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WAKE GUARD

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Abstract

The development and establishment of WakeGuard is presented in this senior project report as a cutting-edge remedy for driver fatigue and an improvement in traffic safety. WakeGuard is a brand of anti-sleeping eyewear that alerts drivers in order to detect and avoid accidents caused by fatigue. WakeGuard offers an innovative approach to improve driver alertness, reduce accidents caused by drowsiness, and enhance overall road safety. The viability of the spectacles and their potential benefits in reducing the dangers connected with driver drowsiness are examined in the report.

The study starts with an introduction that highlights the issue of sleepiness-related road accidents and provides an overview of the project's goals. It highlights how urgent it is to come up with a workable way to combat driver fatigue in order to improve road safety. While the literature review, business plan, project management, requirement gathering and analysis, system design, implementation and testing, conclusion, and next steps are all covered in the following chapters.

Acknowledgments

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Chapter 1:Introduction

1.1 Problem Statement

Traffic accidents are a sickness that plagues and takes the lives of millions of people globally, every year. According to a study on traffic accidents in Bahrain, the period under observation in the study revealed that there were 566 injury accidents on average every day [1]. There are numerous studies that show the enormity of the serious risks to road safety that arise from the growing incidence of drowsiness that drivers experience. These can result in collisions, injuries, and fatalities. Although there are many methods that people use to combat sleepiness, such as: drinking caffeinated drinks, listening to loud music, or pinching oneself which are temporary solutions to a deeper underlying problem. There is an urgent need for a creative and practical solution that can identify and stop driver drowsiness, lowering the risk of accidents and fostering safer driving conditions.

1.2 Project Objectives

This research aims to be able to answer the viability and feasibility of developing anti-sleeping glasses that will aid in ensuring the safety of drivers in arriving at their destination. Also, it will assist future students that want to further develop the device by collecting data from our respondents that will provide more information on any improvements to the product. Finally, we also aspire for this research to assist existing brands of anti-sleeping glasses by addressing any gaps of the product in this research paper.

1.3 Relevance/Significance of the project

There is an urgent need for a creative and practical solution that can identify and stop driver drowsiness, therefore lowering the risk of accidents. WakeGuard attempts to actively identify indicators of sleepiness in drivers using a sensor device. The glasses will have biometric sensors, which will gauge the driver's state of attentiveness and identify signs of drowsiness. WakeGuard will use non-intrusive techniques to wake up the driver and keep them from falling asleep, such as: soft vibrations and auditory cues which will in turn reduce the risk of fatalities or injuries due to drowsiness when it comes to driving.

1.4 Report Outline

Chapter 1 covers the problem statement that focus on traffic accidents which takes the lives of million people globally, moreover it states the objectives, relevance and significance of the project. Chapter 2 will cover all related literature that we, as the researchers, view necessary in relation to our product, WakeGuard: Anti-sleeping Glasses, by covering articles on: traffic accidents, current anti-sleeping glasses, and the benefits of our proposed design in reducing the risks of accidents. Chapter 3 will cover the business and entrepreneurial aspects of the product, such as: SWOT analysis, risk analysis and management, and the budget analysis, to name a few. In the fourth chapter, we will be presenting the surveys conducted on our potential target market. This chapter aims to collect data to address the market's need for the product, while also aiming to address any gaps in both the research and the product. Additionally, it will present relevant data that will benefit not only our research but as well as future researchers that wish to produce anti-sleeping glasses as well. In the fifth chapter, it will tackle the complete design of the product. This will include: the hardware, software, and physical aspects of our product. Furthermore, it will include all the details of our testing of the product and the results of our tests. Lastly, chapter 6 will be the findings and conclusion of the research. We will summate our findings, the feasibility of the study, and give our recommendations to future researchers.

Chapter 2:Literature Review

2.1 Report Outline

Section 2.2 of this chapter will address and review all literature we, as the researchers, have deemed relevant to the research and development of our product. There are three main topics that we will be discussing in this section, that being: traffic accidents, explaining the definition of drowsiness (in regard to this research), existing methods of combating drowsiness while driving, the limitations of these existing methods, the expected benefits of the methods we will be implementing in our product (vibrations and a high-pitched noise), and the existing anti-sleeping glasses in the market.

2.2 Review of Related Literature

A literature review is a vital component of academic research that involves a thorough inspection and evaluation of previous scholarly works and publications pertinent to a particular research topic or field. In addition to identifying research gaps and establishing the current state of knowledge, it offers a framework of theory and concept for a research study.

This literature review addresses several important topics. First and foremost, we take on “Traffic Accidents”, wherein we assess the frequency and consequences of driving while fatigued are covered in this section. Additionally, we discuss "Drowsiness", which focuses on the idea of drowsiness and how it affects the safety and performance of drivers. We also tackle "Current Technologies for Preventing Driver Fatigue". This section looks at certain systems and technologies created by automakers such as General Motors, Honda, Volkswagen, Hyundai, Toyota/Lexus, and Volvo to combat driver fatigue. Another aspect is "Limitations in Current Technologies" and this section of the review addresses the shortcomings and restrictions related to the drowsiness detection and prevention techniques used today. "Advantages of High-pitched Noises and Vibrations" in another section that discusses the possible advantages of employing high-pitched noises and vibrations as stimuli to fend off sleepiness. Finally, "Anti-Sleeping Glasses" that reviews and explores the viability of anti-sleeping glasses and emphasizes how they could be a novel way to increase driver alertness and lower the number of drowsiness-related accidents through the analysis of pre-existing glasses.

The goal of the literature review is to lay the groundwork for the research of our anti-sleeping eyewear brand that is the subject of the senior project report, by analyzing and summarizing these important elements. In addition to laying out the background information and technologies currently in use in the field, it explains WakeGuard's significance and justification as a viable way to combat driver fatigue and improve traffic safety.

2.2.1 Traffic Accidents

As I finish writing this sentence, a person will have died due to a car accident somewhere around the world. According to a study by the United Nations[2] on a fact sheet in terms of road safety, every 24 seconds a life is lot because of a car accident. Annually, we lose the lives of 1.3 million people to fatalities caused by traffic accidents, which brings in how crucial it is to understand the factors contributing to traffic accidents and develop effective strategies to mitigate their impact. In this review of related literature in traffic accidents, we will specifically be tackling traffic accidents in Bahrain utilizing a study conducted by Ben-Hamouche et al. (2011) titled "Traffic Accidents in Bahrain: A Statistical and Spatial GIS-based Analysis" as a primary source of information.

Bahrain, like many other Gulf countries, has witnessed a significant increase in motorization and road traffic accidents over the years (Ben-Hamouche et al., 2011). The rise in car ownership contribute heavily to the growing number of accidents (Ben-Hamouche et al., 2011). Despite the high standards of road infrastructure in Bahrain, the fatality rates per 100,000 population remain alarmingly high when compared to developed countries (Ben-Hamouche et al., 2011).

The study provided valuable insights into the trends of traffic accidents in Bahrain. It highlighted the correlation between the increasing motorization rate and accident rates, identified deficient areas in roads design and urban planning, and shed light on the major causes of accidents (Ben-Hamouche et al., 2011). The research outcomes have practical implications for various public agencies, such as the Ministry of Housing and Works, Ministry of Interior, Ministry of Health, and the Ministry of Municipalities (Ben-Hamouche et al., 2011). Traffic accidents pose a significant challenge in Bahrain, leading to loss of life, injuries, and property damage. Understanding the factors contributing to these accidents is crucial for devising effective strategies to enhance road safety.

This is where we, the developers of WakeGuard: Anti-sleep Glasses, believe that the adoption of anti-sleep glasses as a preventive measure can complement existing strategies, such as improving roads design and urban planning, to mitigate the risks associated with driver fatigue and reduce the number of accidents. Through understanding factors that contribute to traffic accidents, we aim to reduce the likeliness that when a person rides a car that it could be their last time riding a car. We envision a utopia where every 24 seconds there will be someone arriving at their home safely.

2.2.2 Drowsiness

"Sleepy" is another word for "drowsy," which is just another word for the desire to go to sleep. Awake, non-rapid eye movement sleep (NREM), and rapid eye movement sleep (REM) are the three categories for the stages of sleep. The following three stages comprise the second stage, NREM: transition from awake to asleep, light sleep, and deep sleep, respectively[3].

Nobody can predict with certainty when their body will succumb to sleep. It is obvious that falling asleep at the wheel is dangerous, but even if you do not fall asleep, being sleepy impairs your ability to drive safely. Sleepiness impairs your ability to focus on the road, slows down your reaction time when you need to brake or steer quickly, and influences your judgment when making decisions[4].

Everyone has experienced drowsiness while driving at some point. Tired drivers are less able to drive safely, increasing the likelihood of an accident. It is risky to drive when sleepy because your senses and reaction time are compromised. It is possible that you will not see objects quickly or clearly. You might overlook important cues like lights, sounds, and signs. Additionally, you might need more time to comprehend the information you receive or to decide in potentially dangerous circumstances. You might miscalculate distances and speeds. Given the circumstances, being sleepy can interfere with every step of safe driving[5].

2.2.3 Existing Technologies for Combating Drowsiness While Driving

This section includes a variety of innovative approaches intended to tackle the pressing problem of driver drowsiness. By using a variety of techniques, including eye tracking and heart rate monitoring. These revolutionary technologies identify signs of drowsiness and notify drivers, improving road safety.

2.2.3.1 Steering Behavior Monitoring

The "steering behavior monitoring" technique is the most widely used and popular technological application for preventing sleepiness while driving. This approach makes use of sensors to identify shifts in driving behavior. If the driver is drowsy, auditory, or vibrating alerts will sound. There are existing vehicles that have implemented this method, examples of such are:

2.2.3.2 Honda

Honda's Driver Attention Monitor continuously monitors and evaluates driver behavior while driving. It uses data from the Electric Power Steering (EPS) to assess the driver's level of awareness and detect instances of inattention. If the system identifies inattention, the driver will be alerted to take a break[6].

2.2.3.3 Volkswagen

Volkswagen's Driver Alert System advises drivers when they need to take a break. It continuously assesses the driver's behavior, including steering inputs, starting at 65 km/h. The system visually and audibly alerts the driver if it senses signs of tiredness. The Driver Alert System is also integrated into Volkswagen's lane-keeping system, called Lane Assist. Lane Assist uses a camera to monitor lane markings and alert the driver if the car starts to deviate from the lane[7].

2.2.3.4 Hyundai

Hyundai's Lane Keeping Assist (LKA) helps drivers stay in their lane. It detects when the car is veering out of the lane and provides visual and audio alerts. The system utilizes the Motor Driven Power Steering (MDPS) to apply counter-steering torque and assist the driver in steering back to the center of the lane. Hyundai's LKA operates at speeds between 60 and 200 km/h and uses a camera to assess lane deviation and activate the system's alerts or steering assistance if the driver is drowsy[8].

2.2.3.5 Eye-tracking

Eye tracking employs complex technology that makes use of cameras and innovative image processing algorithms. This technology accurately tracks and analyzes the complex eye movements of a driver to identify indicators of fatigue. Eye tracking technology continuously monitors the driver's eye behavior, including blink rate, gaze direction, and duration of eye closure, by means of specialized cameras within the vehicle. The system can spot trends that point to rising levels of exhaustion, allowing for prompt actions to avert an accident.

2.2.3.6 General Motors

As part of the Super Cruise's advanced driver assistance system, General Motors has installed eye-tracking technology in select of its automobiles. When the system is activated, Super Cruise monitors the driver's eyes to make sure they are focused on the road using a combination of cameras and infrared lights[9].

2.2.3.7 Toyota/Lexus

Toyota patented an “Eye-lid Tracking” feature to identify indicators of fatigue or distraction. Depending on the driver's attention span, it can send alerts or suggestions. Toyota's current project is to improve and implement the system that measures how open the upper and lower eyelids are to detect drowsiness amongst drivers to reduce accidents caused by it while driving[10].

2.2.3.8 Volvo

Volvo has pioneered advances in automotive safety and has also investigated the use of eye-tracking technology. Featured in Volvo’s EX90 are two cameras that are trained on the driver. While sensors in the steering wheel measure the driver's steering input, cameras will track their gaze to make sure they are looking at the road. The car will use all this data to track if the driver is focusing on the task, becoming sidetracked, or even nodding off. The car’s internal system will then flash a warning light on the dash or sound an internal alarm if it senses the drivers are not paying it their whole attention[11].

2.2.4 Limitations of Drowsiness-Combatting Technologies While Driving

Current driving-drowsiness technologies, like steering-behavior monitoring and eye-tracking, have demonstrated potential to improve driver safety. They do, however, have certain restrictions, some of which are as follows:

Eye-tracking technology can identify indications of fatigue and distraction by tracking the movement and behavior of the driver's eyes. It might not be able to distinguish between drowsiness-related eye movements and those that are typical. The effectivity of eye-tracking devices can be impacted by variables such as outside distractions or specific eye conditions. Additionally, eye-tracking in cars faces several challenges, such as calibration problems, the need to wear glasses, and glare that can impair the technology's ability to accurately and efficiently determine whether the driver is drowsy[12].

Systems that monitor a driver's steering behavior look for patterns linked to fatigue or inattention by analyzing the steering inputs. Although this technology can offer insightful information, it might not be able to differentiate between drowsiness and other variables, like road conditions or driver preferences, that affect steering behavior. Also, when minor alterations in steering behavior occur, steering-behavior monitoring systems might not be able to identify early signs of drowsiness. This

reduces the possibility of drivers being able to regain consciousness before they fall asleep and increases the risk of the driver getting into an accident. Furthermore, due to wear and tear, the system used for detecting lane deviation receives an error due to wheel-alignment issues between the car and steering wheel. This, in turn, can lead to an unnecessary need for the system to activate the internal alert system of the vehicle which can distract the driver and put them in harm's way[13].

In conclusion, although eye-tracking and steering-behavior monitoring technologies provide useful technologies for identifying fatigue, there are considerable limitations to the systems.

