WORK AND TIME STUDIES PROJECT
Process: Mower's Handle sub-assembly case

Member: Linh, Nguyen Ngoc Khanh - An, Huynh Thien - Tu, Tran Thi My - Yen, Dang Thi Hoang

1.1 Study goal

- Define time of each operation
- Optimize processes, especially on operations that occupy much time
- Utilize the result of the watch time study as inspiration for further optimization ideas in the future

1.2 Method

- Time Measurement (MTM)
- Flowchart
- 5S
- DMAIC

2 Define

Workpiece
- Material: Mower's Handle Sub-assembly
- Status: Good
- Material No: 1000
- Dimension shape weight: 3.5 kg

Environment influences
Good condition & power

Workers
- Name: Nguyen Van Nam
- Personal No: T2395
- Sex: Male
- Age: 23
- Experience in:
  - Similar tasks: 2 months
  - This task: 2 months

Machines
- 01 Magnetic Sensor Pen with green light and alarm in very good condition, power
- 01 Fixture with accurate gauges in very good condition, power

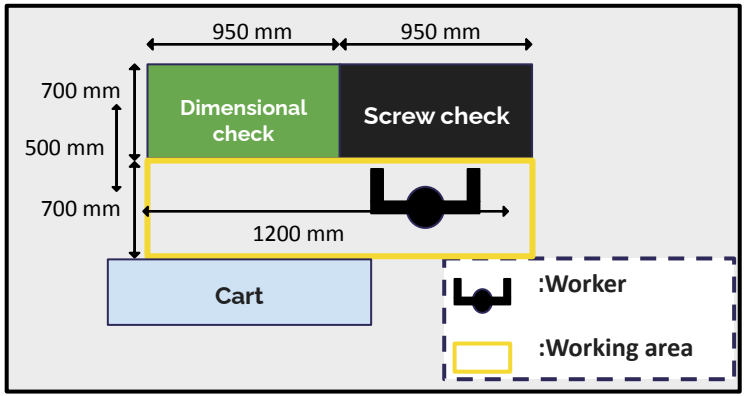

Figure 1: Workplace layout

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3 Measure

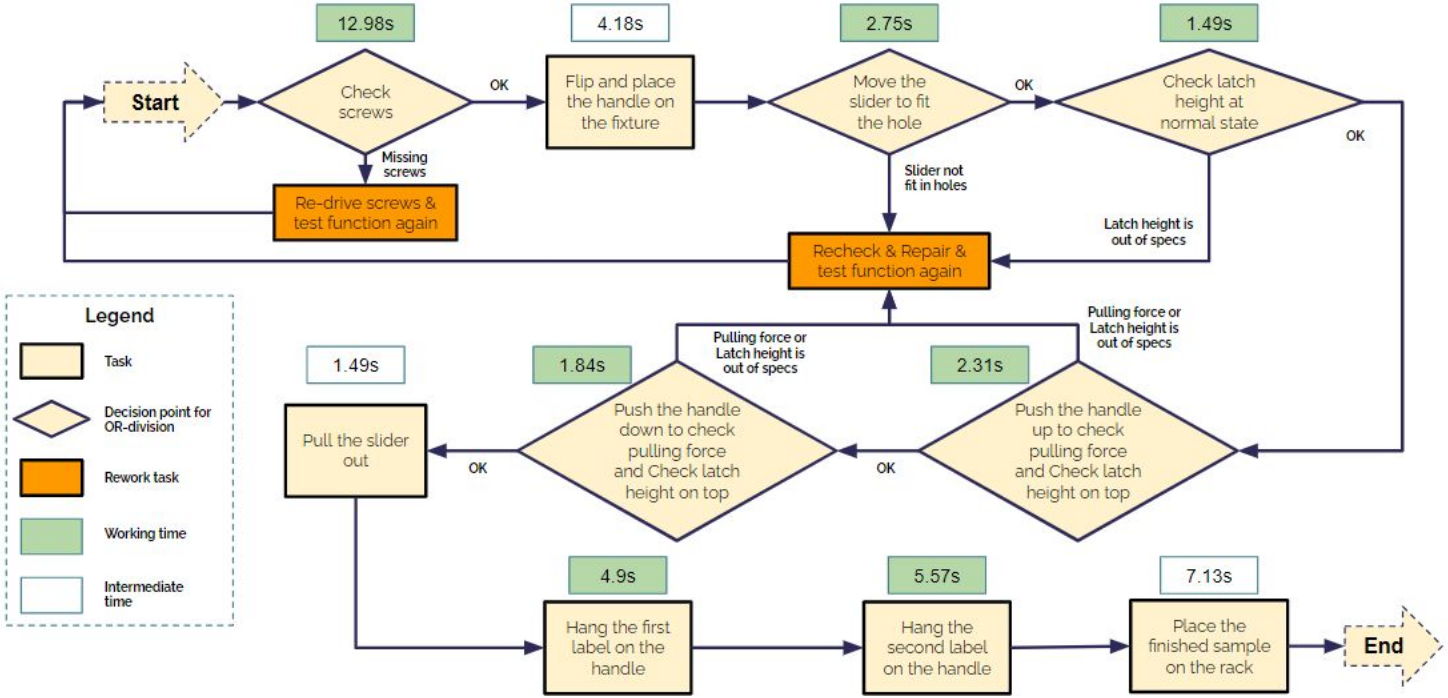

Figure 2: Flow chart

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4 Analysis

- Our process follows **Simple sequence**
- T_T = 44.62s
- There are **10** process elements that take 44.62 seconds to complete.
- **Value-adding**: **7** process elements with time share of 31.83 / 44.62s = 71.33% of the throughput time
- **Non-value-adding**: **3** process elements, 28.66% of the throughput time
- **Production rate**: With cycle time T_T = 44.62s we can calculate the Production rate = 3600 / 44.62 = 80.68 (pieces per hour)

