Finding Relationship among NASA TLX components using Fuzzy DEMATEL method

UNDER THE SUPERVISION OF

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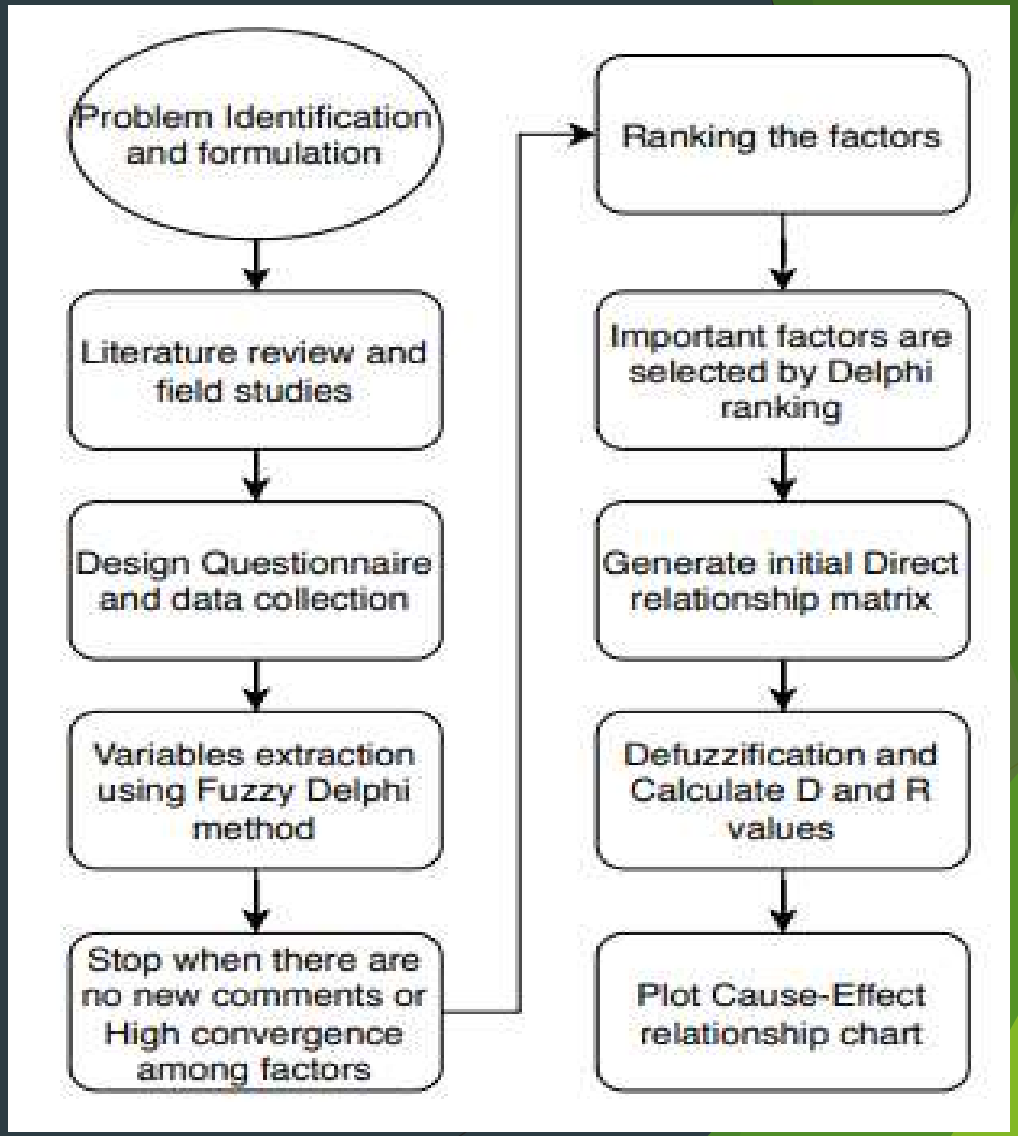
INTRODUCTION

