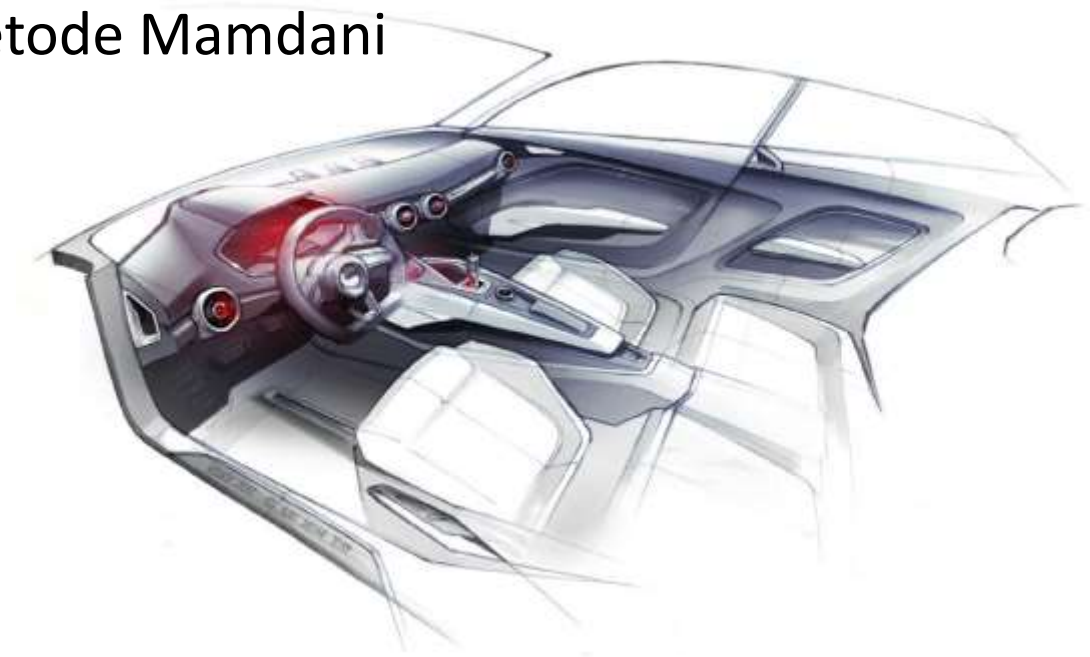
Automatic Braking System

Menggunakan Fuzzy Logic metode Mamdani



Anggota

