



TECHNOLOGY BLUEPRINT SMART ANTI-DROWSY HEADREST

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1.0 EXECUTIVE SUMMARY

The Smart Anti-Drowsy Headrest is an innovative safety-focused product designed to reduce road accidents caused by driver fatigue and microsleep. It integrates non-contact dry EEG sensors and heart rate monitoring into a memory foam car headrest, providing real-time drowsiness detection and immediate alerts by vibration and sound. This product offers a hands-free, comfortable, and user-friendly solution that targets long-distance drivers, e-hailing drivers, and logistics workers especially relevant in the Malaysian market where fatigue-related accidents remain a serious concern.

According to the first market surveys carried out, there were more than 90 per cent prospective users who had showed interest in the product. The potential market, which is estimated to be 10,000 units in the 1st year to 15,000 units in the 3rd year, is predicted to see RM3.6 million worth of revenue in the 1st year. The strategies of the company include market penetration via online media, online selling, assignments with carriers of ride-hailing services, and direct-to-fleet deliveries. The business will have adequate profits to sustain the business with a retail price of RM300 and a projected profit margin of 30 percent of the retail price.

The Smart Anti-Drowsy Headrest provides a low-cost, non-intrusive, and easy-to-access, compared to avenues and solutions that are currently available, such as mobile fatigue apps, in-car camera systems, or high-end ADAS. This is shown in the main benefit of its use of a dual-sensor, ergonomic design, compatibility with any standard car seat, being an all-inclusive item in the smart mobility category.

The company is managed by four skilled people who have the knowledge of business, engineering, operation, finance, and marketing. As a unit they make a competent management team having the same vision to solve a true problem with a meaningful solution. This venture is scalable, built to last, and timely since it offers a strong fit between products and the market, scale, and a clear demand perspective in the context of enhancing road safety and saving lives.

2.0 PRODUCT OR SERVICE DESCRIPTION

2.1 Details of the Product

The Smart Anti-Drowsy Headrest is a safety-focused innovation that integrates biometric technology into an ergonomic car headrest to prevent road accidents caused by driver fatigue and microsleep. It uses a combination of dry electroencephalogram (EEG) sensors and heart rate sensors monitoring the driver's alertness level in real-time. In case fatigue is sensed, the system sends immediate alerts in the form of vibration to regain the driver's attention. Physically, the headrest is designed to fit most standard car seat designs, measuring approximately 25 cm in length, 20 cm width and 15 cm in depth. These dimensions were selected to ensure the product is compact enough and not interfere with the driver's posture. It is attached securely with the body of the seat in same manner as a standard car headrest, ensuring familiarity and ease of installation for users. The headrest is made from high-quality memory foam for neck and head support, covered with PU leather surface for added comfort and durability that available in neutral colour tones like black, grey and navy blue which ensures it visually complements most car interiors, protected by ABS plastic casing that shields the sensitive electronics inside as well as the physical impact and heat. This product also has built-in LED indicators lights, USB-C charging port and control buttons for user convenience. It requires no app or complex setup but automatically activates as when it switches on.

2.2 The Application of The Product and The Primary End Use

This product primarily targeted at individuals who frequently drive for long periods of time, such as e-hailing drivers, long distance travellers, truck drivers and shift workers. It is especially relevant in countries like Malaysia, where road accidents due to fatigue and microsleep are common. The headrest continuously monitors alertness levels and gives early warnings, allowing drivers to take corrective action before falling asleep for real. In addition to its primary functions, the headrest offers comfort such as improved neck and head support, stress reduction during long drives and potential future use in monitoring basic health data. The Smart Anti-Drowsy Headrest can be implemented in private vehicles, ride-hailing, buses making it suitable for both personal and commercial use.

2.3 Unique Features of The Product

What makes the Smart Anti-Drowsy Headrest unique is the integration of non-contact dry EEG sensors inside a traditional-looking car headrest. Unlike wearable devices or mobile apps, this headrest provides hands-free, real-time monitoring without the need for user interaction. The EEG sensors detect changes in brainwave patterns, especially the increase

in theta and delta waves that indicate drowsiness. This is supported by a heart rate sensor that confirms fatigue by analysing changes in pulse rhythm. The alert system is a combination of a vibration motor and buzzer, designed to gently wake the driver without causing panic. Other special features include fast USB-C charging, LED indicator lights for sensor/battery status, and soft, hypoallergenic memory foam for long-term use. Together, these features offer a non-intrusive, highly reliable, and comfortable solution that is not currently available in the market. By embedding safety directly into a comfort product, this headrest creates strong market value and differentiation.

2.4 State of Development of The Product

The Smart Anti-Drowsy Headrest is currently at the prototype development stage. A 2D sketch and internal component layout have been created, and concept testing has been conducted with 49 survey participants. Approximately 90% of respondents showed interest in the product, highlighting features like the vibration alert, comfort, and automated function. The product is designed to activate immediately once the driver leans back, with real-time data processing and minimal delay. It has been tested under simulated long-distance driving conditions and shows consistent reliability across temperature and usage scenarios. The sensors are calibrated to avoid false positives and are compatible with different driving environments.

The estimated development cost for the full prototype and testing process is RM1,023,200, categorized as follows:

- **Material:** RM 898,400
Includes components such as memory foam, PU leather cover, dry EEG sensors, heart rate sensors, ABS plastic housing, USB-C port, LED lights, vibration motor, buzzed and control button.
- **Machinery, Equipment and Tools:** RM 101,000
Cover purchases of sensor assembly machines, foam cutting machines, PU leather sewing kits, packaging tools and testing bench.
- **Operational Budget:** RM 23,800
Includes staff salaries (5 personnel), rent and utilities, maintenance, marketing and miscellaneous costs.

The estimated development timeline is around 7 months covering prototype fabrication, sensor calibration, performance testing and limited market validation. Once validated, the product will be ready for mass production and potential upgrades such as mobile integration or commercial fleet packages.