2.2.5 Benefits of Vibrations and High-pitched Noises to Combat Drowsiness

High-pitched noises and vibrations can help prevent driving while sleepy. The purpose of these sensory cues is to increase the driver's level of wakefulness and attentiveness by arousing and stimulating them. Listed below are some of the benefits of high-pitched noises and vibrations:

2.2.5.1 Increased alertness

High-pitched sounds and vibrations can alert sleepy drivers out of their drowsiness, help bring them back to consciousness, and make them more aware of their surroundings. These stimuli offer a sensory input that breaks up the monotony and may keep the driver from nodding off while operating a vehicle.

2.2.5.2 Immediate response

The driver receives instant feedback from vibrations and high-pitched noises, which helps them recognize their drowsiness in real time. The driver can take corrective action and avoid hazards or accidents with the assistance of this quick response.

2.2.5.3 Non-intrusive

High-pitched noises and vibrations are discreet ways to warn the driver. Vibrations and high-pitched noises can successfully awaken the driver without adding to their stress or discomfort, in contrast to other interventions that might entail physical contact or distractions like loud noises or flashing lights.

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2.2.5.4 Customizable settings

It is frequently possible to modify these alert systems to accommodate personal preferences and sensitivities. To ensure the best possible experience, drivers can modify the high-pitched noises' volume or pitch as well as the vibrations' frequency or intensity.

2.2.6 Anti-sleeping Glasses

Anti-sleeping glasses are innovative gadgets made to prevent drowsy driving. They are also referred to as fatigue monitoring glasses or drowsiness detection glasses. These glasses track the wearer's physiological and behavioral signs of fatigue sensors. The glasses provide the wearer with real-time alerts when they detect signs of drowsiness, which helps to prevent accidents caused by fatigued drivers.

2.2.6.1 Optalert

Optalert is a company that sells sleeping-distracting eyewear known as the "Optalert Driver Fatigue System." Their glasses detect early signs of drowsiness by measuring eyelid closure and eye movement patterns using infrared technology. The driver can stay vigilant and avoid collisions by using the system's real-time alerts.

2.2.6.2 SmartEye

Another company that sells anti-sleeping glasses is called EyeAlert. Their glasses track head movements and eye blinking patterns with the use of sensors. The glasses notify the driver to take the appropriate safety measures when they notice indications of drowsiness.

2.2.6.3 SmartCap

SmartCap is a wearable cap with sensors built into it that is part of the SmartCap fatigue monitoring system. It is worth mentioning even though it is not a traditional glass because it accomplishes the

same thing. The cap gauges the driver's level of fatigue by monitoring brainwave activity and applying an algorithm. The driver receives alerts from the system indicating the need for a break if it detects elevated levels of fatigue.

2.2.7 Summary

A thorough analysis of the literature considered to be important to the product's development and research was given in this chapter. The section addressed a number of subjects, such as driving accidents, the definition of drowsiness, current strategies for preventing drowsiness, their drawbacks, the anticipated advantages of suggested strategies (such as vibrations and loud noises), and the accessibility of anti-sleeping glasses. The researchers established the framework for the importance of their study and the possible benefits of their product in resolving the problem of drowsiness while driving with this review.

Chapter 3:Business Plan

3.1Feasibility Study

To determine the viability and likelihood of success of a proposed project or business venture, a feasibility study is a crucial evaluation process. It entails examining a number of factors to ascertain whether the project is feasible and achievable, including organizational capacity, market demand, technical viability, and financial viability.

Our feasibility study began by conducting a thorough analysis of WakeGuard's strengths, weaknesses, opportunities, and threats (SWOT analysis). This helped us understand the project's real advantages and challenges. We also used the Business Model Canvas. This blueprint outlined how WakeGuard would provide value to customers, who the target customers were, how we would make money, and what resources and activities were needed. It gave us a clear idea of how WakeGuard would work in the market. Then, we validated our ideas by gathering feedback from customers through surveys. This helped us understand if there was a real demand for WakeGuard and if it solved a problem that people had. This introduction set the stage for a detailed exploration of WakeGuard's feasibility. By combining careful analysis with feedback from customers, we evaluated its potential and paved the way for its future success.

By incorporating these aspects into the feasibility study, the business plan provided a comprehensive assessment of the WakeGuard project's practicality and potential for success. It served as a foundation for decision-making, enabling project stakeholders to determine the viability of the venture and make informed strategic choices moving forward.

3.2SWOT Analysis

A SWOT analysis is a practical instrument which is meant to assess all of the benefits, drawbacks, possibilities, and risks related to the development of our anti-sleep glasses. It evaluates the positive internal elements, while pointing out possible negative aspects. Additionally, it highlights

opportunities while also assessing external factors that prove to be a potential threat to the product and its implementation.

Table 3.2-1 SWOT Analysis[17]

Strengths	Weaknesses
- Innovative design in combating drowsiness - Few competitors - Untapped niche - Competitive advantage (differentiation) - Low competition	- Inaccurate - High production cost - Limited distribution network - prototype design - Limitations
Opportunities	**Threats**
- Ability to connect with existing technologies - Endless development - Partnerships - Integration with AI - Targeting on new segments (Market expansion) - Stakeholder's interests	- High competition - Regulations - User adoption - Liability - Technological advancements - Economic failure - Legal challenges - Low awareness

1. **Strengths**:

- Innovative design in combating drowsiness: The anti-sleeping glasses have a unique and innovative design that effectively addresses the issue of drowsiness while driving.
- Few competitors: There are not many existing products or competitors in the market that offer a similar solution.
- Untapped niche: The market for anti-sleeping glasses is relatively unexplored, providing an opportunity for capturing a new customer segment.
- Competitive advantage (differentiation): The unique features and design of the glasses give them a competitive edge over other solutions.

- Low competition: The limited number of competitors in this space allows for potential market dominance.

2. **Weaknesses**:

- Inaccurate: There is a risk of false positives, where the glasses may detect drowsiness when the driver is actually alert.
- High production cost: The cost of manufacturing the glasses may be relatively high.
- Legal challenges: There may be legal regulations or safety standards that need to be met before the glasses can be legally used on the road.
- Low awareness: The target audience may have limited awareness about the existence and benefits of anti-sleeping glasses.
- Limited distribution network: The glasses may face challenges in terms of distribution and reaching the target market effectively.
- prototype design: The glasses may still be in the development phase and have certain design aspects that need improvement.
- Limitations: The glasses may have limitations in terms of compatibility or integration with other systems or technologies.

3. **Opportunities**:

- Ability to connect with existing technologies: The glasses can be integrated with other existing vehicle systems to enhance their overall effectiveness.
- Endless development: There is room for continuous improvement and innovation in the design and functionality of the glasses.
- Partnerships: Collaborations with car manufacturers, well-known sunglass brands, and driving departments can provide opportunities for expanding market reach.
- Integration with AI: Leveraging artificial intelligence technology can further enhance the performance and capabilities of the glasses.
- Targeting new segments: The glasses can be targeted at specific customer segments that are currently underserved, expanding the potential market.
- Stakeholder's interests: There may be stakeholders interested in supporting and investing in the development and success of anti-sleeping glasses.

4. **Threats**:

- High competition: The market for drowsiness detection and prevention solutions may already have established competitors offering alternative technologies or devices.
- Regulations: Compliance with legal and safety regulations may pose challenges for the implementation and usage of the glasses.
- User adoption: Some drivers may be resistant to adopting and using the glasses, either due to personal preferences or skepticism about their effectiveness.
- Liability: In the event of accidents or incidents, the glasses may be held responsible or blamed for any negative outcomes.
- Technological advancements: Rapid advancements in technology may render the glasses obsolete or less effective compared to newer solutions.
- Economic failure: The product may face economic challenges, such as insufficient demand or financial sustainability.
- Legal challenges: There may be legal regulations or safety standards that need to be met before the glasses can be legally used on the road.
- Low awareness: The target audience may have limited awareness about the existence and benefits of anti-sleeping glasses

3.3 Business Model Canvas

Business Model Canvas				
Key Partners	**Key Activities**	**Value Propositions**	**Customer Relationships**	**Customer Segments**
WakeGuard will partner with manufacturers to produce the glasses. It will also partner with trucking companies and other organizations to sell its products in bulk, Suppliers of glasses and sensors, Distributors, delivery partners for the online store.	WakeGuard will focus on Developing and improving the anti-sleeping glasses and sensors, Marketing and promoting the anti-sleeping glasses and the benefits of the device services, and and selling the glasses online and offline. It will also conduct research to improve its products and develop new ones. Developing, TESTING, AND maintaining the dashboard and device software and	WakeGuard provides anti-sleep glasses that alert drivers when they are getting drowsy, thereby preventing accidents. The glasses use sensors to detect the driver's eye movements and alert them with a sound and vibration when they start to get drowsy and Prevent drivers	WakeGuard will maintain a customer service team to handle customer queries and complaints. It will also provide a warranty for its products. Loyalty programs and discounts for repeat customers and referrals. Customer feedback and reviews via social media and online	WakeGuard targets drivers who are prone to drowsiness while driving. This includes long-distance truck drivers, taxi drivers, night-shift workers, and people with sleep disorders, trucking company operators who want to ensure the safety and productivity of their drivers, Insurance companies who want to

and retailers, Research institutions and universities AND Insurance companies	hardware. Collecting and analyzing data on driver behavior and sleep patterns	from falling asleep at the wheel. Improve driver safety and performance.	platforms. Community and social media engagement	reduce the risk of accidents caused by drowsy driving.
	Key Resources WakeGuard will require funding to manufacture and market its products. It will also need to hire a team of engineers to develop the glasses. WakeGuard will partner with manufacturers to produce the glasses. • Anti-sleeping glasses and sensors. • Dashboard and device software and hardware • Brand and reputation.		**Channels** WakeGuard will sell its products through online channels such as its website and social media platforms. It will also partner with trucking companies and other organizations to sell its products in bulk. • Social media and online ads. • Offline channels (distributors, retailers, events) • Partnerships and referrals	
Cost Structure			**Revenue Streams**	
WakeGuard's costs will include manufacturing, marketing, and personnel expenses. It will also need to invest in research and development to improve its products. • Cost of goods sold (COGS) (glasses, sensors, packaging, shipping) • Research and development (R&D) expenses for the platform and device software and hardware. • Marketing and sales expenses for the online store and ads. • Human resources • Partnerships			WakeGuard will generate revenue by selling its anti-sleep glasses. It will also offer a subscription service for its glasses, which will include regular updates and maintenance. • Sales of anti-sleeping glasses and accessories • Sales of glasses • Advertising and sponsorship • Licensing and royalties	

Figure 3.3-1:Business Model Canvas[18]

3.3.1 Key Partners

1) Manufacturers:

WakeGuard will collaborate with producers to create the eyewear**.**

2) Bulk Distribution Partners:

WakeGuard will collaborate with other businesses, such as transportation firms, to sell its goods in large quantities.

3) **Vendors:**

WakeGuard will collaborate with manufacturers of eyewear and sensors.

4) **Distributors and Delivery Partners:**

WakeGuard will collaborate with online shop distributors and delivery partners.

5) **Universities and Research Institutions:**

WakeGuard will collaborate with universities and research institutions to create new technologies and enhance current ones.

6) **Insurance Companies:**

WakeGuard will collaborate with insurers to provide drivers who wear their glasses savings.

WakeGuard has a variety of strategic alliances. The business may guarantee that the highest quality requirements are met in the production of its glasses by forming partnerships with manufacturers.

By working with trucking companies and other companies to sell its products in bulk, WakeGuard will be able to increase its clientele and earnings. Through its partnerships with eyewear and sensor manufacturers, the company will ensure that it has access to the newest materials and technologies. WakeGuard's partnership with online store delivery partners and distributors will enable it to reach customers more efficiently. Because of its collaborations with academic institutions and research centers, the company will be able to develop new technologies as well as improve existing ones. Finally, WakeGuard and insurance companies will offer users discounts on their glasses, which will lower their cost and increase their accessibility to a larger market.

3.3.2 Key Activities

The aim at WakeGuard is to develop and improve anti-sleeping eyewear and sensors. We market and advertise the benefits of our gadget services in addition to selling these glasses both offline and online. In order to create new products and enhance those that already exist, our team performs a lot of research. We assume full responsibility for the development, testing, and upkeep of the dashboard's hardware and software. An essential component of our efforts to improve our services is the collection and analysis of data on the sleeping patterns and habits of drivers.

At WakeGuard, our mission is to create anti-drowsiness glasses and sensors that can precisely identify driver fatigue and send out timely reminders to take a break. We are committed to tackling the serious

problem of sleepy driving, which causes many accidents all over the world. Our objective is to considerably lower the number of accidents brought on by driver fatigue by developing creative solutions.

3.3.3 Customer Relationship

At WakeGuard, we are dedicated to providing excellent customer service. Our customer service team is here to answer any questions and resolve issues for our clients promptly. We also offer a warranty for our products, so customers can have them fixed or replaced if any problems arise.

In addition to our customer support, we value our customers and strive to give them the best experience possible. We have rewards for repeat business and referrals, as well as loyalty programs. We encourage our customers to share their feedback and reviews on websites and social media. These comments help us improve our services and understand our customers' needs better.

At WakeGuard, we believe in building strong bonds of trust with our clients. We actively engage with them through community involvement and social media interactions. We understand the importance of nurturing these relationships for our success. We are committed to continuously finding fresh and innovative approaches to connect with our customers and ensure they have a fulfilling experience with our brand.

3.3.4 Customer Segments

WakeGuard is designed for drivers who are prone to falling asleep behind the wheel. This include individuals with sleep difficulties, night shift workers, long-distance truck drivers, and taxi drivers. The firm also sells its goods to insurance companies, who wish to lower the danger of accidents brought on by intoxicated drivers, and trucking company operators, who want to guarantee the security and efficiency of their drivers. Anyone who must drive for extended periods of time and maintain alertness and concentrate on the road can use WakeGuard's anti-sleeping eyewear and sensors. Those who must remain vigilant and task-focused while working in high-stress conditions might also benefit from the company's solutions.

3.3.5 Value Propositions

When the driver begins to feel sleepy, these glasses employ sensors to monitor eye movements and alarm them with a sound and sensation. This can enhance driver performance and safety by preventing drivers from nodding off while operating a vehicle. You won't experience any pain using the glasses for extended periods of time because they are made to be simple to wear and comfy. You may carry them with you everywhere you go because they are both robust and lightweight. WakeGuard's anti-sleep glasses could be exactly what you need if you're seeking for a strategy to maintain attention and alertness while driving.