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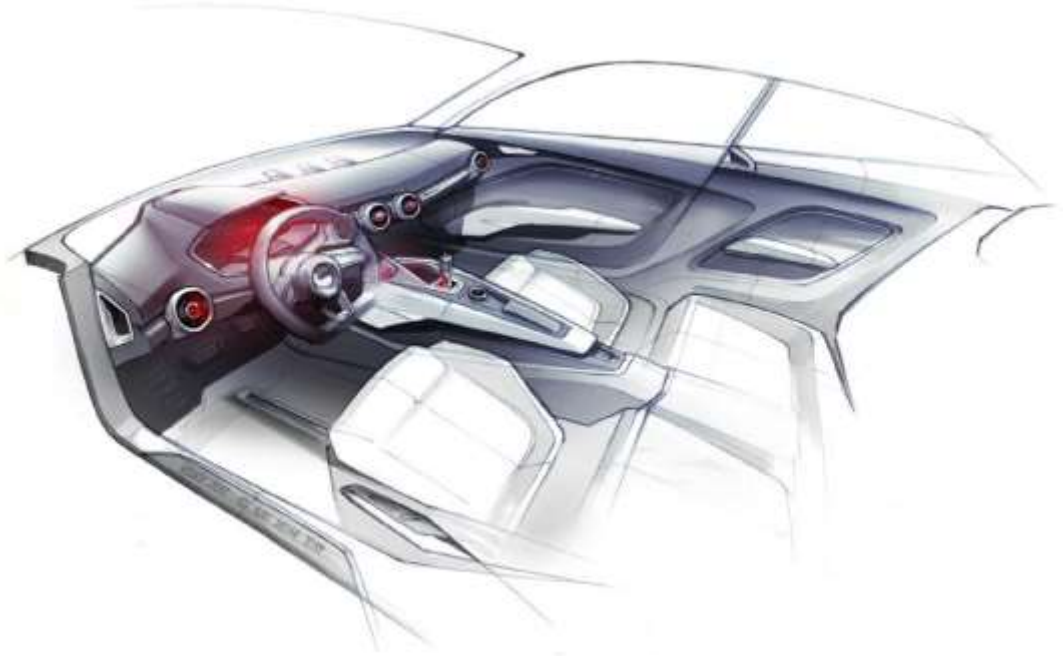
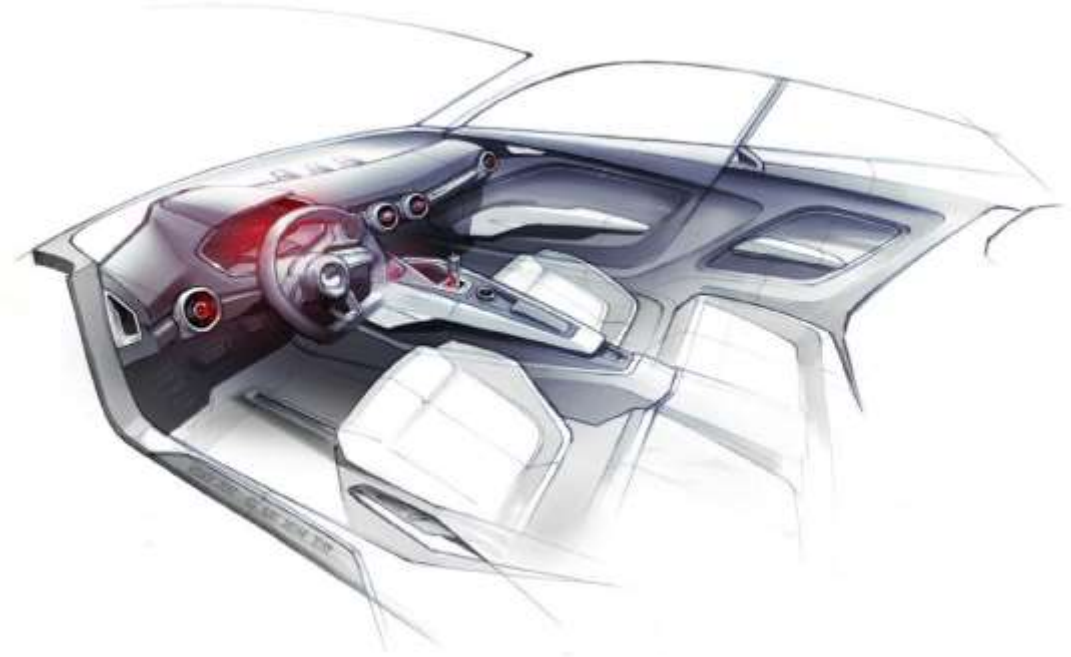


