Willing of public to purchase and understanding of pedestrian AEB system in Malaysia

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Abstract. Autonomous Emergency Brake (AEB) is a vehicle safety technology which has the potential to prevent a crash or reduce the impact speed of a crash. The technology can alert a driver to an imminent crash and help them use the maximum braking capacity of the car. AEB comes in three categories namely low speed, higher speed and pedestrian system. The pedestrian AEB system detects pedestrian movement in relation to the path of the vehicle to determine the risk of collision. AEB systems are designed to support the driver only in emergency situations and that the driver remains responsible for the vehicle at all times. The main aim of this study is to determine understanding of citizen in Malaysia and their willingness-to-pay for pedestrian AEB system to fit in their vehicle. The result of this research will find the willingness of Malaysia citizen to purchase with affordable range price of pedestrian AEB system and their understanding it function and the importance of this system nowadays. From this study, it can encourage car manufacturers in Malaysia to produce vehicles that fitted with pedestrian AEB system on their car as standard of ASEAN NCAP in the future.

1. Introduction
The preliminary report issued by the National Transportation Safety Board, on a fatal accident that occurred on 18 March 2018 involving a pedestrian and a Uber vehicle confirmed that the car had detected the pedestrian as early as 6 seconds before the accident, but did not reduce the speed of vehicle or stop because the emergency braking system is was disabled [1]. This accident can be avoided if Uber does not disable this emergency system which also known as Autonomous Emergency Braking (AEB).

In Malaysia, pedestrian accounted 8% deaths due to road accidents [2]. Driver distraction is a main factor of collisions between vehicle and pedestrian [3]. Other than driver distraction, pedestrian height, car velocity and car frontal head are another reason for the fatal accidents for pedestrian [4]. AEB is the recent technology has been develops acts to reduce the speed by automatically applying the brake if a potential of crash will occur [5]. This safety feature that will give a warning to the potentials accidents that will happen and help the driver use maximum brake cars to avoid accidents. AEB will react with its own brake if the situation is in critical and no response from the driver itself. An audio-visual warning with an added brake pulse is the most effective in alert the driver to prevent accidents [4]. Most AEB systems use laser technology, radar, and optical sensor to identify vehicle and many cases pedestrians and it very effective at lower speed [6]. For ASEAN NCAP, AEB system is one of
the requirements of Advanced Safety Assist Technologies which has become one of the major road map in the new system rating for the 2017-2020 ASEAN NCAP and it accounts for 25% of Safety Assist Technologies (SATs) rating [7]. 96% of car rated by ASEAN NCAP get 4-star at minimum rating and automotive manufacture advertise their achievement as marketing tool with their positive result. Association of British Insurers (ABI) estimates that AEB system could reduce 800 000 accidents during 2012 to 2018 [8].

In 2017, the larger segment market has exhibited more safety equipment in car passengers for safety technologies such as AEB in non-luxury cars [9]. AEB comes in three categories which are AEB Inter-Urban, AEB City and AEB Vulnerable Road Users (VRU) as shown in Figure 1. AEB Inter-Urban works at a typical speed to drive outside the city, for example on a city road or highway. For AEB City, it works at lower speeds. AEB VRU is specifically for respond to vulnerable road users such as motorcyclists, pedestrian and cyclists. In 2015, analyses of international crash data identify cars fitted with AEB system 38% less likely to hit car in front of it [10].

AEB is a very important system at car nowadays to prevent accidents from occurs. However, only 56% of the Malaysian citizens are aware of the importance of AEB and it functions especially for pedestrian system. This paper wills findings the understanding Malaysian people about pedestrian AEB system and their willingness to purchase this system to fit in their vehicle.

![Figure 1.](image)

2. Methodology
This study was used survey method to collect data about awareness of Malaysians people in understanding about pedestrian AEB system. The survey was conduct for two month and distributed to Malaysians those aged 18 years and above where they were allowed to take a car driving license. A total number of 160 respondents had answered the questionnaire with 63% male and 37% female respondents.

There are have five main sections in survey which is about respondent’s personal information, respondent’s exposure to AEB pedestrians system, operation perceptions from respondents, accuracy of respondent’s judgement and respondents trust. Likert scale five points have been used to see respondents understanding of the AEB pedestrian system as result of their answers either 1=Strongly Disbelieve, 2=Disbelieve, 3=Neutral, 4=Believe and 5=Strongly Believe for each statement in survey. End of the survey, the respondent were asked whether they want spend money to fit pedestrian AEB system in their vehicle and how much they willing to pay for it.
3. Results and discussion
From a total of 160 valid respondents was collect the data information, 100 or (62%) of the respondents are male and 60 and (38%) of respondents are female. Majority of them aged between 30-39 years old (44%) and the majority education level is college or university level (66%). All the respondents participated in this survey have an occupation such as government employee (23%), educator (10%), researcher/scientist (9%), engineer/technology (30%), management/business (8%), legal profession (1%), self-employed (9%) and student (10%).