⇒ Workflow **can be improved**

Worker utilization:

- Set up time = 0
- Execution time = 0
- Time per unit = 44.62
- Order time = 44.62

⇒ Worker utilization rate = 44.62 / 44.62 = **100%**

Machine utilization:

- Magnetic Sensor Pen: 12.98 / 44.62 = **29.10%**
- Fixture: (2.75 + 1.49 + 2.31 + 1.84 + 1.49 + 4.90 + 5.57) / 44.62 = **45.56%**

Figure 2: Flow chart

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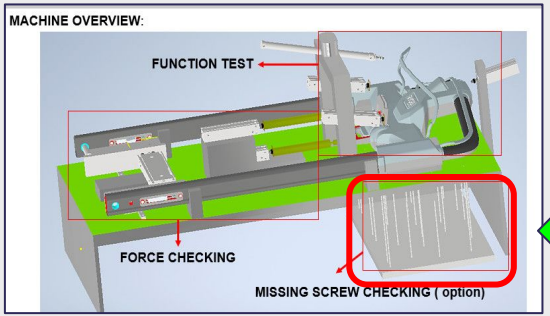
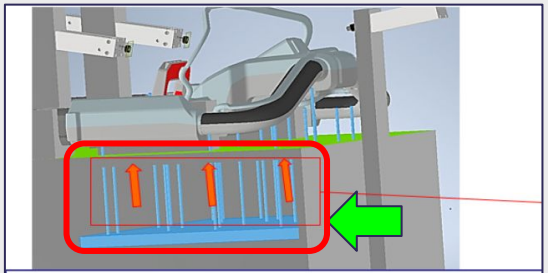
5 Improve

3 suggestions Overview & characterics of optimized process:

- Apply auto-check-screw
- Apply auto-zip-tie machine
- Change working layout

Process 1: Auto-check-screw

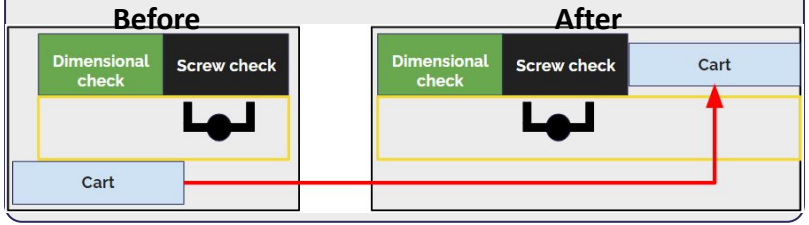




- **Machine's lower part :**
- Has missing screw checking structure.
- Works same time with function testing structure on top.

Process 8, 9: Auto-zip-tie machine (*)

Process 10: Change rack layout



(*) ML120 Fixing Label Toy Elastic Plastic Pin Tagging Machine Pneumatic for Garment Packing, Available at: URL https://www.alibaba.com/product-detail/Elastic-Plastic-Machine-Packaging-Machine-ML120_1600096322775.html (Accessed: 24/04/2022)

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6 Control

	Actual process	Optimized process	Comparison
Throughput time	44.62 s	**28.35 s**	**Decrease 16.27s**
Value-adding activity time	71.33%	**80.68%**	**Increase 9.3%**
Non-value adding activity time	28.66%	**19.37%**	**Decrease 9.29%**
Production rate (pieces per hour)	80.68 pcs/h	**126.98 pcs/h**	**Increase 46.3 pcs/h**