3.3.6 Key Resources

The business will need money to produce and sell its goods. To create the spectacles, it will also need to engage an engineering staff. WakeGuard will collaborate with producers to create the eyewear. The business will also need to create the hardware and software for dashboards and devices. Lastly, WakeGuard must concentrate on establishing its reputation and brand..

3.3.7 Channels

WakeGuard intends to use a variety of distribution methods to market its goods. The business will use social media and its website as online distribution channels for its items. In order to market its goods in large quantities, it will also collaborate with other businesses and shipping firms. WakeGuard will also distribute its goods through offline channels including distributors, shops, and events in addition to these. To boost sales, the corporation will also use alliances and recommendations. WakeGuard will be able to reach more people and boost revenues with the aid of these platforms.

3.3.8 Cost Structure

The costs associated with people, marketing, production, R&D, and collaborations will all be part of WakeGuard's cost structure. Glasses, sensors, packing, and shipping will all be included in the cost of goods sold (COGS). Additionally, the business will have to pay for platform and device hardware as well as software R&D costs. The online store and advertisements will result in marketing and sales costs. It will take human resources to oversee the business's operations. Another key component of the company's growth plan will be partnerships. Retailers and service providers have different cost structures, thus the expenditure accounts that show up on a financial statement are dependent on the cost objects—like a product, service, project, client, or business activity.

3.3.9 Revenue Streams

WakeGuard as a business will make money by offering its sleep-inhibiting eyewear for sale. In addition, it will provide a subscription service for its glasses that would cover routine upkeep and upgrades. The following sources will provide revenue streams for the business:

1. Sales of anti-sleeping eyewear and accessories: WakeGuard will offer its clients anti-sleeping eyewear and associated accessories. The purpose of the glasses is to aid with alertness and wakefulness whether driving or working. Cases, cleaning cloths, and other complementary things might be considered accessories for the spectacles.
2. Glasses sales: WakeGuard will also offer its clients prescription lenses and sunglasses, among other kinds of glasses. The anti-sleep glasses may or may not be connected to these spectacles.
3. Sponsorship and advertising: WakeGuard may make money by running adverts on its website or social media accounts. The firm could also look to other companies or groups for sponsorship.
4. Licensing and royalties: WakeGuard may provide other businesses a license to use its designs or technologies in exchange for royalties. This might involve contracts for licenses with producers of eyeglasses or other companies wishing to use WakeGuard technology into their goods.

It's crucial to remember that WakeGuard may look into other revenue streams in the future. These are just a few examples of the various revenue streams available.

3.3.10 Idea Validation

the idea for wakeguard (anti sleeping glasses) occurred after observing and experience drowsiness during driving which puts your life and the life of others in danger and falling a sleep during important lectures or meetings could makes you miss the important things in that lecture. Wakeguard helps you stay awake and can help save you from accidents. To validate the feasibility of this idea we have conducted a survey, to see the awareness about the issue and how many people suffer with feeling drowsiness while driving and if they will be willing to accept our product. The following diagrams illustrates the responses of 113 people:

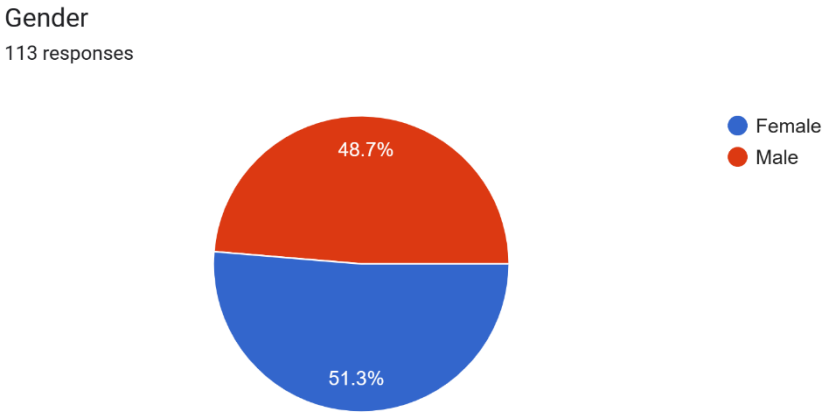


Figure 3.3-2 survey-gender

To start with, the shows that majority of the respondents were females with a percentage of 51.3% over male.

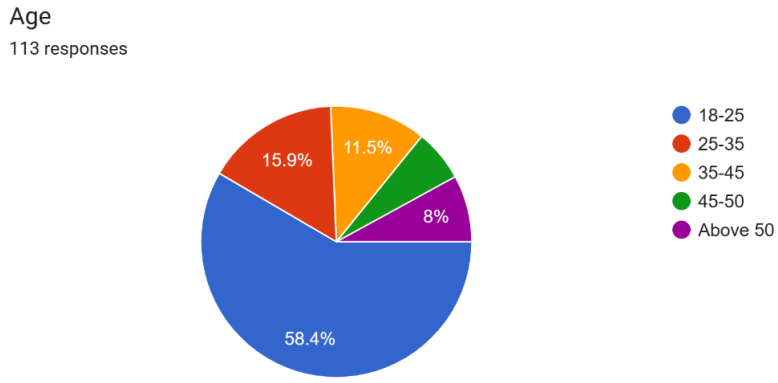


Figure 3.3-3: Respondents average age

Since most responses were from people between the age of 18-25, number of people between 25-50 and above 50 was little. Nevertheless, this survey was intended for people of all age groups.

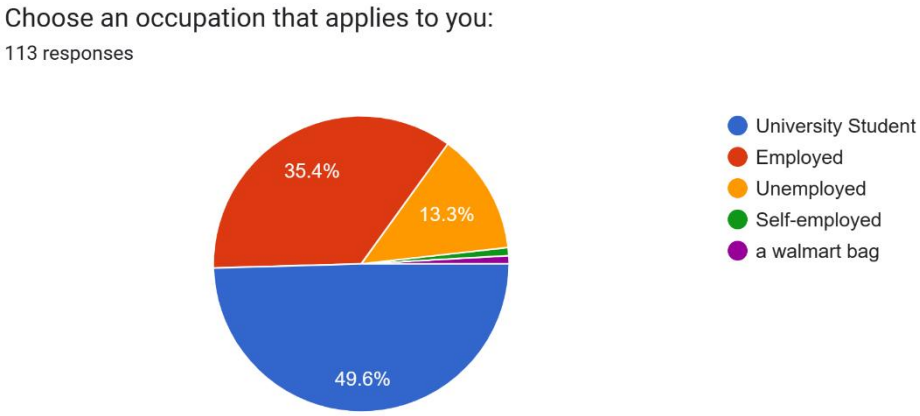


Figure 3.3-4: survey-occupation

Even Tho our product is for everyone our target was to get as many responses as possible from university students and almost 50% of the respondents are university students.

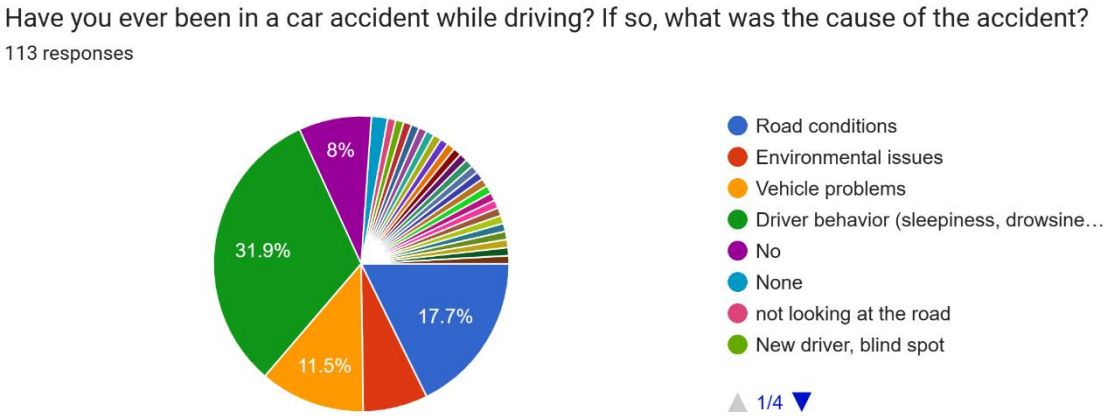


Figure 3.3-5:survey- cause of accident

Out of 113 only 9 people haven't been in an accident and more then 40 people have reported to be in accident due to driver behavior(sleepiness, fatigue ,drowsiness).

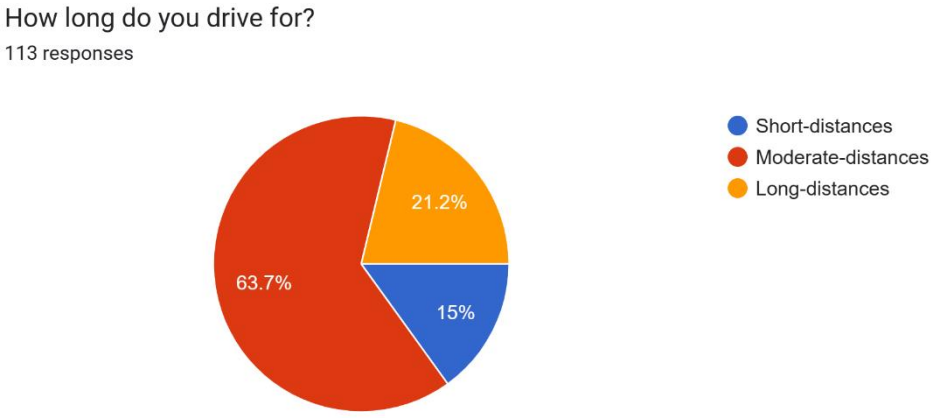


Figure 3.3-6:survey- duration of drive

Most of the respondents drive for moderate to long distance and a very few respondents drive for a short distance.

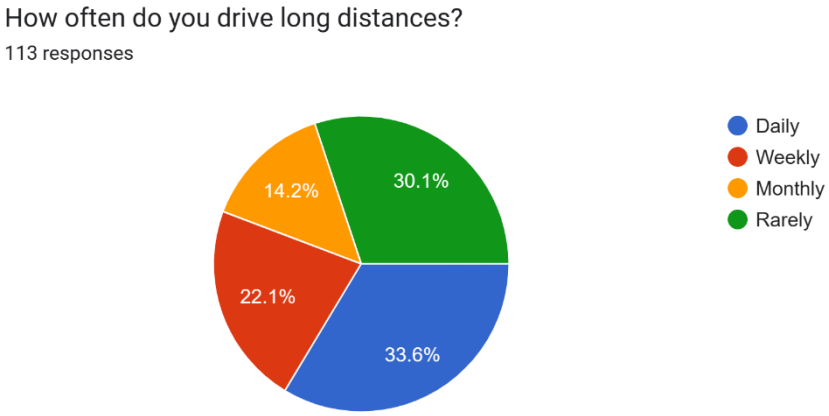


Figure 3.3-7: survey- repetition of long-distance driving

Most of the respondents have reported to drive for long distance daily with the percentage of 33.6% and 30.1% have reported that they rarely drive for long distance daily.

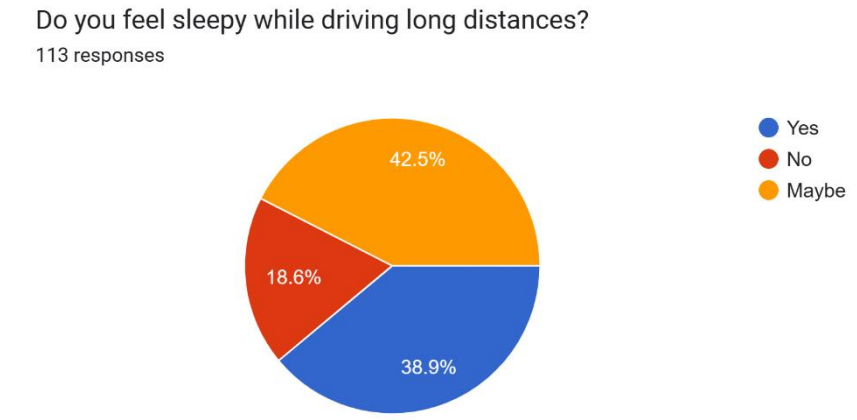


Figure 3.3-8: survey- feeling sleepy

Although most of the respondents have reported to me "Maybe" feeling while driving , the majority after that have reported to feel sleepy while driving for long distances, and a very few reporting not feeling sleepy driving for long distances.

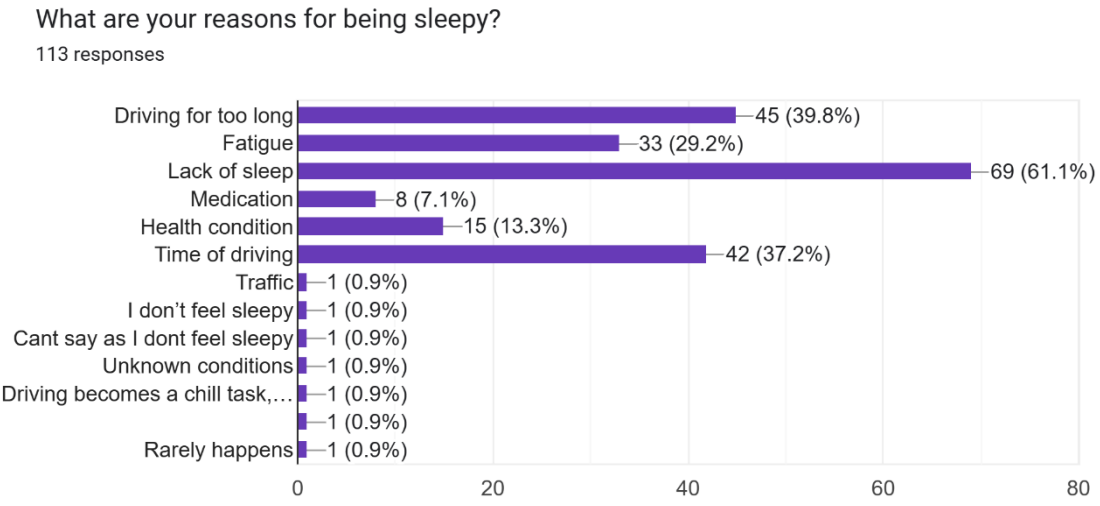


Figure 3.3-9: survey – reason for being sleepy

Most of the drivers have reported that they feel sleepy during driving because of lack of sleep, fatigue and driving for too long, with a relatively low number of people saying they feel sleepy because of health conditions and medications and a very low percentage of people saying that they don't feel sleepy at all.