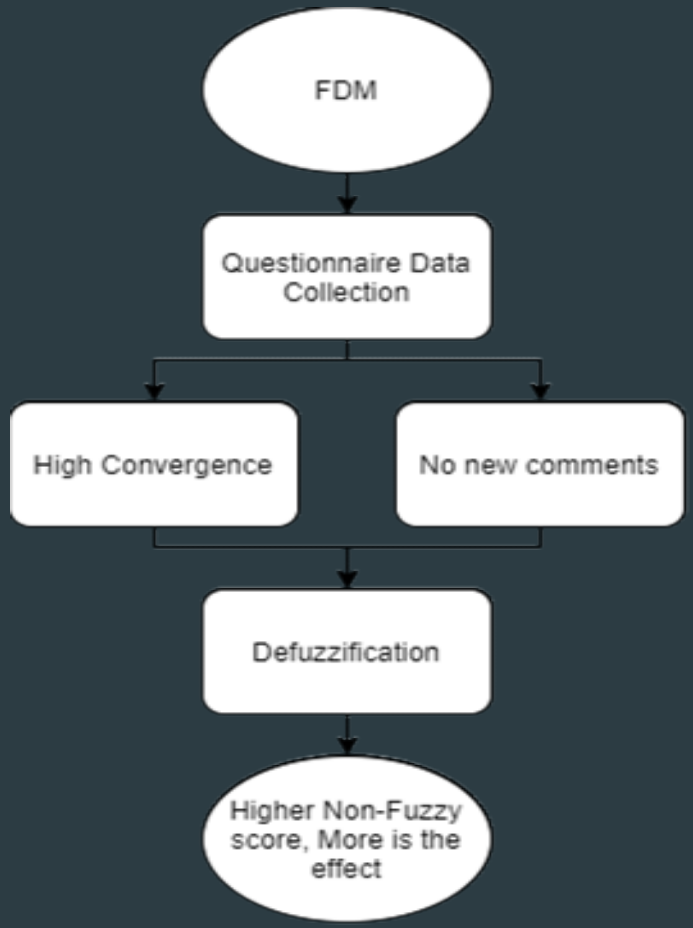
- Workload is one of the main factors to achieve high performance.
- Assessment of mental workload is an important aspect in the design and evaluation of tasks at work.
- Fuzzy logic is a method that has the ability to process variables that are blurred or biased and can’t be described with certainty.
- Fuzzy DEMATEL could well identify the interdependency among the factors.

Methodology

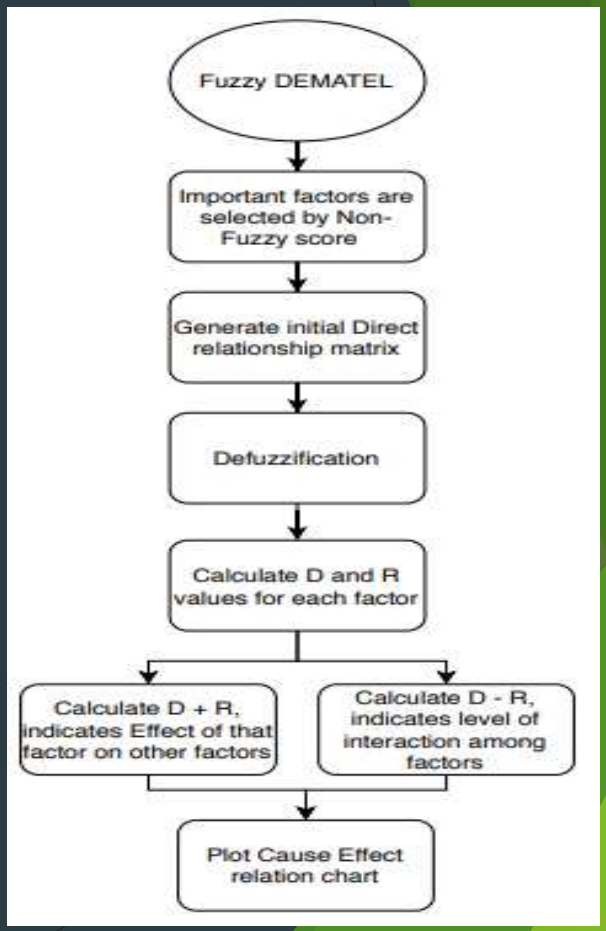
Road map for conducting the study



Implementation of Fuzzy Delphi and DEMATEL



Stopping Criteria



Questionnaire Direct relation matrix

- WI – Weakly Important
- VSI – Very Slightly Important
- SI - Slightly Important
- MI - Moderately Important
- AI – Absolutely Important