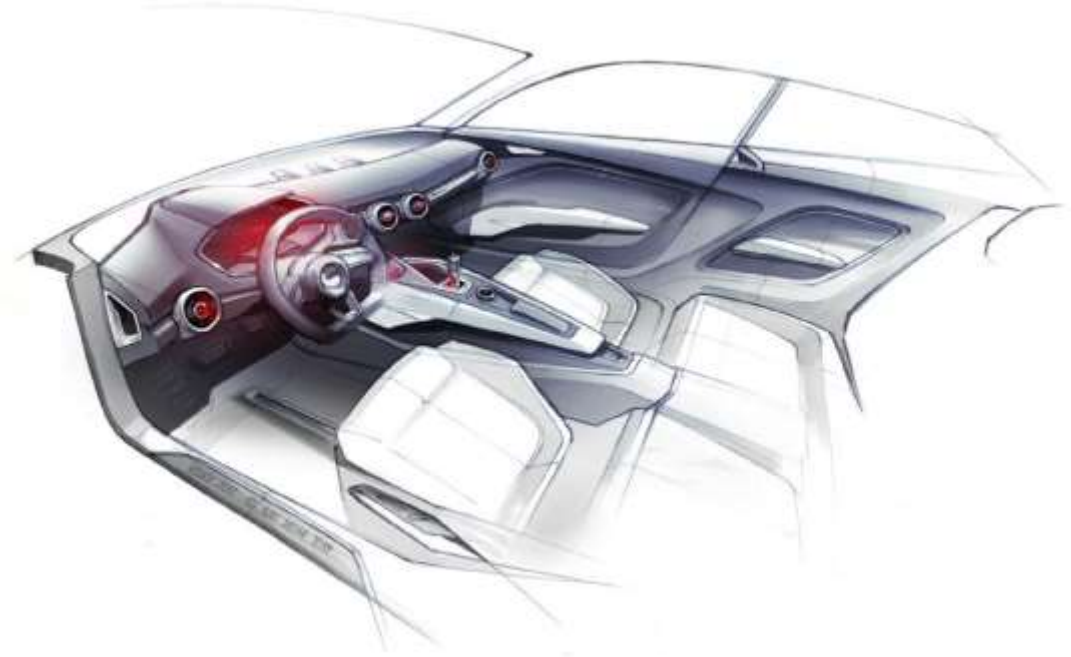
Tujuan

- Membuat sebuah sistem pengereman otomatis pada mobil agar memperkecil jumlah resiko terjadinya kecelakaan pada kendaraan mobil dengan menerapkan inferensi fuzzy Mamdani.



Perancangan

- Input dan Output
- Fungsi Keanggotaan
- Penyusunan Rules
- Perancangan GUI



Perancangan : Input & Output

Input/output	Nama variabel	Himpunan Universal
Kecepatan (km/h)	Speed	[0,120]
Jarak (m)	Distance	[0,10]
Kemiringan Jalan ( )	Angle	[-90,90]
Tingkat Kekuatan Rem	Brake Level	[0,10]

Fungsi Keanggotaan : Kecepatan

Slow (X)

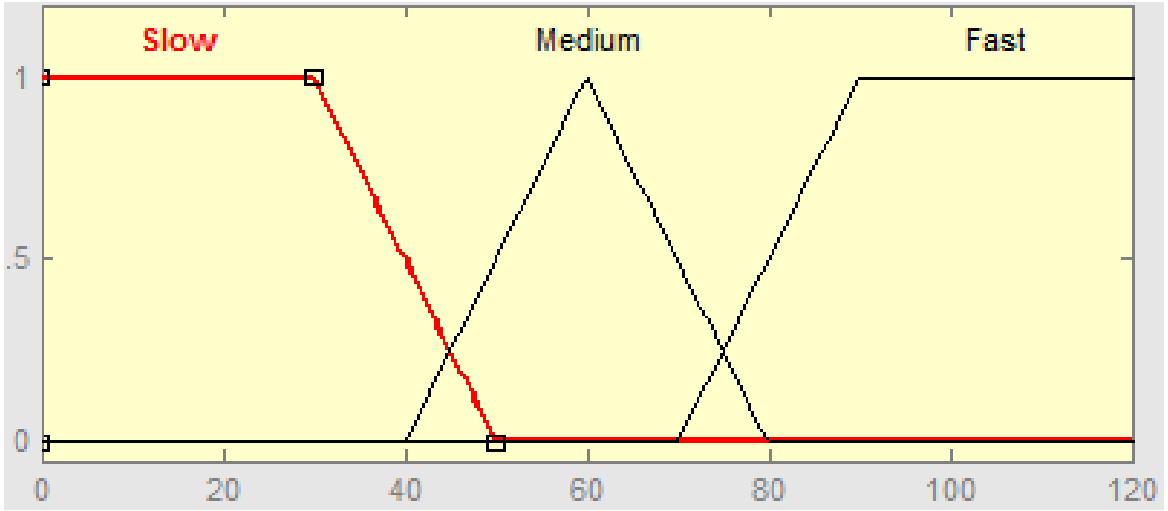
$$\begin{cases} 1, & X \le 30 \\ \frac{50 - X}{50-30}, & 30 < X < 50 \\ 0, & X \ge 50 \end{cases}$$