Table 1. Personal Respondent’s Information.

|            | Frequency | Percentage (%) |
|------------|-----------|----------------|
| Gender     |           |                |
| Male       | 100       | 62             |
| Female     | 60        | 38             |
| Age        |           |                |
| 18-29      | 45        | 31             |
| 30-39      | 78        | 44             |
| 40-49      | 25        | 16             |
| 50-59      | 10        | 6              |
| >60        | 2         | 3              |
| Education  |           |                |
| High School| 15        | 9              |
| College / University | 128 | 80         |
| Post Graduate (Master / PhD) | 17 | 11         |
| Occupation |           |                |
| Government Employee | 37 | 23         |
| Educator / Lecturer / Teacher | 16 | 10        |
| Scientist / Researcher | 15 | 9          |
| Engineer / Technology | 48 | 30        |
| Management / Business | 11 | 8          |
| Legal Profession | 2  | 1          |
| Self-employed | 15 | 9          |
| Student     | 16        | 10             |

From the survey, 47% of the respondents had experience in road accident while driving and 40% of them had experience involving the pedestrian as shown in pie chart in Figure 2. From the pedestrian accident, 33% of pedestrian has no injuries sustained, but 60% of pedestrian had minor injuries and 7% had severe injuries as shown in Figure 3.
From all the respondents, the result shown in Table 2 shows that only 19% of respondents have experienced driving or riding vehicles with AEB system. The cars that have all functions of AEB system which is recognized by ASEAN NCAP for Malaysian market are Honda CR-V (2017) and Hyundai Ioniq Hybrid. Perodua Myvi (2017) also has AEB system but AEB City only for this car. Most of Malaysia people find about AEB system from internet and still there are among them first time hearing about this advanced safety assist system.

**Table 2.** Perception of the operation of the pedestrian AEB system.

| Statement                        | Strongly Disbelieve | Disbelieve | Neutral | Believe | Strongly Believe |
|----------------------------------|---------------------|------------|---------|---------|-----------------|
| Alert the driver via audio warning | 0                   | 5          | 30      | 70      | 55              |
|                                  | (3%)                | (19%)      | (44%)   | (34%)   |                 |
| Alert the driver via a display   | 0                   | 5          | 55      | 60      | 40              |
|                                  | (3%)                | (34%)      | (38%)   | (25%)   |                 |
| Apply the brakes to reduce speed.| 0                   | 0          | 20      | 100     | 40              |
|                                  | (13%)               | (63%)      | (25%)   |         |                 |
| Apply the brakes to completely stop the vehicle | 0               | 10         | 30      | 75      | 45              |
|                                  | (6%)                | (19%)      | (47%)   | (28%)   |                 |
| Turn the steering wheel to avoid collision with the pedestrian. | 15                  | 40         | 60      | 30      | 15              |
|                                  | (9%)                | (25%)      | (38%)   | (19%)   | (9%)            |

Mean result perception respondent toward operation of the pedestrian AEB system show that respondents believe this system alert the driver via audio warning and via display. Besides that, respondents also believe this system will apply the brake to reduce the speed and completely stop the vehicle. Majority of respondents not sure about the system will turn the car steering to avoid collision with pedestrian. From the survey from all the respondents, the results also found that most of the respondent not yet believed or know the real function of AEB. Figure 4 shows the opinion of respondents about the AEB function and what kind of situation of this system can detect. Most of the respondents are not sure about the ability of AEB system in saving people lives.

Actually it depends on the technology was used by automotive manufacture for their cars to detect the pedestrian and give alert to driver from involve accidents with pedestrian but the function and requirement to avoid the collision are still same. The standard alerts will give a warning the driver is by alarm audio and blinking display on the car meter. This system will completely reduce the speed when detect object towards vehicle and brake completely to stop the vehicle if no any reactions from driver to avoid the potential of accidents.
Figure 4. Respondents responses about AEB functions.

Figure 5 shows the number of respondents responding on how much trust they put on pedestrian AEB system. 81% of the respondent trust pedestrian AEB system will make driver feel safer while driving and lead less accident involving pedestrians. Its can save vulnerable pedestrians and 43% of the respondents strongly believed that all vehicles should be equipped with pedestrian AEB systems. But, every technology must have their own lack and this system can not be perfect because it function just to assist driver.

Figure 5. Number of respondents about user trust on AEB system.
Table 3 shows that majority of the respondents not sure (neutral) about the malfunction of the pedestrian AEB system because some of them has watching car fit this system failure to avoid pedestrian on internet but that have no experienced yet. There have many potential that will effect this system such as extreme weather, visibility and systematic error. From the survey, most of the respondents also believe that AEB system does not engage when the car is accelerating, braking and turning the wheel of the steering. However, 50% of respondents still has no idea about the engagement of this system.

| Statement                                               | Strongly Disbelieve | Disbelieve | Neutral | Believe | Strongly Believe |
|---------------------------------------------------------|---------------------|------------|---------|---------|-----------------|
| The systems can accidentally engage when there is nothing wrong | 10 (6%)             | 10 (6%)    | 85 (53%) | 50 (31%) | 5 (3%)          |
| The systems can fail to engage at times when they should. | 0 (16%)             | 25 (16%)   | 80 (50%) | 40 (25%) | 15 (9%)         |
| Presence of the systems completely prevents collisions with pedestrians. | 0 (3%)              | 5 (3%)     | 85 (53%) | 55 (34%) | 15 (9%)         |

However, most Malaysians people don’t want spend more money to own advanced safety assist technologies in their vehicle. As observed from the survey, Malaysians are really considering a lot of cost factors such as maintenance cost, car cost, fuel consumption and performance as shown in Figure 6. They are just likely suggested to have safety features in the car. However, 84% of total respondents are very interested to own a vehicle fitted with pedestrian AEB and many are suggested to have an affordable price for AEB.

Suppose you are going to buy a vehicle, what would be your preferences?

![Figure 6. Preferences in buying vehicles.](image)

The AEB system cannot be retrofitted into the car which does not offer this system from manufacture. To get this system, you can find car with AEB system even you buy used car.
Figure 7 shows that 69% of sample willing to pay extra for fit this safety system in their vehicle and them willing pay up to RM451 to RM550 to have pedestrian AEB system.

4. Conclusion
Even though the understanding pedestrian AEB system among Malaysian people is not high, however, majority of them willing-to-pay for install this system on their vehicle because this system make their feel safe while driving.

5. References
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