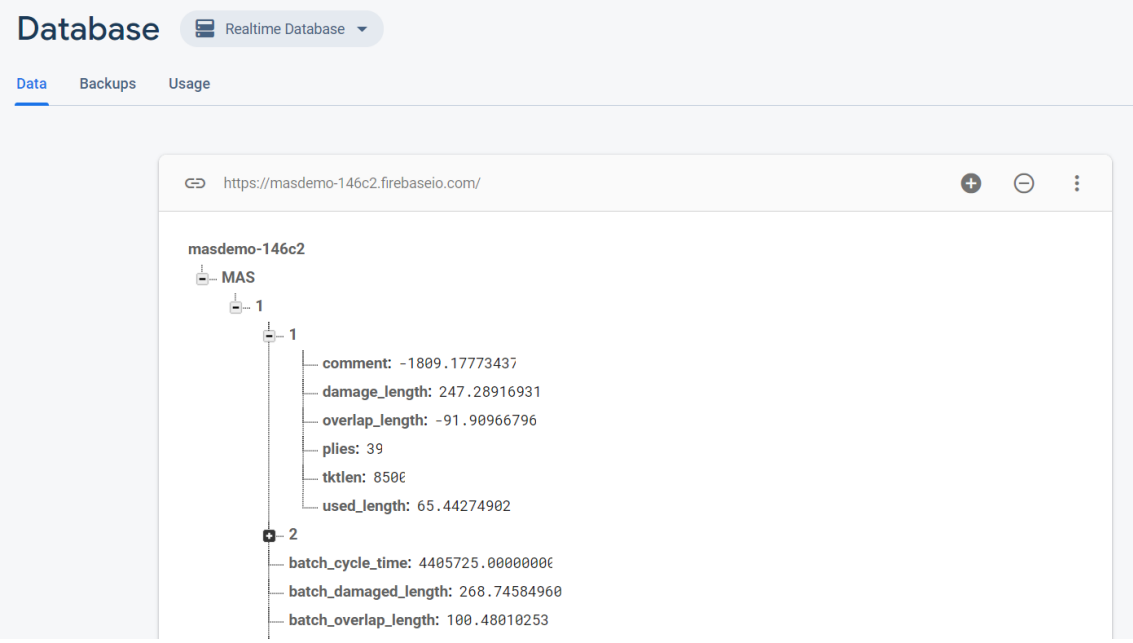
Final Hardware design

The circuit diagram can be represented as follows,

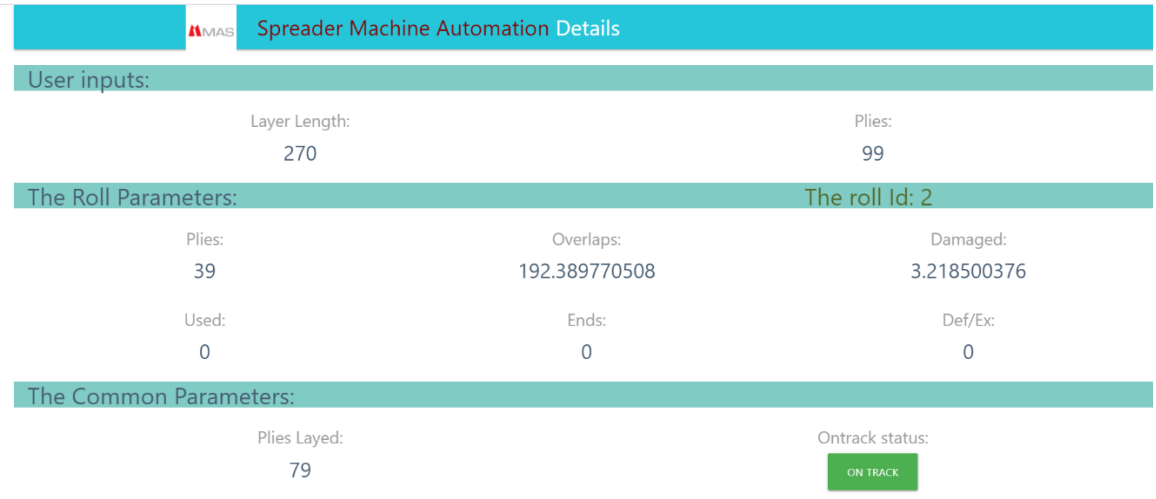


5) **The software component** was too developed in parallel, upon developing the hardware. The code was written on Arduino. A chart was first mapped with the required rules to perform the task and was then coded while testing it on the hardware.

6) **The Database development** was carried out to upload and store the machine data. MAS uses a server to store such data. However, for the ease of testing and developing Google Firebase was selected as the best suited database platform.



7) **The Dashboard** was developed to support visual communication on the machine parameters and for real-time production tracking.



8) **Implementation** of the project was carried at standard working conditions. This was the phase where the developed hardware and system was put into test. The results obtained were used to perform modifications and improvements.

9) **The sustainability of the solution** will be determined upon the fulfilment of the Process, Capability and the Management system.