Medium (X)

$$\begin{cases} \frac{X - 40}{60-40}, & 40 < X \le 60 \\ \frac{-X - 80}{80-60}, & 60 < X \le 80 \\ 0, & X \le 40, X \ge 80 \end{cases}$$

Fast (X)

$$\begin{cases} 1, & X \ge 90 \\ \frac{X - 70}{90-70}, & 70 < X < 90 \\ 0, & X \le 70 \end{cases}$$



Fungsi Keanggotaan : Jarak

Near (X)

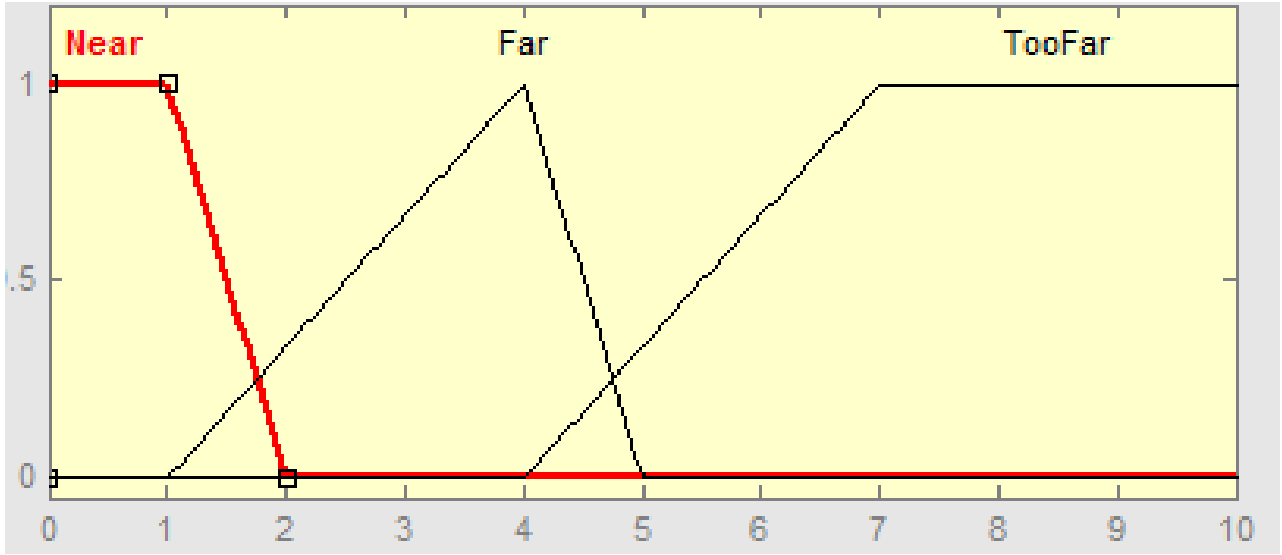
$$\begin{cases} 1, & X \le 2 \\ \frac{2 - X}{2 - 1}, & 1 < X < 2 \\ 0, & X \ge 2 \end{cases}$$

Far (X)

$$\begin{cases} \frac{X - 1}{4 - 1}, & 1 < X \le 4 \\ \frac{-X - 5}{5 - 4}, & 4 < X \le 5 \\ 0, & X \le 40, X \ge 80 \end{cases}$$

TooFar (X)

$$\begin{cases} 1, & X \ge 7 \\ \frac{X - 4}{7 - 4}, & 4 < X < 7 \\ 0, & X \le 4 \end{cases}$$



Fungsi Keanggotaan : Kemiringan Jalan

Down (X)