- VL- Very Low
- L – Low
- ML – Moderately Low
- M – Moderate
- MH – Moderately High
- H – High
- VH – Very High

	MD	PD	TD	F	E	P
Mental Demand (MD)	EI	MI	VSI	SI	WI	SI
Physical Demand (PD)	VSI	EI	SI	WI	SI	MI
Temporal Demand (TD)	SI	MI	EI	SI	MI	EI
Frustration (F)	SI	VSI	SI	EI	VSI	WI
Effort level (E)	MI	VSI	SI	MI	EI	SI
Performance (P)	VSI	SI	MI	WI	SI	EI

	MD	PD	TD	F	E	P
Mental Demand (MD)	VH	ML	H	L	MH	VL
Physical Demand (PD)	MH	VH	VL	H	L	MH
Temporal Demand (TD)	MH	L	H	ML	H	VH
Frustration (F)	H	M	MH	ML	VH	H
Effort level (E)	VH	L	MH	ML	VL	L
Performance (P)	VL	H	VL	H	MH	H

Linguistic Terms and their Fuzzy Numbers

Trapezoidal Fuzzy Number

	A	B	C	D
EI	0	0	0.1	0.2
VWI	0.1	0.2	0.2	0.3
WI	0.2	0.3	0.4	0.5
MI	0.4	0.5	0.5	0.6
SI	0.5	0.6	0.7	0.8
VSI	0.7	0.8	0.8	0.9
AI	0.8	0.9	1	1

Triangular Fuzzy Number

	A	B	C
VL	0	0	0.1
L	0	0.1	0.3
ML	0.1	0.3	0.5
M	0.3	0.5	0.7
MH	0.5	0.7	0.9
H	0.7	0.9	1
VH	0.9	1	1

Results

- **Defuzzification:**

$Z = 0.25 * (a+ 2*b + c)$

$Z = (2*a+ 7*(b + c) + 2*d) / 18$

	A	B	C	Non-Fuzzy number
VL	0	0	0.1	0.16
L	0	0.1	0.3	0.35
ML	0.1	0.3	0.5	0.55
M	0.3	0.5	0.7	0.71
MH	0.5	0.7	0.9	0.84
H	0.7	0.9	1	0.94
VH	0.9	1	1	0.99