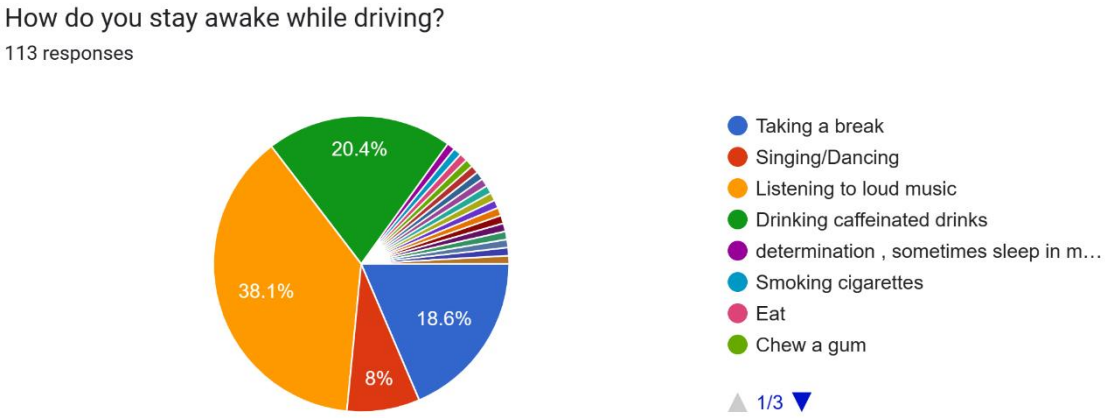


Figure 3.3-10: survey- methods of staying awake

Most of the drivers have reported to listen to loud music to overcome sleepiness, which is not a very good method as it isolates you from the noise outside the car and be dangerous, some other methods drivers use are drinking coffee or caffeinated drinks , smoking and taking a break.

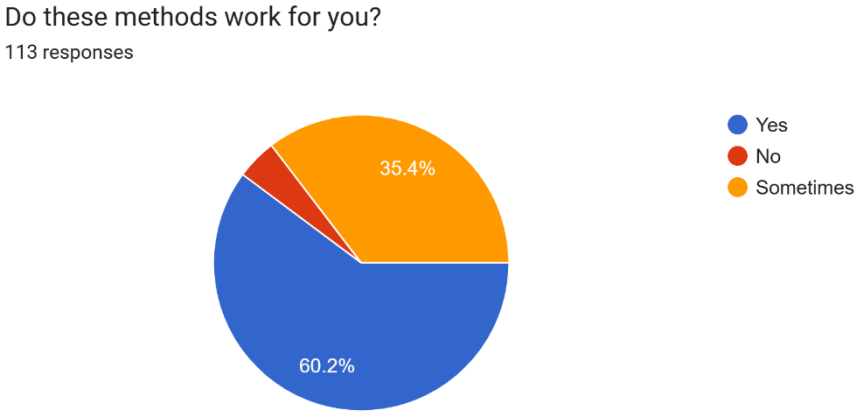


Figure 3.3-11: survey- effectiveness of the methods

60.2% of drivers have reported that the methods they use work for them where as 35.4% have reported that these methods work sometime and 4.4% have said that they don't work for them.

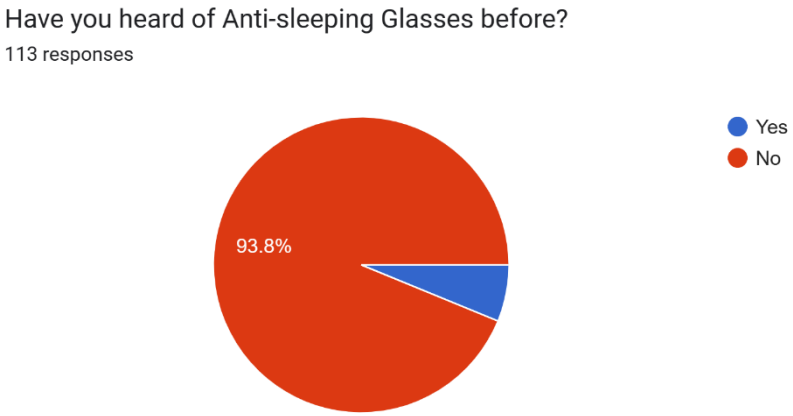


Figure 3.3-12: survey- awareness of anti-sleeping glasses.

Almost 94% of the drivers have reported that they have never heard of anti-sleeping glasses and only 6.2% have heard of them. This raises a question about the awareness of such methods that can easily and effectively help the drivers and keep everyone on the road safe.

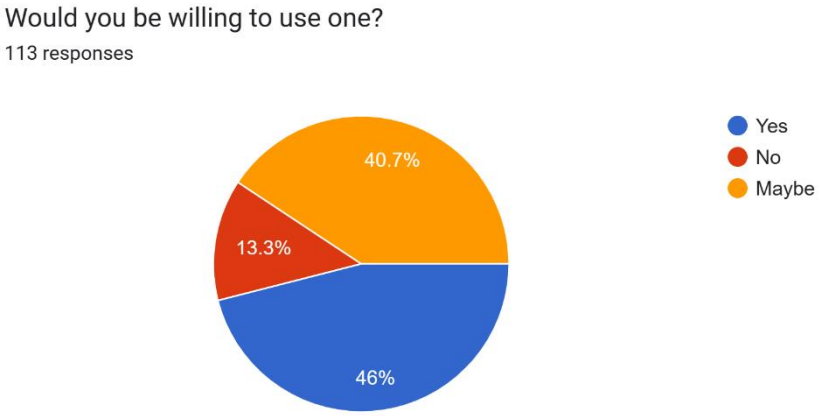


Figure 3.3-13: survey- trying wakeguard(anti-sleeping glasses)

46% of the respondents have agreed to use anti-sleeping glasses whereas 40.7% are not sure about it and only 13.3% have said no to using anti-sleeping glasses.

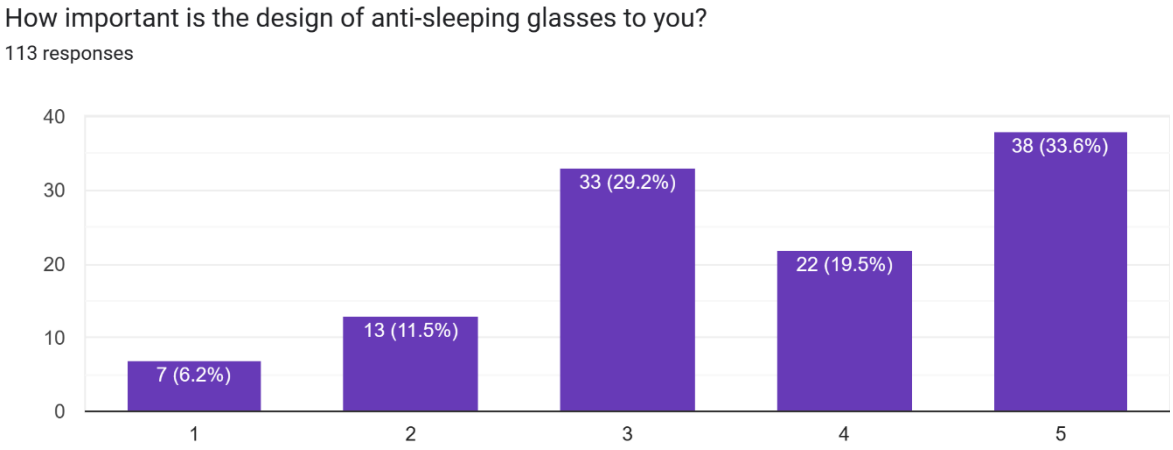


Figure 3.3-14: survey-importance of design

Out of 113 people 93 have said that the design of the anti-sleeping glasses is important and only 20 people say that the design is not really important .

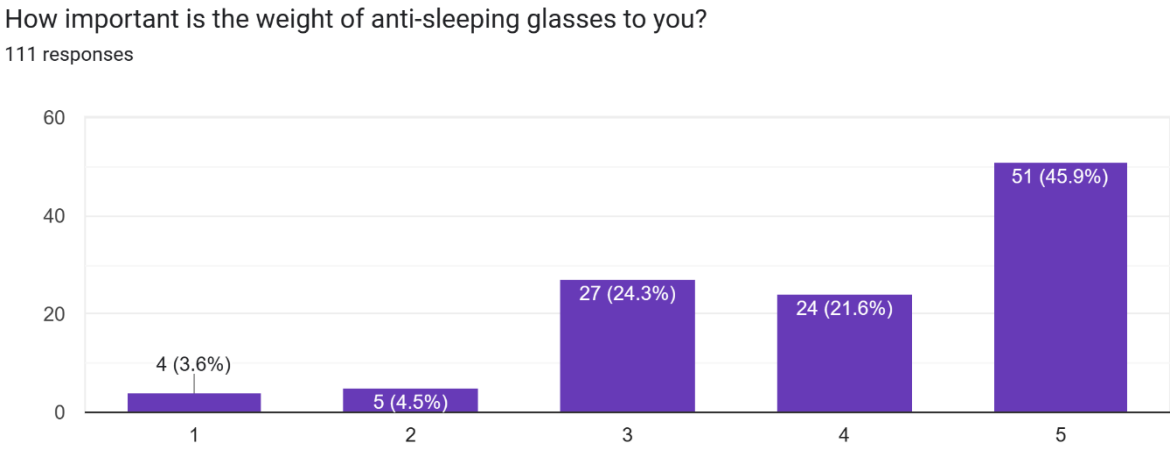


Figure 3.3-15: survey- weight of the anti-sleeping glasses

Out of 113 people 102 said that the weight of the anti-sleeping glasses is important and only 9 people have said that it doesn't matter a lot .

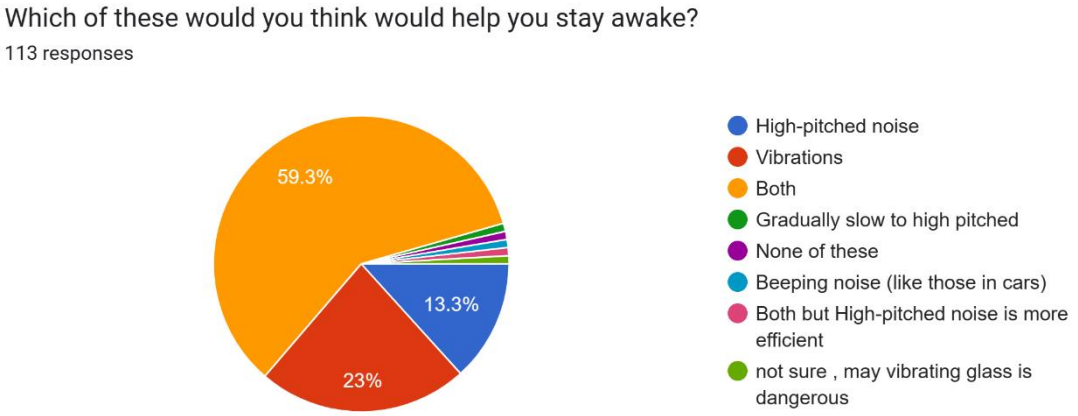


Figure 3.3-16: survey- methods to be used in anti-sleeping glasses

People were given option to choose between the method used in anti-sleeping glasses that they think will be the most effective in keeping them awake while driving (vibration or high pitch sound). Almost 60% of the people said that a combination of both will help them stay awake, 23% voted for vibration and rest of they users leaned toward using high-pitch sound.

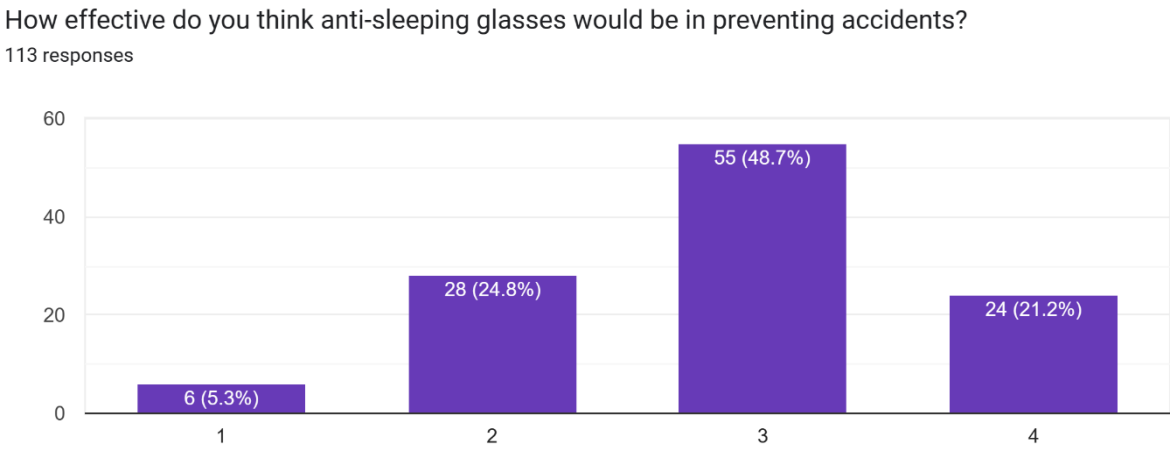


Figure 3.3-17: survey- expected effectiveness of anti-sleeping glasses

Almost 49% think that anti-sleeping glasses will effectively in preventing accidents, 21.2% think that it will be very effective and only about 5% of the drivers think that it will not be effective.