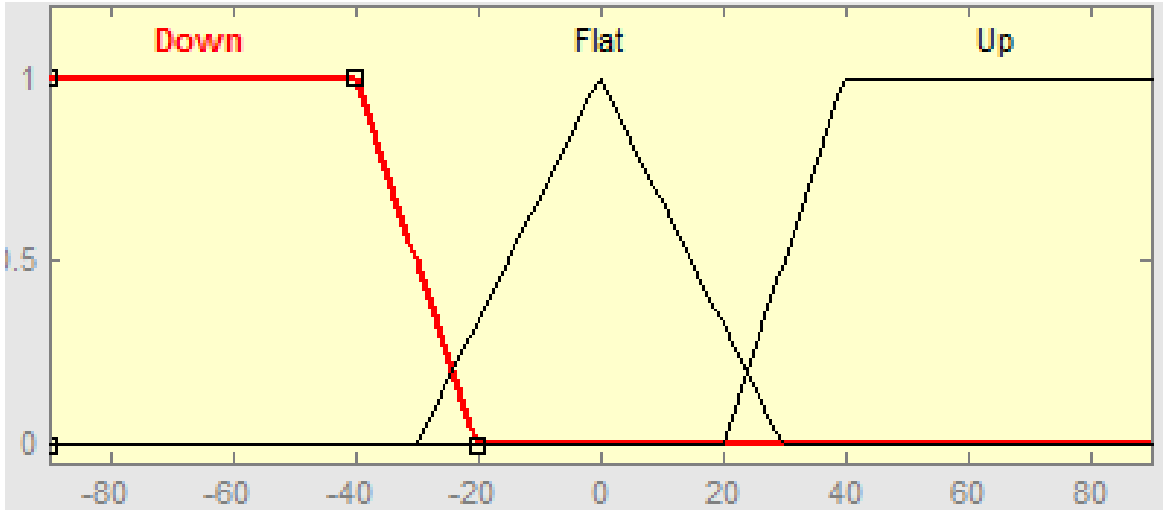
1,	X ≤ -40
-30 - X,	-40 < X < -20
-30-(-0)	
0,	X ≥ -20

Flat (X)

X – (-30),	-20 X ≤ 0
0 – (-30)	
-X - 30,	0 < X ≤ 30
30 - 0	
0, X ≤	-30, X ≥ 30

Up (X)

1,	X ≥ 40
X - 20,	20< X <40
40 - 20	
0,	X ≤ 20



Fungsi Keanggotaan : Tingkat Pengereman

Weak (X)

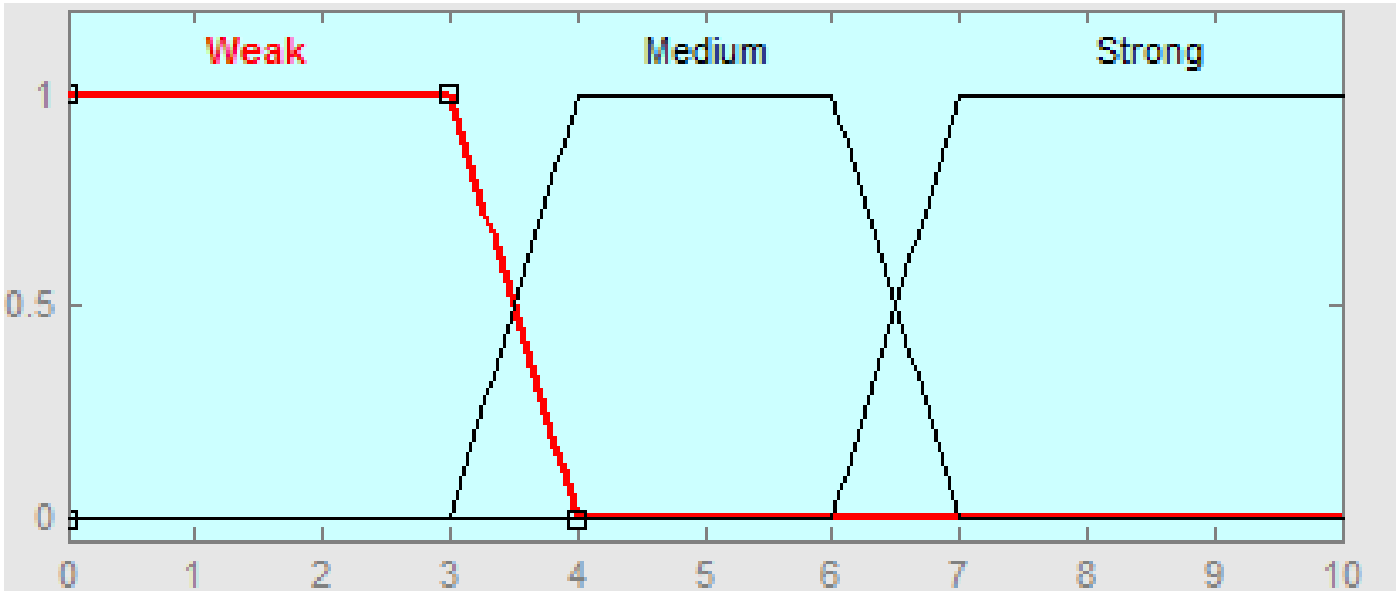
$$\begin{cases} 1, & X \le 3 \\ \frac{4 - X}{4 - 3}, & 3 < X < 4 \\ 0, & X \ge 4 \end{cases}$$