- **Direct Relation Non-Fuzzy Score Matrix:**

D value indicates the effect of that factor on other factors

R value indicates the effect of other factors on this factor

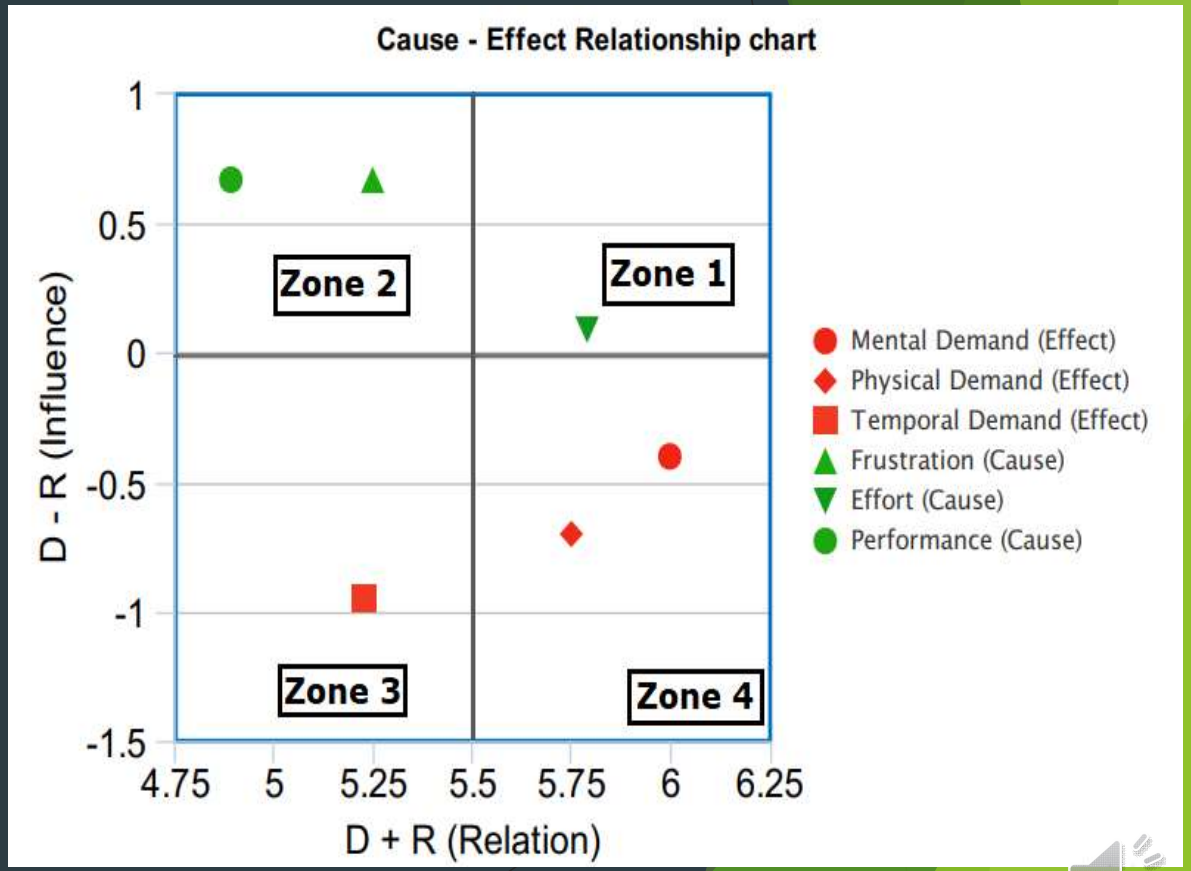
	MD	PD	TD	F	E	P	D - Value
Mental Demand (MD)	0.06	0.42	0.75	0.61	0.33	0.64	2.80
Physical Demand (PD)	0.75	0.06	0.64	0.33	0.64	0.42	2.84
Temporal Demand (TD)	0.54	0.47	0.06	0.54	0.47	0.06	2.14
Frustration (F)	0.61	0.67	0.54	0.06	0.75	0.33	2.96
Effort level (E)	0.49	0.75	0.61	0.42	0.06	0.61	2.94
Performance (P)	0.75	0.54	0.49	0.33	0.61	0.06	2.78
R -Value	3.20	2.91	3.09	2.29	2.85	2.11	

Summary Table

Factor	ID	D - Value	R - Value	D + R	D - R	Group
Mental Demand	MD	2.80	3.20	6.00	-0.40	Effect
Physical Demand	PD	2.84	2.91	5.75	-0.07	Effect
Temporal Demand	TD	2.14	3.09	5.23	-0.95	Effect
Frustration	F	2.96	2.29	5.25	0.67	Cause
Effort level	E	2.94	2.85	5.79	0.09	Cause
Performance	P	2.78	2.11	4.89	0.67	Cause

Cause-Effect Relation Chart

Factor	Zone	D - Value	R - Value	D + R	D - R	Group
Mental Demand	4	2.80	3.20	6.00	-0.40	Effect
Physical Demand	4	2.84	2.91	5.75	-0.07	Effect
Temporal Demand	3	2.14	3.09	5.23	-0.95	Effect
Frustration	2	2.96	2.29	5.25	0.67	Cause
Effort level	1	2.94	2.85	5.79	0.09	Cause
Performance	1	2.78	2.11	4.89	0.67	Cause



THANK YOU