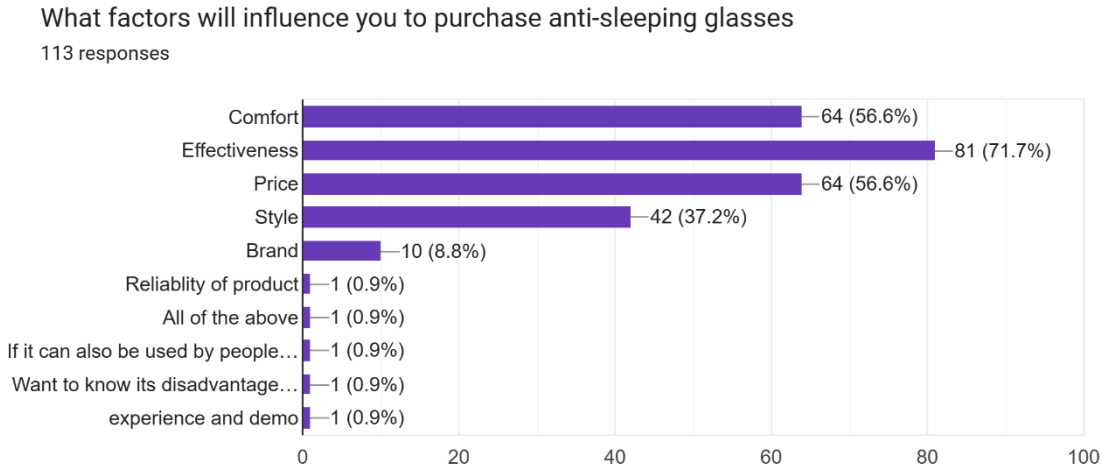


Figure 3.3-18: survey- factors to purchase anti-sleeping glasses

Most the of the people said that effectiveness (71.1%), comfort (56.6%), price (56.6%) and style (37.2%), respectively will be the most influential factors while purchasing anti-sleeping glasses.

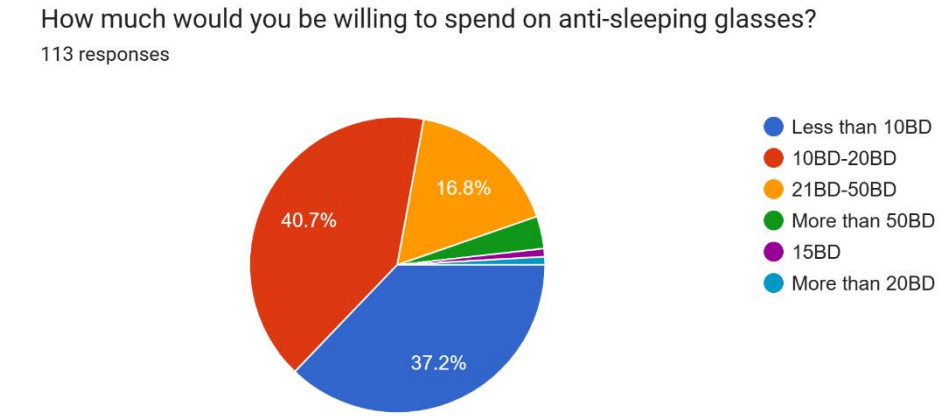


Figure 3.3-19: survey- price range

The purpose of this question is knowing the average prices of products to estimate the prices and take the average prices accordingly in the financial plan. Majority of respondents price ranges are less then 10BD,10BD-20BD and 21BD-50BD.

As a result of this survey and from the response to the marketing activities, a faith has been put into the idea and a decision has been made to implement it as soon as possible to grab this opportunity and fill a gap in the market.

3.3.11 Problem-Solution Fit

This section allows students to test their assumptions, and this can be through prototyping their solutions and getting feedback from customers and then refining the prototype until they get user satisfaction before the start working on the actual product/system.

Our team spent a lot of time discussing the design, how to make it work, where to find the parts, and how to put it all together when we first started working on WakeGuard. It took us several days to locate its various parts online via the social media application Instagram. To proceed, we needed to fix and figure out the electrical layout to avoid destroying the board, and we found someone to help us after 2 days of effort, but we made it work in the end. We needed to identify someone (business, electronic shop) willing to assist us in constructing our product design into a prototype so that we can see how it will operate and estimate what needs to be done, and eventually by trying different codes to get the coding right for the IR sensor and Arduino board. And after all those efforts we had the problem of our IR sensor not working properly which was later identified as an issue with the soldering points and was an easy fix.

3.4 Industry Analysis

Industry analysis is a vital part of strategic planning for businesses. It helps them understand the market they're in by looking at things like market size, competition, customer behavior, and new technology. By doing this analysis, companies can find opportunities, anticipate challenges, and make smart decisions. At WakeGuard, we use industry analysis to see how popular our anti-sleeping eyewear and sensors are, understand the automotive safety industry, and find the best partnerships and markets to focus on. It helps us stay ahead and succeed in a fast-changing market.

3.4.1 Market Size and Growth

Since drowsiness negatively impacts safety and productivity, the anti-sleep glasses market is expected to grow significantly in the coming years. According to Market Research, the market will reach 2150 BD by 2025, and it is expected to grow at a CAGR of 116.28% in 2026

3.4.2 Key Market Segments

WakeGuard's fight against drowsy driving takes aim at two crucial targets Consumers and Commercial segments. Consumers segments Everyday drivers, students, professionals – all united by a desire for safer roads. Commercial segment is for logistics giants to truckers, their responsibility demands proactive solutions. We will navigate their unique challenges, regulations, and risk management needs, making WakeGuard a trusted safety partner in every vehicle.

By tailoring our strategies to these diverse landscapes, we unlock WakeGuard's full potential

3.4.2.1 Consumer Segment

Long distance drivers, students, and professionals working long hours make up this segment, which buys anti-sleep glasses for personal use.

3.4.2.2 Commercial Segment

The anti-sleep glasses Wake Guard makes are designed for industry segments such as transportation, logistics, aviation, healthcare, and manufacturing, where employee alertness is crucial for safety and productivity.

3.4.3 Competitive Landscape

In the anti-sleep glass market, there are a number of established players as well as new entrants. Wake Guard competes with Optalert, SmartCap, and SmartEye among the industry's major players. Their product portfolios are diverse, their distribution networks are established, and they have strong market presences. By focusing on user comfort, providing personalized fatigue management solutions, and using innovative technologies, Wake Guard differentiates itself. Wake Guard’s competitive advantage is based on strategic partnerships with key stakeholders and continuous research and development efforts.

3.4.4 Technological Trends

By utilizing advanced sensors, such as electroencephalography (EEG), eye tracking, and facial recognition, Wake Guard detects drowsiness in real time. By integrating artificial intelligence (AI) and machine learning (ML) algorithms, Wake Guard increases drowsiness detection accuracy and enables personalized alerts tailored to individual users. In order to stay at the forefront of technology, Wake Guard’s anti-sleep glasses are constantly being improved through continuous innovation.

3.4.5 Regulatory Environment

It is crucial that anti-sleep glasses comply with safety standards and regulations before entering the market and ensuring consumer safety. To ensure adherence to the highest safety standards, Wake Guard maintains a proactive approach to regulatory compliance, staying abreast of industry guidelines and working with regulatory bodies. Keeping up with regulatory requirements promotes trust in wake Guard's products and establishes the company as a trustworthy and responsible player.

3.4.6 Market Opportunities and Challenges

At the point of opportunity and challenge, WakeGuard's mission to eliminate sleepy driving makes a significant turn. Opportunities arise as a result of growing awareness, a growing sector, technological advancements improving accuracy, and a focus on traffic safety. The breezes that are filling our sails are these. The challenges remain unchanged, building brand awareness, striking a balance between pricing and innovation, and negotiating data privacy laws are the challenges that we need to scale.

3.4.6.1 Opportunities

In emerging economies, there is potential for wearable technology to expand beyond transportation. There is also an increasing focus on the well-being and safety of employees.

3.4.6.2 Challenges

Maintaining strong distribution relationships, staying ahead of technological advancements, and educating consumers about the benefits of anti-sleep glasses are just some of the challenges facing the anti-sleep glasses industry

3.4.7 Industry Description and Trends

The demand for anti-sleeping glasses is fueled by the pressing need for a viable and efficient way to address driver fatigue and lower the likelihood of car crashes. WakeGuard is a sensor-based gadget that uses sensor technology to actively identify drivers' signs of sleepiness. It incorporates non-intrusive methods like gentle vibrations and auditory cues to keep drivers awake and reduce the risk of drowsiness-related accidents. This creative strategy fits with the industry trend of utilizing cutting-edge sensor technologies and preemptive actions to improve traffic safety and reduce the dangers posed by fatigued drivers.

3.4.8 Competitor Analysis

As the researchers who founded WakeGuard, we recognize the value of researching our rivals for our senior project at WakeGuard. Analyzing competitors gives us a competitive advantage in the market. We can learn what works and what needs improvement by taking a close look at other businesses that offer comparable anti-sleeping eyewear and sensors.

We can stay ahead of the competition, make improvements, and provide our customers with the best products by conducting in-depth competitor analysis. We can stay ahead of the competition, make improvements, and provide our customers with the best products by conducting in-depth competitor analysis. It enables us to seize opportunities and get past obstacles, ensuring WakeGuard maintains its position as an industry leader and offers excellent value to our clients.

3.4.8.1 Major Competitors

Table 3.4-1:Major Competitors

Company	WakeGuard	Optalert	SmartCap	SmartEye
Company Profile	Found in 2023	Found in 2003	Found in 2014	Found in 1999
Revenue Stream	Sales	Sales	Non-profit	Transactions-based
Number of Customers	a few (new entrance in the market)	Over 90k	26k	73k
Business Model	Product Sales, Partnerships, After sales Services	Product Sales, Service based	Focused on adding a vlue	Developing core technologies
Country	Bahrain	Australia	Redmond, Washington, United States	Swedish
Pricing	35 BHD	120 BHD	90 BHD	100 BHD

Perks	Adjustable IR Sensor, Coding the board	Data availability	Integration with Other Technologies	Human eye insight AI
Strength	Cheap, Lightweight, Minimum false alerts	Camera, The most accurate algorithm, More features	Funded by many organizations	Emotion AI and Facial Expression, Eye tracking
Weakness	GCC Scope only, Incomplete design	High cost, not for everyone	For commercial real state only	Avaialbe in limited locations only
Marketing Channels				
Instagram	Yes			Yes
Facebook		Yes	Yes	yes
Twitter				Yes
Youtube			Yes	Yes
Tiktok	Yes			

Some notable competitors offer similar products in the anti-sleep glasses market that uses an IR Sensor. Here are a few competitors worth noting:

1. Optalert:

The company has a long history of using an IR sensor since 2003 to detect drowsiness in their products and has a solid reputation for product reliability. They have over ninety thousand customers and a comprehensive distribution network. The company is based in Australia and their biggest strength is their camera which is the most accurate algorithm that helps them to gain a competitive advantage over their competitors.

2. SmartCap:

The company offers the latest technology in anti-sleep glasses and offers sleek and stylish designs accompanied by top of the line alert mechanisms. The company is non profitable, they support commercial real estate industries to serve their employees to increase a security in their day to day work which is why they are funded by many organizations moreover they were established in 2014

3.5 Market Approach

In this chapter, we will discuss all the relevant topics in relation to marketing planning. These topics will include our marketing plan, marketing segment, target market, and marketing strategy.

3.5.1 Marketing plan

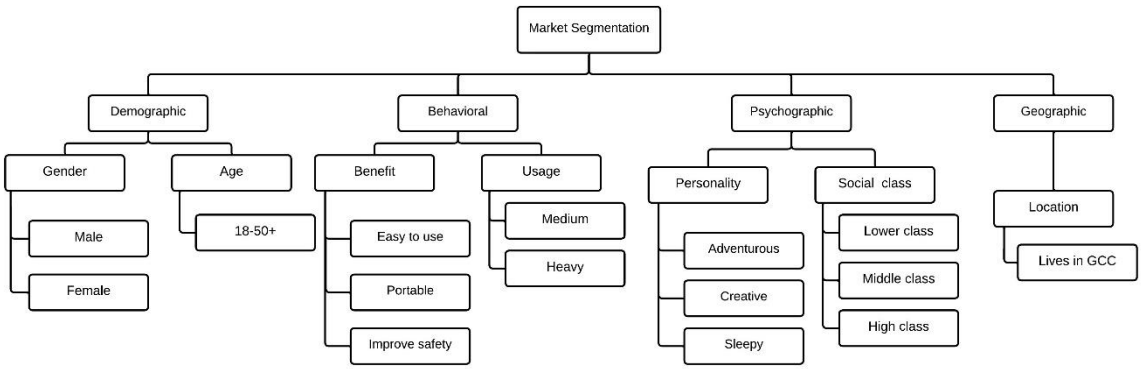
An operational document known as a marketing plan describes the advertising approach that a company will use to reach its target market and create leads. A marketing strategy outlines the public relations and outreach strategies that will be implemented over time, along with the methodology the organization will use to gauge their success. A marketing plan's duties and elements consist of the following:

- Marketing segment
- Target market
- Marketing strategy
- Marketing channels

3.5.2 Marketing Segment

The method of segmenting a market involves breaking the target market down into smaller groups based on shared attributes like age, income, personality traits, behavior, hobbies, requirements, or geography. You can better focus your product, sales, and marketing strategies if you are aware of your market segmentation.

Table 3.5-1 Marketing Segmentation



Demographic:

both genders are included because sleeping while driving is not exclusive to one gender. All adults from the age of 18 to 64 are targeted for having the financial capability to purchase and be aware about sleeping while driving.

Behavioral:

he benefits that the buyer seeks are an easy-to-use, portability and an additional level of improved safety . The usage rate is medium to high users due to the nature of the products which is targeted toward people who sleep on the wheel

Psychographic:

the buyer who have sleep disorders or sleeps on the wheel are interested in wakeguard. The buyer's personality is adventurous and sleepy.

Geographic: the buyer resides in GCC as we offer delivery to any country in GCC.

3.5.3 Target Market

A target market is a group of prospective clients to whom you intend to sell goods or services. Age, geography, income, and lifestyle are commonly used to categorize segments. For example; targeting and selling to people who share your concerns and views about particular features. It is important to utilize the concept of splitting your target market into accessible segments known as market segmentation. Market segmentation helps divide a market into subsets based on demographics, requirements, goals, similar interests, and additional behavioral features that help the target audience be better understood. A successful product marketing plan begins with a thorough understanding of

your target customer. You must establish a precise target demographic and create a customer profile to help you understand the customer's discomfort points, expectations, and requirements.