Medium (X)

$$\begin{cases} \frac{1}{4 - 3}, & X \ge 4, X \le 6 \\ \frac{X - 3}{4 - 3}, & 3 < X < 4 \\ \frac{7 - X}{7 - 6}, & 6 < X \le 7 \end{cases}$$

Strong (X)

$$\begin{cases} 1, & X \ge 7 \\ \frac{X - 4}{7 - 6}, & 6 < X < 7 \\ 0, & X \le 3, X \ge 7 \end{cases}$$



Penyusunan Aturan Fuzzy (RULES)

1. If (Speed is Slow) and (Distance is Near) and (Angle is Down) then (BrakeLevel is Strong)
2. If (Speed is Slow) and (Distance is Near) and (Angle is Up) then (BrakeLevel is Weak)
3. If (Speed is Slow) and (Distance is Near) and (Angle is Flat) then (BrakeLevel is Medium)
4. If (Speed is Slow) and (Distance is Jauh) and (Angle is Flat) then (BrakeLevel is Weak)
5. If (Speed is Slow) and (Distance is Jauh) and (Angle is Up) then (BrakeLevel is Weak)
6. If (Speed is Slow) and (Distance is Jauh) and (Angle is Down) then (BrakeLevel is Medium)
7. If (Speed is Slow) and (Distance is TooFar) and (Angle is Flat) then (BrakeLevel is Weak)
8. If (Speed is Slow) and (Distance is TooFar) and (Angle is Up) then (BrakeLevel is Weak)
9. If (Speed is Slow) and (Distance is TooFar) and (Angle is Down) then (BrakeLevel is Medium)
10. If (Speed is Medium) and (Distance is Near) and (Angle is Flat) then (BrakeLevel is Strong)
11. If (Speed is Medium) and (Distance is Near) and (Angle is Up) then (BrakeLevel is Medium)
12. If (Speed is Medium) and (Distance is Near) and (Angle is Down) then (BrakeLevel is Strong)
13. If (Speed is Medium) and (Distance is Jauh) and (Angle is Flat) then (BrakeLevel is Medium)
14. If (Speed is Medium) and (Distance is Jauh) and (Angle is Up) then (BrakeLevel is Weak)
15. If (Speed is Medium) and (Distance is Jauh) and (Angle is Down) then (BrakeLevel is Strong)
16. If (Speed is Medium) and (Distance is TooFar) and (Angle is Flat) then (BrakeLevel is Weak)
17. If (Speed is Medium) and (Distance is TooFar) and (Angle is Up) then (BrakeLevel is Weak)
18. If (Speed is Medium) and (Distance is TooFar) and (Angle is Down) then (BrakeLevel is Medium)
19. If (Speed is Cepat) and (Distance is Near) and (Angle is Flat) then (BrakeLevel is Strong)
20. If (Speed is Cepat) and (Distance is Near) and (Angle is Up) then (BrakeLevel is Medium)
21. If (Speed is Cepat) and (Distance is Near) and (Angle is Down) then (BrakeLevel is Strong)
22. If (Speed is Cepat) and (Distance is Jauh) and (Angle is Flat) then (BrakeLevel is Strong)
23. If (Speed is Cepat) and (Distance is Jauh) and (Angle is Up) then (BrakeLevel is Medium)
24. If (Speed is Cepat) and (Distance is Jauh) and (Angle is Down) then (BrakeLevel is Strong)
25. If (Speed is Cepat) and (Distance is TooFar) and (Angle is Flat) then (BrakeLevel is Medium)
26. If (Speed is Cepat) and (Distance is TooFar) and (Angle is Up) then (BrakeLevel is Weak)
27. If (Speed is Cepat) and (Distance is TooFar) and (Angle is Down) then (BrakeLevel is Strong)