Based on calculated value, the **optimized process** prove to **work better**

Appendix 1 - Observation sheet

WTS	Time Study Sheet for non-recurrent processes	Doc No 01 Page 1 of 2 Pages

Work task: Check dimension (height, pulling force) and label finished goods

Order No.	2104	**Quantity m of the order**	1000	**Department**	Production	**Cost Center**	140000
Date of time study	18.04.2022	**Start**	Time Quantity: 8:00	**End**	Time Quantity: 8:20	**Duration**	20 mins

Contruction of time per unit	Time in second	Origen
Basic time t.g	44.62	
Recovery time t.er if Z.er = %	0	
Allowance time t.v if z.v = %	0	
Other surcharges	0	
Time per unit t.e1	44.62	
t.e1/ t.e100/ t.e1000		
Setup time t.r	0	

Work procedure and work method

Worker uses the Magnetic Sensor Pen to check srew and then fix the object in the table. After pushing the handle to check height, pulling force, he labels and stores in the rack waiting for the next step

	Denotation	Material	Initial State	Drawing No	Material No	Dimension shape weight
Workpiece (input)	Line 1, shopfloor	Mower's Handle Sub-assembly	Good	M111	1000	3.5 kg

	Name	Personal No.	m	f	Age	Experience in similar tasks	Experience in this task
Man	Nguyen Van Nam	T2395	x		23	2 months	2 months

	Denotation, type	No	Machine No	Pt year	Technical data, condition
Operating means	Magnetic Sensor Pen	1	M11	2018	very good condition, power
	Fixture	1	F14	2018	very good condition, power

Environment influences						**Remuneration**	Time wage
Remarks	The time study aims on determination of standard time						
Quality of the result	Good						
Elaborated by	Tu	**Checked by**	An	**Date**	21.04.2022	Valid from 21.04.2022 to new changes	

Appendix 1 - Observation sheet

No.	Process section and Measurement point	Ref. quant	Influence variables	Meas. val. Class	Zy / mz	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Sum(L) / n	L	t= L t / 100.00 i
1	Check screws	1	Check 22 screws		L	100	120	110	110	110	100	100	120	110	100	100	120	120	120	120	110	110	110	110	110	2210 / 20	110.50	12.98
					ti	14	11	12	12	12	13	14	11	12	13	13	11	11	11	11	11	11	11	11	10	235 / 20	11.75	
	Check last screw				F	14	53	95	137	188	230	273	317	353	394	436	473	518	563	600	641	687	727	769	808			
2	Flip and place the handle on the fixture	1	Weight of handle : 3.5kg		L	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	2200 / 20	110.00	4.18
					ti	4	3	5	4	3	4	3	3	4	4	5	3	4	3	3	4	5	4	4	4	76 / 20	3.80	
	The handle is placed on fixture				F	18	56	100	141	191	234	276	320	357	398	441	476	522	566	603	645	692	731	773	812			
3	Move the slider to fit the hole	1			L	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	2200 / 20	110.00	2.75
					ti	3	3	3	2	3	3	2	3	3	3	3	3	2	3	2	2	2	2	1	2	50 / 20	2.50	
	2 sliders are fit into 2 holes				F	21	59	103	143	194	237	278	323	360	401	444	479	524	569	605	647	694	733	774	814			
4	Check latch height at normal state	1			L	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	2200 / 20	110.00	1.49
					ti	1	1	1	1	2	2	2	2	1	1	1	2	2	1	1	1	1	2	1	1	27 / 20	1.35	
	Touch the red clamp				F	22	60	104	144	196	239	280	325	361	402	445	481	526	570	606	648	695	735	775	815			
5	Push the handle up to check pulling force and Check latch height on top	1	The positions of latch		L	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	2200 / 20	110.00	2.31
					ti	2	2	2	3	2	2	3	2	2	2	2	2	2	2	2	2	2	2	2	2	42 / 20	2.10	
	Pull back the the red clamp				F	24	62	106	147	198	241	283	327	363	404	447	483	528	572	608	650	697	737	777	817			
6	Push the handle down to check pulling force and Check latch height on top	1	The positions of latch		L	110	110	110	110	110	10	110	110	110	110	110	110	110	110	110	110	110	110	110	110	2100 / 20	105.00	1.84
					ti	2	2	2	2	1	1	2	2	1	1	1	1	3	2	2	2	2	2	2	2	35 / 20	1.75	
	Release the the red clamp				F	26	64	108	149	199	242	285	329	364	405	448	484	531	574	610	652	699	739	779	819			
7	Pull the slider out	1			L	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	2200 / 20	110.00	1.49
					ti	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	3	3	3	27 / 20	1.35	
	2 sliders are pulled out of 2 holes				F	27	65	109	150	200	243	286	330	365	406	449	486	532	575	611	653	701	742	782	822			
8	Hang the first label on the handle	1			L	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	2200 / 20	110.00	4.90
					ti	5	5	4	5	5	4	5	5	4	5	4	5	5	4	5	6	3	3	4	3	89 / 20	4.45	
	First label is hung nicely				F	32	70	113	155	205	247	291	335	369	411	454	491	540	580	618	659	704	745	786	825			
9	Hang the second label on the handle	1			L	110	110	110		110	110	110		110	110		110	110		110	110	110	110	110	110	1760 / 16	110.00	5.57
					ti	6	4	5		6	6	6		6	5		4	5		5	4	5	5	4	5	81 / 16	5.06	
	Second label is hung nicely				F	38	74	118		211	253	297		375	416		496	545		623	663	709	750	790	830			
10	Place the finished sample on the rack	1	Weight of handle : 3.5kg		L	120	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	2210 / 20	110.50	7.13
					ti	4	6	7	7	6	6	6	6	6	7	6	6	6	6	7	7	7	8	7	8	129 / 20	6.45	
	The handle is placed nicely on rack				F	42	80	125	162	217	259	303	341	381	423	461	502	551	587	629	670	716	758	797	838			
11	Re-input wire into hole if drop	1			L																							
					ti		3					3					4											
	Worker fully stand up				F		83					306					506											
12	Wait for previous station to take new workpiece	1			L																							
					ti				14												6			1				
	New handle is placed on table				F				176												676			798				
n=	20	k =	4	Sum of time per cycle tz		42	41	42	51	41	42	47	35	40	42	36	42	41	33	39	46	40	42	40	40	Σ tz = 791	Σ t =	44.62
tz=	Σ tz /n = 791 / 20		= 39.55	Range per 5 cycle Rz			10					12					9					6				Σ Rz = 37		
Rz=	Σ Rz /k = 37 / 4		= 9.25	Z = (Rz / tz) × 100% = (9.25/39.55) × 100% =		23.39%																					