3.5.4 **Marketing strategy**

Our marketing strategy consists of 3 main goals and are assigned specific settings with their respective budgets. To make marketing as simple as possible

Table 3.5-2 Marketing Strategy

	Goal	Objectives	Steps	Budget	Controls	Occurance
1	Increase Brand Awareness	1 Increase instagram followers.	1- decide which customer type to target. 2- create promotional posts. 3- choose a budget based on the reach & days.	25BD	no.of followers	Twice a month
		2. Create informative content	1 conduct a research about sleeping disorders,accidents caused by sleeping 2. summarize the findings. 3- create an infographic.	N/A	no. of interactions, instagram visits	Once a month
		3- Collaborate with an influencer.	1- search for suitable local influencers 2- choose an influencer and contact them. 3. reach an agreement with the influencer.	60 BD	no. of followers, account	Once every 6 months
2	Increase Website Traffic	1- Start email marketing.	1 identify the purpose 2. personalize the email content 3. select the best send time.	none	no. of instagram visits	Twice a month
		2- Enable search engine optimization	1 choose words that are relevant to the website. 2. write a meta description for the chosen words.	15 BD	no.of instagram visits	Once every year
		3- Create a TikTok account	1 search for creative ideas for videos 2- use popular hashtags. 3. use trending sounds.	N/A	no. of followers, instagram visits	twice every week
3	Improve Customer Retention	1- increase engagement on Instagram.	1 decide which customer type to target 2- create interactve content for the target customers. 3. reply to customers	N/A	No. of interactions, instagram visits	Once a week

Growing awareness of the brand is the first marketing aim, and there are three ways to do this. The first goal is to get more Instagram followers by using promotional advertising, which cost 12.5 BD each time and 25 BD overall because they happen twice a month. The secondary goal is to produce educational material by researching relevant subjects and sharing the results in an Instagram post. This will take place once a month, and the quantity of interactions and page views will be used to track its progress. Reaching out to a suitable local influencer is the third goal in order to work together with them. This will be carried out once every six months, and it will be tracked by looking at the quantity of followers, account views, and website visits and will cost around 60 BD.

Increasing website traffic is the second marketing aim, and there are three ways to get there. The initial goal is to begin email marketing by giving them individualized communications. This will take place twice a month and be quantified by the quantity of website views.

By selecting phrases that are relevant to the platform, the second goal is to enable search engine optimization, which will be gauged by the quantity of visitors to the website. The search engine optimization plugin is paid for once a year. The third goal is to establish a well-known TikTok account by making brief films that adhere to current trends on the network.

Increasing retention of customers via Instagram interaction is the third marketing objective. Making interactive material, like surveys, Q&A sections, and quizzes, is one way to do this. This will happen once a week, and the quantity of interactions and page views will be used to gauge its success.

3.5.5 **Marketing channels**

For wakeguard Instagram is the main marketing channel since 2023, it allows us to upload our photos and videos and helps us to interact with our users and supporter as it is our main marketing channel and our online shop. We regularly post about our prototyping routine and ask for a feedback from our followers and interact with our followers. We are planning on increasing our marketing channels to different social media accounts like Tiktok , X and creating a website for better user interactions

WakeGuard attempts to reach its intended customer base via advertising on Instagram, conducting surveys, and posting product designs for potential buyers to notice the product and pay attention to it. They strive to target largely students like themselves to see and buy their goods because some students travel great distances to get to their destinations, whether it's university or other areas, have a lack of sleep due to assignments, and so on

3.6 Financial Planning

Table 3.6-1: Financial Planning

financial planing		
cost of production		
Material cost		20 BD per unit
Labor and manufacturing costs		5 BD per unit
Overhead costs		2 BD per unit
Research and Development (R&D) Expenses		
R&D budget		2000 BD per year
Marketing and Promotion		
Marketing budget		1500 BD per year
Pricing Strategy		
Average selling price		80 BD per unit
Sales Forecast		
year 1 (2024)		700 units
year 2 (2025)		1500 units
year 3 (2026)		3000 units
Distribution and Logistics		
Shipping and fulfillment costs		3 BD per unit
After-sales Support		
Customer support and warranty costs		5 BD per unit
Revenue Streams		
year 1 (2024)		
Total Revenue		56000
Total Costs		28000
Profit/Loss		28000
year 2 (2025)		
Total Revenue		120000
Total Costs		56000
Profit/Loss		64000
year 3 (2026)		
Total Revenue		240000
Total Costs		108500
Profit/Loss		131500

In a financial plan, costs, revenue, and profitability are outlined for a three-year period. There is a budget for production, a budget for research and development, a budget for marketing and promotion, a pricing strategy, sales forecasts, a budget for distribution and logistics, and an expenditure on after-sales support. The plan predicts that sales will increase over time, Consequently, revenue increases. However, the plan also accounts for various costs, such as materials, labor, overhead, shipping, and customer support, which have an impact on profitability as well. Over the course of the next three years, the business' profits are expected to steadily increase, indicating its potential to grow and succeed.

Chapter 4:Project Management

4.1 Process Model

We have decided to adopt the Agile methodology as our software development life cycle approach for our senior project report. This decision was influenced by the nature of our project, which involves research and development. The Agile methodology offers various aids that align with our project objectives. Primarily, its iterative, flexible, and emphasis on continuous customer feedback were the qualities of the Agile Methodology that resonated with our objectives and interests. This development approach allows us to break down the project into smaller, manageable increments, enabling us to focus on specific tasks and deliver tangible results at regular intervals. This iterative approach is particularly advantageous for a research-based project like ours, where requirements and design may evolve over time as we gather new insights and feedback.

4.2 Risk Management

This section of our research aims to assess the possibility of any associated risks in the development of our product. Likewise, it aims to produce preventive and mitigative actions to address these risks. In doing so, we can be aware of potential risks early on and can take respective actions to decrease the threat of it occurring while increasing the probability of the project's success.

4.3 Risk Identification

During the risk identification phase, we thoroughly analyzed our project to identify potential risks that could impact its integrity and success. We held brainstorming sessions which included reviewing project documentation to consider factors that could hinder our progress early on in the development stage. Such examples of these included: technological uncertainties, resource constraints, time limitations, external dependencies, and changes in requirements. Then, we would also complement this stage with the aid and guide of our advisors to ensure that we are remaining on the right path. This collaborative approach ensured a comprehensive identification process, laying a proper foundation for effective risk management.

4.4 Risk Assessment

After identifying the potential risks, we evaluate the identified risks by assessing their potential impact and likelihood. This involves analyzing the severity of each risk and the probability of its occurrence. We leverage both objective data and our own knowledge and experience to make informed assessments. By conducting a thorough risk assessment, we gain a clearer understanding of the risks' significance and prioritize them based on their potential impact on the project. This information serves as a basis for developing the appropriate risk mitigation strategies and allocating resources effectively.

4.5 Risk Mitigation

Once the risks have been assessed, it's important to develop strategies to mitigate or minimize their impact. This involved implementing preventive measures to reduce the likelihood of risks occurring. Additionally, we also created contingency plans to address the risks that in the instance that they do occur. The main objective of this is to be able to proactively manage the risks and have strategies in place to minimize their negative effects on the project if they do manage to happen.

4.6 Risk Monitoring and Control

After, throughout the project, it's crucial to continuously monitor the identified risks and their status. This involves tracking the progress of risk mitigation strategies, assessing any changes in the project environment that may affect the risks, and updating risk assessments accordingly. Regular communication and collaboration with the project team are essential for effective risk monitoring and control.

By implementing a robust risk management process, we can identify potential risks early, develop appropriate strategies to address them, and monitor them throughout the project's lifecycle. This proactive approach helps us minimize the impact of risks on the project and increase the likelihood of its success.

Table 4.6-1: WakeGaurd project activities plan

Risk Description	Impact	Likelihood	Severity	Mitigation Strategy	Contingency Plan
Delays in project schedule due to unforeseen circumstances	Loss of customers, decrease in sales, damage to reputation/integrity, increase in costs	Medium	High	Regular project monitoring and tracking, proactive communication with stakeholders	Allocate additional resources, adjust project timeline if necessary
Insufficient budget allocation	Project delays, limited resources, compromise in quality, inability to fulfill project deliverables	Low	Medium	Conduct thorough budget analysis and forecasting, explore potential funding sources	Prioritize project tasks, seek additional funding if required
Technical difficulties in implementing the anti-sleeping glasses technology	Increase in costs, higher support/maintenance, decrease in customer value, compromised performance	High	High	Conduct thorough research and testing, involve technical experts, have backup technology options	Develop contingency plans, explore alternative technologies
Inadequate market demand for anti-sleeping glasses	Decrease in sales, increase in marketing cost, decrease in value/reputation, competitive disadvantage, limited company growth	Medium	Medium	Conduct market research and analysis, validate product viability with potential customers	Explore alternative target markets, diversify product offerings if needed
Lack of user acceptance or resistance to using anti-sleeping glasses	Inability to penetrate the market, negative reviews/word-of-mouth, increase in cost, competitive disadvantage, loss of customers	Medium	High	Conduct user testing and feedback sessions, provide extensive user training and support	Address user concerns, improve product usability, provide user education programs

4.7 Project activities Plan

The project activities plan outlines the key steps and tasks involved in the development and implementation of your senior project. It provides a structured approach to guide the project from initiation to post-launch phases. The plan encompasses various stages, including project initiation, requirements gathering, system design, development, testing, deployment, and post-launch activities.

Table 4.7-1: WakeGaurd project activities plan

Phase	Activities	Duration	Start Date	Finish Date
1.	Project Initiation			
	Choose a topic to pursue and assess its viability	206 days	23/02/2023	17/09/2023

	Choose an advisor and meet with them to ask them to be our advisor	<1 day	17/09/2023	17/09/2023
	Meet with advisor to assess the viability of the project topic to be pursued	<1 day	17/09/2023	17/09/2023
	Define project scope, objectives, and deliverables	2 days	26/10/2023	28/10/2023
	Identify project stakeholders and their roles	<1 day	26/10/2023	26/10/2023
	Conduct initial project kickoff meeting with the team and supervisor	3 days	25/10/2023	27/10/2023
	Develop a project charter outlining project goals and constraints	2 days	26/10/2023	28/10/2023
	Produce proposal	5 days	15/09/2023	20/09/2023
	Meet with supervisor to discuss proposal	<1 day	19/09/2023	19/09/2023
	Submit proposal	<1 day	20/09/2023	20/09/2023
	Wait for the approval of the proposal	6 days	20/09/2023	26/10/2023
	Make adjustments that the committee made on our submitted proposal	<1 day	28/10/23	28/10/2023
	Received proposal approval	<1 day	26/10/2023	26/10/2023
2.	Gathering Requirements			
	Produce surveys			
	Share survey and gather respondents with potential users (buyers and providers)	4 days	27/11/2023	01/12/2023

	Gather relevant resources and information of functional and non-functional requirements	7 days	26/10/2023	03/11/2023
	Conduct a review of related literature on significant aspects in of the research topic	7 days	26/10/23	03/11/2023
	Analyze the business aspects, strategies, model, competitors, etc.	15 days	30/11/2023	15/12/2023
	List down the details of the project and the specificities of all the analysis of risks associated with the product	5 days	30/11/2023	05/12/2023
	Analyze and prioritize requirements based on business value and feasibility	12 days	30/11/2023	12/12/2023
	Study the data collected by the surveys and produce a study the data collected by the surveys and produce a comprehensive analysis report that highlights key findings, trends, and insights.	7 days	30/11/2023	07/12/2023
3.	System Design			
	Develop a system architecture design	13 days	30/11/2023	13/12/2023
	Design the user experience (UX) of the platform	7 days	30/11/2023	07/12/2023
	Create wireframes and prototypes to visualize the system design	3 days	30/11/2023	03/12/2023

	Define the database schema and data models	9 days	30/11/2023	09/12/2023
	Define the software algorithm, create an outline of necessary code, and choose code/software the device will use	2 days	30/11/2023	02/12/2023
	Conduct testing and debugging	2 days	13/12/2023	15/12/2023
4.	Development			
	Set up the development environment (programming languages, frameworks, tools)	1 day	02/12/2023	03/12/2023
	Implement the front-end components of the digital platform	2 days	10/12/2023	12/12/2023
	Build the back-end systems and database functionality	3 days	09/12/2023	12/12/2023
	Conduct regular code reviews and testing on physical connections to ensure quality and functionality	6 days	12/12/2023	18/12/2023
	Plan and execute various types of testing (unit testing, integration testing, system testing)	6 days	12/12/2023	18/12/2023
5.	Platform Testing			
	Identify and fix any bugs or issues in the platform	3 days	09/12/2023	12/12/2023
	Gather a small sample population to test the product on and gather feedback on experience, feedback, and recommendations	3 days	14/12/2023	17/12/2023

	Gather feedback and ask whether there are any areas of improvement users would like to see	3 days	14/12/2023	17/12/2023
	Deployment and Launch	2 days	12/12/2023	14/12/2023
6.	Deployment and Launch			
	Prepare the platform for deployment	1 day	15/12/2023	16/12/2023
	Perform final testing and quality assurance checks	<1 day	15/12/2023	15/12/2023
	Develop a marketing and communication strategy for the platform launch	15 days	03/12/2023	18/12/2023
	Provide ongoing support and maintenance	6 days	12/12/2023	18/12/2023
	Identify any possible future enhancements	5 days	26/11/2023	01/12/2023
	Monitor the platform's performance and user feedback	4 days	14/12/2023	18/12/2023
7.	Post-Launch			
	Continuously improve and enhance the platform based on user needs	6 days	12/12/2023	18/12/2023
	Provide ongoing support and maintenance for the platform	6 days	12/12/2023	18/12/2023
	Evaluate the platform's success based on predefined metrics and KPIs	5 days	13/10/2023	18/10/2023
	Identify opportunities for future enhancements and updates	2 days	26/10/2023	28/10/2023

	Produce report on the entirety of the product (planning, development, launch, etc.)	299 days	23/02/2023	19/12/2023

Chapter 5:Requirement Collection and Analysis

5.1 Introduction

The journey of building a successful solution is paved with understanding the user's needs. Chapter 5 talks deeply about the important process of requirement collection and analysis. Here, we take a look at the techniques and strategies used to gather user feedback and translate them into requirements, and lay the foundation for a product that truly solves the problem at hand.