CONTOH KASUS A

- Masukkan 3 Titik yang menghasilkan 2 Rules, Semisal ada pengendara yang tertidur melaju dengan kecepatan 75 (km/h), dan berada pada jalan yang menurun sebesar 45° dan didepannya berada sebuah kendaraan yang jaraknya kurang lebih 7 meter. Maka seberapa kuat tingkat pengereman yang akan dilakukan oleh system. Maka dapat diasumsikan masukkan untuk system berupa.
- *Speed* = 75 (km/h)
- *Distance* = 7 meter
- *Angle* = -45.

KASUS A

Pada variabel *Speed* didapatkan

- *Medium* (0,25) & *Fas*t (0,25)

Pada variabel Distance didapatkan

- *TooFar* (1)

Pada Variabel *Angle* didapatkan

- Down (1)

Penerapan *Rules* serta **Implikasi**

- Medium (0,25) ^ TooFar (1) ^ Down (1) = Medium (0,25)
- Fast (0,25) ^ TooFar (1) ^ Down (1) = Strong (0,25)

Menggunakan **Fuzzy inference system** metode mamdani untuk mendapatkan area *medium* dan *Strong*

Centroid / COG dengan Titik sempel pada 1 s/d 10
Brake Level= 7

CONTOH KASUS B

- Semisal ada pengendara yang tertidur melaju dengan kecepatan 50 (km/h), dan berada pada jalan yang menanjak sebesar 29° dan didepannya berada sebuah kendaraan yang jaraknya kurang lebih 4 meter. Maka seberapa kuat tingkat pengereman yang akan dilakukan oleh system. Maka dapat diasumsikan masukkan untuk system berupa.
- ***Speed* = 50 (km/h)**
- ***Distance* = 4 meter**
- ***Angle* = 29.**

Pada variabel *Speed* didapatkan

- *Medium* (0,5) & Slow (0)

Pada variabel Distance didapatkan

- *Far (1)* & *TooFar* (0)

Pada Variabel *Angle* didapatkan

- *Up (0,45)* & *Flat (0,03)*

Penerapan *Rules* serta **Implikasi**

- *Medium (0,5) ^ Far (1) ^ Up (0,45) = weak (0,45)*
- *Medium (0,5) ^ Far (1) ^ Flat (0,03)= Medium (0,03)*
- *Medium (0,5) ^ Toofar (0) ^ Up (0,45)= weak (0)*
- *Medium (0,5) ^ Toofar (0) ^ Flat(0,03)= Weak(0)*
- Slow (0)^ *far (1) ^ Up (0,55)= weak (0)*
- Slow (0)^ *far (1) ^ Flat(0,03)= weak(0)*
- Slow (0)^ *TooFar (0) ^ Up (0,45)= weak(0)*
- Slow (0)^ *TooFar (0) ^ Flat(0, 03)= weak(0)*

Agregasi

- Weak (0,45) n Weak (0) n Weak (0) n Weak (0) n Weak (0) n Weak (0) = Weak (0,45)
- Medium (0,5)

Centroid / COG dengan Titik sempel pada 1 s/d 10
Brake Level= 2.206