Nr/Zy	From	To	Duration	Comment
11/2	80	83	3	
11/7	303	306	3	Wire drop so worker need to put the wire into the hole again
11/12	502	506	4	
12/4	162	176	14	
12/16	670	676	6	Previous station sometimes has failure or other reason so this station need to wait for that
12/19	797	798	1	

Appendix 2 - Production task, information on workers and machines

No.	Process	Working person	Magnetic Sensor Pen	Fixture	Work piece
1	**Check screws**	Main activity	Main utilization	Interruption due to cycle	Checking
2	**Flip and place the handle on the fixture**	Ancillary activity	Interruption due to cycle	Ancillary utilization	Conveying
3	**Move the slider to fit the hole**	Main activity	Interruption due to cycle	Main utilization	Checking
4	**Check latch height at normal state**	Main activity	Interruption due to cycle	Main utilization	Checking
5	**Push the handle up to check pulling force and Check latch height on top**	Main activity	Interruption due to cycle	Main utilization	Checking
6	**Push the handle down to check pulling force and Check latch height on top**	Main activity	Interruption due to cycle	Main utilization	Checking
7	**Pull the slider out**	Ancillary activity	Interruption due to cycle	Ancillary utilization	Conveying
8	**Hang the first label on the handle**	Main activity	Interruption due to cycle	Main utilization	Affecting
9	**Hang the second label on the handle**	Main activity	Interruption due to cycle	Main utilization	Affecting
10	**Place the finished sample on the rack**	Ancillary activity	Interruption due to cycle	Interruption due to cycle	Conveying
11	**Re-input wire into hole if drop**	Additional activity	Interruption due to dysfunction	Interruption due to dysfunction	Additional modifying
12	**Wait for previous station to take new workpiece**	Interruption due to dysfunction	Interruption due to dysfunction	Interruption due to dysfunction	Additional lying

Appendix 3 - Production task

No.	Activities	Description
1	Check screws	Check whether if the quantity of screws is adequate
2	Flip and place the handle on the fixture	Set up the checking position of handle
3	Move the slider to fit the hole	Check whether if the handle has flashing /bur
4	Check latch height at normal state	Check the quality and balance of the latches
5	Push the handle to check pulling force and check latch height on top	Check the quality and balance of the springs
6	Pull the slider out	Finish checking
7	Hang the labels on the handle	Label to identify the product brand and instructions for use
8	Place the finished sample on the rack	In position ready for next process