This chapter is not just about technical specifications; it's about understanding the user's blueprint. It's about bridging the gap between their needs and the functionalities that fulfill them. We explore different approaches to requirement collection, from traditional interviews and surveys to user observation and usability testing. You'll discover how to analyze the collected data, identify patterns and trends, and prioritize requirements based on their impact and feasibility.

5.2 Requirement Elicitation

The success of Wake Guard's anti-sleep glasses hinges on a thorough understanding of its target audience and their needs. This chapter delves into the crucial steps of requirement collection and analysis, laying the foundation for a product that enhances road safety.

5.2.1 Techniques for Elicitation:

- Interviews: Conducting individual or group interviews with key stakeholders like potential customers, industry experts, and internal teams is invaluable. This allows for in-depth exploration of user needs, pain points, and desired features.
- Surveys: Distributing surveys to a wider audience helps capture quantitative data and identify patterns in user preferences and expectations. This provides valuable insights for market research and product development.
- Observation: Observing potential users in real-life scenarios allows for a deeper understanding of their behavior, challenges they face, and how they currently address sleepiness while driving. This helps identify unmet needs and opportunities for innovation.
-

5.3 Management

Requirement Management Tools: Utilizing dedicated tools streamlines the collection, organization, and tracking of requirements throughout the development process. This ensures clarity, consistency, and collaboration among team members.

5.4 System Requirements

The system requirements portion outlines the necessary functionality and qualities of the anti-sleep technology glasses. It includes specifications such as accurately detecting drowsiness, allowing sensor customization, ensuring usability, performance, security, reliability, and compatibility. These requirements ensure that the glasses are effective, user-friendly, and safe for preventing driver fatigue.

5.5 Functional Requirements

- Anti-sleep technology: The glasses must effectively detect drowsiness and promote alertness during driving.
- sensor customization: Users should be able to adjust sensor strength and functionalities based on their individual needs and preferences.
- Comfort and wearability: The glasses should be lightweight, comfortable for extended wear, and compatible with varying head sizes and shapes.
- Durability: The glasses must be constructed from high-quality materials that can withstand regular use and wear and tear.

5.6 Non-functional Requirements

- Usability: The glasses should be intuitive and easy to use, even while driving.
- Performance: The anti-sleep technology should be effective and consistent in promoting alertness.
- Security: The glasses shouldn’t obstruct the users vision.
- Reliability: The glasses should function reliably under various weather conditions and driving situations.

- Compatibility: The glasses should be compatible with different types of drivers and prescription eyewear.

5.7 Personas

Developing detailed user personas representing different segments of the target audience provides invaluable insights into their specific needs, motivations, and challenges. This helps in understanding the "who" behind the requirements. By knowing the typical users and their unique characteristics, the product can be tailored to their specific needs and preferences. Wake Guard Anti-Sleep Glasses Personas:

5.7.1 Trucker:

Name: farooq, 45 years old

Occupation: Truck driver, spends long hours on the road

Needs: Stay alert and focused during long drives, avoid drowsiness-related accidents.

Challenges: Fatigue from extended driving, difficulty staying awake at night, limited time for sleep breaks.

Wants: Durable and comfortable glasses, easy-to-adjust sensor.

5.7.2 The Busy Mom:

Name: Maryam, 32 years old

Occupation: Working mom with demanding schedule, commutes with children.

Needs: Maintain alertness during morning commutes, avoid sleepiness while driving children.

Challenges: Multitasking and early mornings lead to fatigue, limited time for self-care.

Wants: Stylish and lightweight glasses, convenient on-the-go charging.

5.7.3 Night Shift Worker:

Name: AbdulHaseb, 28 years old

Occupation: Night shift worker struggles with circadian rhythm disruptions.

Needs: Combat sleepiness during night drives, avoid accidents caused by fatigue.

Challenges: Difficulty sleeping during the day, disrupted sleep patterns, reliance on caffeine.

Wants: Glasses that effectively keep him awake during long shifts.

5.7.4 The Senior Citizen:

Name: Jamshed, 68 years old

Occupation: Retired, enjoys road trips and independent travel.

Needs: Maintain alertness and safety while driving, address age-related changes in sleep patterns.

Challenges: Medication side effects can cause drowsiness, difficulty adjusting to new technology.

Wants: Simple and user-friendly glasses

These are just a few examples that we found around us.

5.8 System Models

Visualizing the structure and behavior of the anti-sleep glasses system through models helps in:

- Communicating requirements effectively: Models provide a clear and concise representation of the system for all stakeholders, facilitating communication and collaboration.
- Identifying potential challenges and design flaws: Analyzing models allows for early detection of issues and inconsistencies in the system design, enabling corrective action before significant resources are invested.
- Ensuring completeness and consistency of requirements: Models help ensure that all relevant requirements are captured and that they are consistent with each other.
- Facilitating system testing and verification: Models serve as a guide for developing test cases and verifying the system's functionality against the defined requirements.

5.8.1 Examples of System Models:

Here we will talk about different system model examples which includes use case and data flow diagram

5.8.1.1 Use cases

Use cases depict how different user types interact with the glasses. This helps understand user needs and inform design decisions.

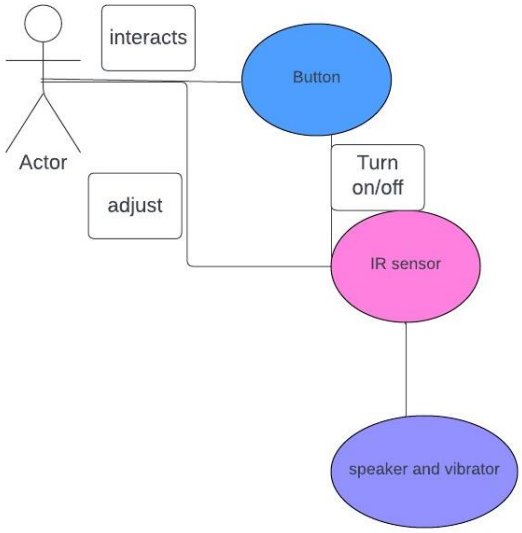


Figure 5.8-1: use case

In this use case diagram, we can see that user interacts with the button to turn the IR sensor on/off and the user can also adjust the strength of the IR sensor to adjust according to his eyes. IR sensor is connected to the speaker and vibrator and as soon as the IR sensor detects drowsiness it sends signals to speaker and vibrator to make sound and vibrate.

5.8.1.2 Data flow diagrams

Data flow diagrams illustrate the flow of data through the system, including input, processing and output. This helps identify potential bottlenecks and ensure efficient data management.

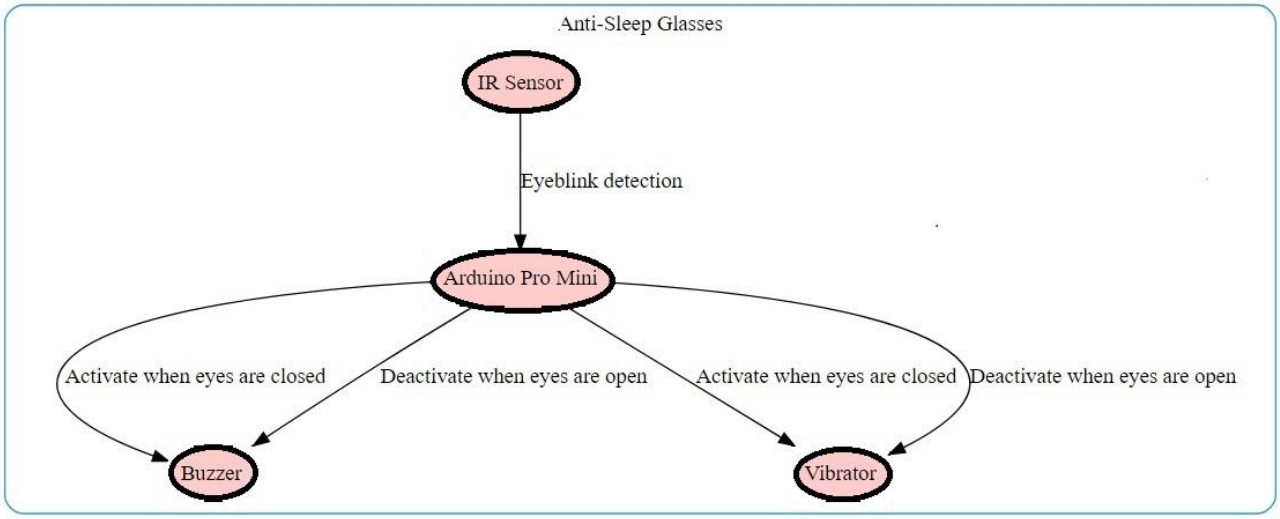


Figure 5.8-2:Data Flow Diagram

Anti sleep glasse's main function comes from its IR sensor that functions according to the code that is saved in Arduino Pro Mini in which the buzzer and the vibrator activates based on the eye blink if it is closed

Benefits of Using System Models

1. Improved communication: System models provide a common language for stakeholders to understand the system's functionality.
2. Enhanced requirement analysis: Models help identify and refine system requirements based on user needs and data flow.
3. Efficient development: By visualizing the system architecture, developers can make informed decisions about component selection and integration.

- Reduced risk: System models help identify potential problems early in the development process, allowing for corrective action before significant resources are invested.

By leveraging different models, we can gain a comprehensive understanding of the system's requirements and ensure its successful implementation.

In summary, Chapter 5 focuses on the critical aspects of requirement collection and analysis for the Wake Guard anti-sleep glasses system. By effectively gathering and analyzing requirements, creating user personas, and utilizing system models, Wake Guard can develop a system that truly meets the needs and expectations of its target audience.

Chapter 6:System Design

6.1 Introduction

The purpose of this section of the document is to provide you with a brief overview of the key components that are used throughout the project, and I hope that this will assist you in gaining a better insight into the entire project.

6.2 Components

The anti-sleep glasses were designed in an effort to reduce drowsiness and to prevent accidents while driving. Using innovative methods and technologies, in these glasses sleepiness or exhaustion indicators are detected and timely notifications are sent to prevent accidents when people fall asleep while driving or operating machinery. It is necessary to develop a strong system capable of correctly monitoring the wearer's eye movements in order to diagnose symptoms of sleepiness. Anti-sleep glasses do this by integrating numerous components.

6.2.1 Arduino Pro Mini

An Arduino Pro Mini is like a tiny computer that can be controlled and programmed to perform tasks. It is a small electronic board that can interact with other electronic components.

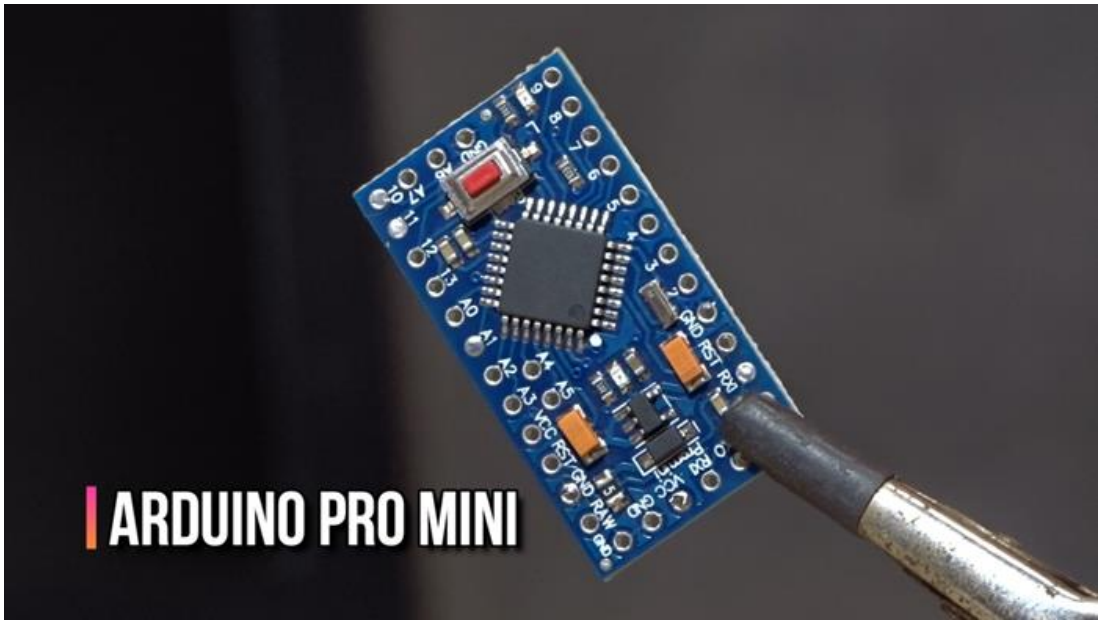


Figure 6.2-1: Arduino Pro Mini

6.2.1.1 Compact Design and Power Efficiency

Pro Mini is convenient because of its compact design and ensures that less power is used, thus making it perfect for projects that require space or a lower energy consumption.

6.2.1.2 Interfacing with Electronic Components

Various electronic components, including sensors, buttons, lights, and motors, can be connected, and controlled with the Pro Mini's multiple pins. As well as reading information from connected components, these pins facilitate the acquisition and processing of data, allowing the Pro Mini to be customized and adapted to a wide variety of project requirements with its flexible pin configuration.

6.2.1.3 Programming the Arduino Pro Mini

Pro Mini is programmed using Arduino software, which is an easy to use programming environment for beginners, allowing users to define specific actions and behaviors for the device by writing code. Moreover, Arduino supports a wide range of programming languages, including C and C++, so it can be used by developers of all levels.

6.2.1.4 Application Examples

It is possible to use the Pro Mini to automate homes, monitor the environment, and log data. By sensing temperature and humidity, controlling lighting systems, or navigating robots, the Pro Mini enables users to develop diverse and innovative projects in a wide range of fields.