The following are a few tools that can be used to fulfill the above,

- Process audits
- Gemba Walks
- Standard Worksheets
- Transfer of Knowledge
- Training and Development

OUTCOME CALCULATION

Below is a summary of the outcome

	BEFORE	AFTER
Counting Plies	Manual	Automatic
Damaged Length measurement	Manual	Automatic (Single input)
Overlap Length measurement	Manual	Automatic (Single input)
Used Length measurement	Manual	Automatic (Single input)
Roll Short Calculation	Manual	Automatic
Data Updating	Manual	Automatic
Layer Performance measures	Absent	Present
Data Accuracy	Low	High
Data Recording	Not consistent	100%
Paper usage	High	Zero
Non-Value Adding activities	High	Reduced
Touchpoints	High	Reduced

1) Removes Wastes (7 wastes)

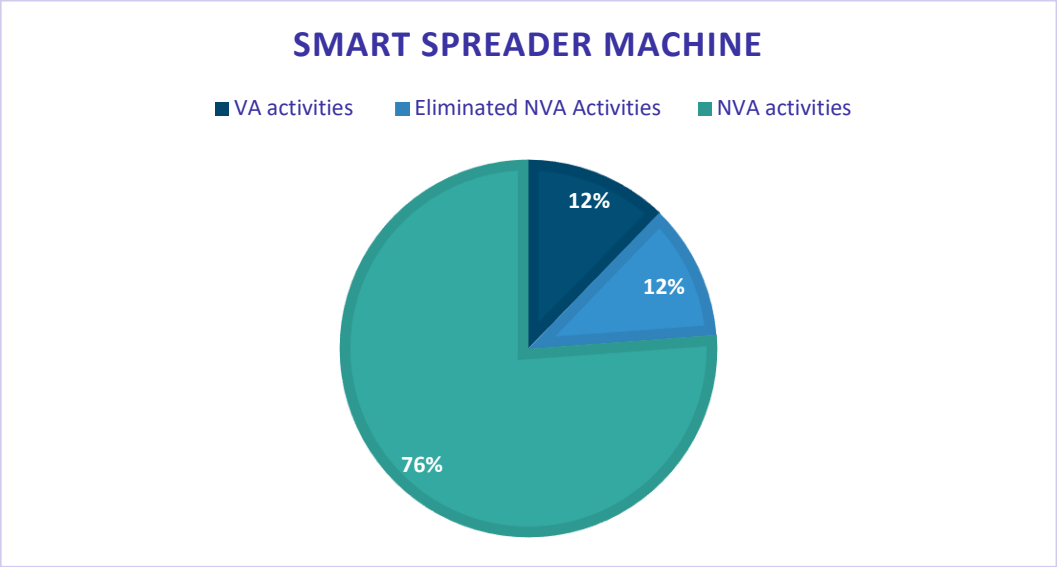
WAITING – The Spreader machine timing interrupts the timing of all upstream processes (Cutting department, Market place, Team Members) The SMART Spreader machine will increase continuity and thereby reduce waiting.

INVENTRY – The unlaid fabric rolls depends on the rate of the spreader. Hence, the optimization of the spreader machine performance would reduce inventory stored behind.

MOTION – To reduce unnecessary motion, the movements of the operator should be standardized. However, due to the complexity and variations of the existing system, the movements cannot be predicted. The SMART Spreader Machine reduces unnecessary motions and simplifies the process.

2) Increase in the value adding capacity

The SMART Spreader machine would eliminate 9 non value adding activities and allow the operator to spend more time and effort towards value addition.



Hence, assuming there lies a 5% chance of joints and damages, the SMART Spreader Machine increases the total Value Addition time by two-fold. (Since the eliminated NVA time can be utilized for value addition)

3) Reduced Touchpoints

The reduction of touchpoints would increase productivity and efficiency. And this would support continuous flow.

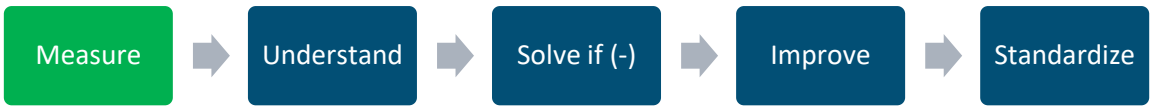
Further, the reduction of touchpoints would reduce the workload of people. This reduction of the workload can be utilized for other value adding processes. Or excess workers can be removed to reduce expenses.

4) Optimize Problem Solving Capabilities

What is the problem? Is it big? Small? The Business Impact? None of these questions can be answered without data. The SMART Spreader Machine can answer these questions due to,

- Data availability
- Data accuracy
- Effortless due to automated data collection
- Continuous streaming of data

This data can be utilized to support continuous improvement which roots from data collection,



5) Support Sustainability

Social Sustainability – Reduction of the workload and complexity of the operator's task.

Environmental Sustainability - Reduction of Paper usage

FUTURE WORK/ MODIFICATIONS

- Analyzing collected data and searching for trends/ forecasting.
- Implementing rewarding and incentive schemes for layer performance.
- Automatic detection of abnormalities
- Data accuracy increment
- Standardizing process performance parameters