6.2.1.5 Variants and Voltage Compatibility

Several versions of the Arduino Pro Mini are available, including versions appropriate for components running on 5V and 3.3V. Users can pick a version that is suitable for their chosen components based on their voltage specifications. In addition to ensuring smooth operation, the voltage integration feature protects components from damage.

6.2.1.6 Size and Mounting Options

It is ideal for applications that require a limited amount of space because of its small physical footprint, which is around the size of a coin. Having a tiny size and a variety of mounting options makes the Pro Mini an excellent choice for many project situations, whether it is attached to a circuit board permanently or connected to a breadboard, which can be used for prototyping and experimentation.

6.2.1.7 Benefits and Popularity

Arduino Pro Mini is easy to use, inexpensive, and has a wide community of users that provide resources and support. Adaptability, accessibility, and compatibility with a wide variety of electronic components make this device popular among students, hobbyists, and professionals alike. In addition to exploring creativity, creating electrical projects, and learning how to program and use microcontrollers, the Pro Mini lets users learn about microcontrollers.

6.2.1.8 Target Users and Applications

It is suitable for a wide range of users, including electronics enthusiasts, students, robotics professionals, and engineers. In addition to prototyping and teaching, it can be used for home automation, the Internet of Things (IoT), and industrial automation projects. New and experienced

electronics users alike will find the Pro Mini a valuable asset because of its user friendliness and wide range of applications.

Table 6.2-1: Technical Specifications of Arduino Pro Mini (Robu.in, 2020)

Input Voltage Range	5V - 12V
Operating Voltage	3.3V/5V
Crystal Frequency	8 MHz (for 3.3V) / 16 MHz (for 5V)
Maximum current through each I/O pin	40 mA
SRAM	2KB
EEPROM	1KB
Flash Memory	32KB
Pre- installed Flash	0.5KB

Arduino Pro Mini Microcontroller Development Boards operate at 3.3 volts or 5 volts and can be plugged into any voltage between 5 volts and 12 volts. The board includes a crystal oscillator rated at 8 MHz or 16 MHz, 2 KB of SRAM, 1 KB of EEPROM, 32 KB of Flash memory, and 0.5 KB of bootloader Flash memory, all of which are pre-installed.

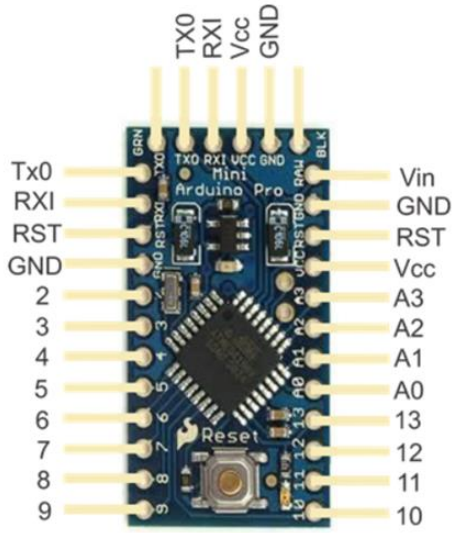


Figure 6.2-2: Pin Configuration of Arduino Pro Mini (Robu.in, 2020)

- **GND (Ground)**: This pin is connected to the ground of the system.
- **RST (RESET)**: This pin is used to reset the microcontroller.
- **VIN (Voltage Input)**: This pin is used to supply voltage to the board. It can be connected to a power source between 3.35V and 12V.
- **Vcc (Voltage Common Collector)**: This pin is used to supply voltage to the microcontroller. It should be connected to a power source of 5V.
- **Tx0 (Transmit)**: This pin is used for serial communication, furthermore it transmits data from the board to other devices.
- **Rx1 (Receive)**: This pin is used for serial communication, moreover it receives data from other devices.
- **Analog Pins**: The Arduino Pro Mini has 6 analog input pins labeled A0 through A5. These pins are used to read analog signals from sensors.
- **Digital Pins**: The Arduino Pro Mini has 14 digital input/output pins labeled 0 through 13. Six of these pins can be used as PWM outputs. These pins can be used for both input and output.

6.2.2 IR Sensor

An IR sensor detects objects by using IR or infrared waves and is also used to differentiate between black and white colors, thereby being commonly used in line following robots. Although IR waves can be detected as heat, they cannot be seen by the human eye, like visible light.

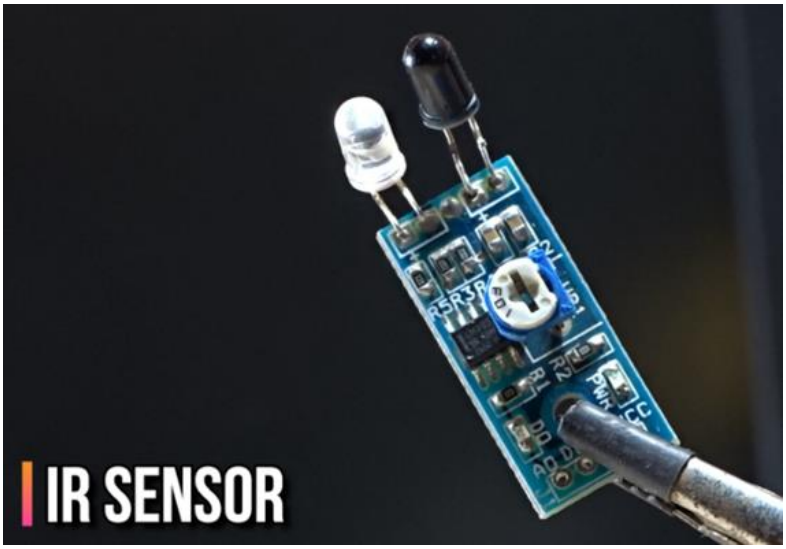


Figure 6.2-3: IR Sensor

There are two main parts to every IR sensor or infrared sensor: an IR transmitter and an IR receiver. The IR transmitter sends infrared waves, while the IR receiver receives these transmitted infrared waves by constantly sending a digital signal in the form of 1 or 0 to the sensor's Vout pin.

6.2.2.1 IR Motion Sensor Module

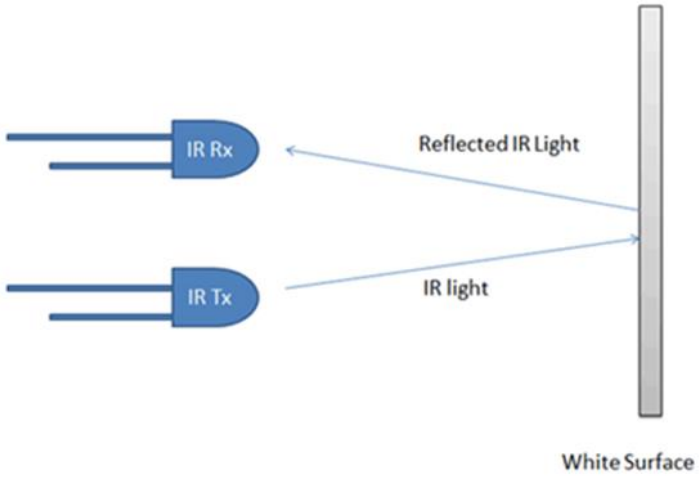


Figure 6.2-4 The operation of an infrared transmitter and receiver on a white surface (Anon, 2018)

IR sensors receive infrared waves that have been transmitted by IR transmitters when there is an object in front of them. In that case the IR sensor gives 0; in a similar manner, IR waves are reflected back from a white surface in front of the sensor since white surfaces do not absorb light.

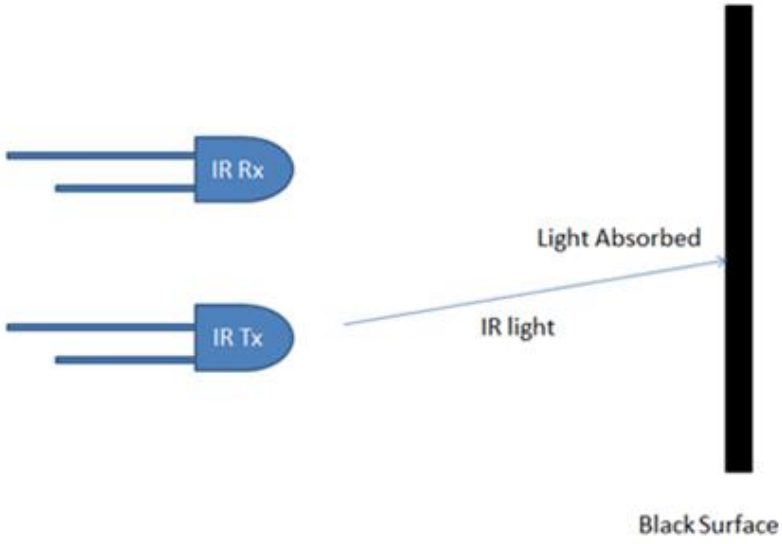


Figure 6.2-5: The operation of an infrared transmitter and receiver on a black surface (Anon, 2018)

The infrared waves from the transmitter are not received by the receiver of the IR sensor when no object is in front of it, so the IR sensor gives 1. Also, if there is a black surface in front of the sensor, no IR waves are reflected back because the black surface completely absorbs the light[21].

6.2.2.2 IR Sensor Pinout

There is a 3 pin connector on the IR sensor that connects it to the outside world via the 3-pin connector.

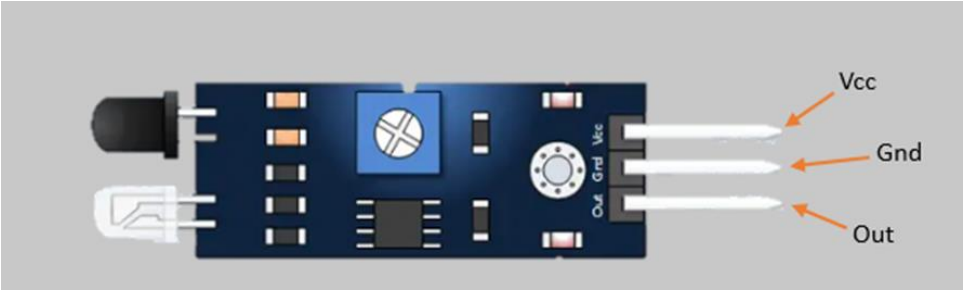


Figure 6.2-6: IR Sensor Pinout (Anon, 2018)

- On the Arduino, VCC connects to the 5V pin as the power supply for the IR sensor.
- Arduino's ground pin should be connected to GND
- The output pin is a 5V TTL logic signal, LOW indicates there is no motion detected, HIGH indicates there is motion detected.

6.2.2.3 IR Sensor Parts

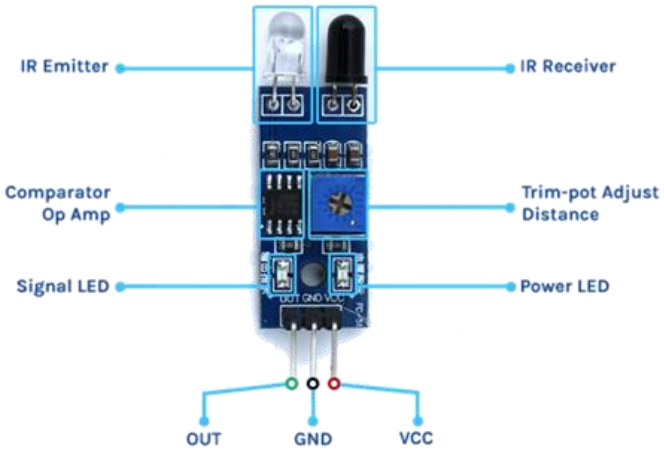


Figure 6.2-7: IR Sensor Parts (Anon, 2018)

Generally, these sensors are used for Arduino projects to detect proximity or build obstacle avoidance robots. They are popular among beginners because of their low power, low cost, ruggedness, and wide sensing range that can be trimmed down. Moreover two of the three pins of this sensor are level VCC and GND, and the other is the sense/data pin, as shown above. Onboard are power LEDs and signal LEDs; the power LEDs are activated when the board is powered on, and the signal LEDs are activated when a circuit is triggered. As well as this board comes with a comparator Op-amp, which converts incoming analog signals from the photodiode into digital signals. The device also has a potentiometer to adjust its sensitivity. Finally, we have a photodiode and an IR emitting LED pair that come together to form the IR proximity sensor module as a whole.

6.2.2.4 Circuit Diagram

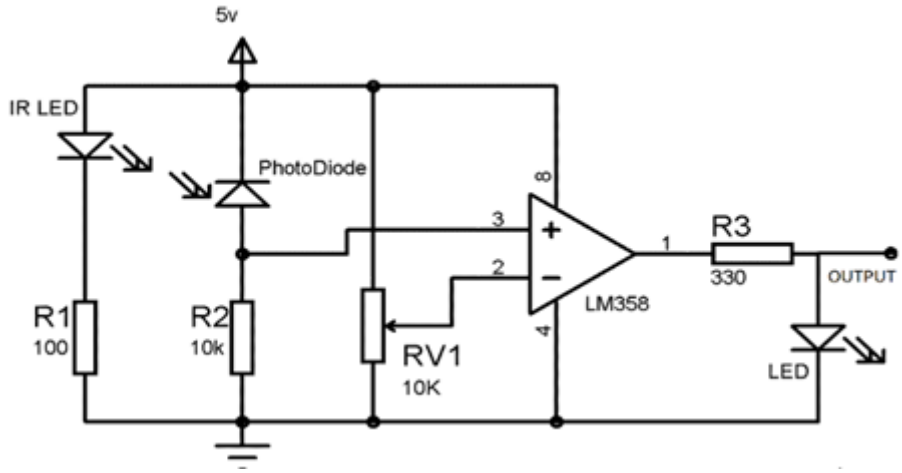


Figure 6.2-8: IR Sensor Circuit Diagram

As shown in the schematic, we have an InfraRed LED that transmits and a Photodiode that receives the reflected light from an object in front of the sensor. Based upon the intensity we can determine how far or how close the item is to the sensor. Also visible on the schematic is an LM358 Op-Amp that performs all the comparison work and generates the output. A potentiometer is also included to adjust the IR Sensor module's sensitivity or triggering distance.

6.2.3 NPN Transistor BC547

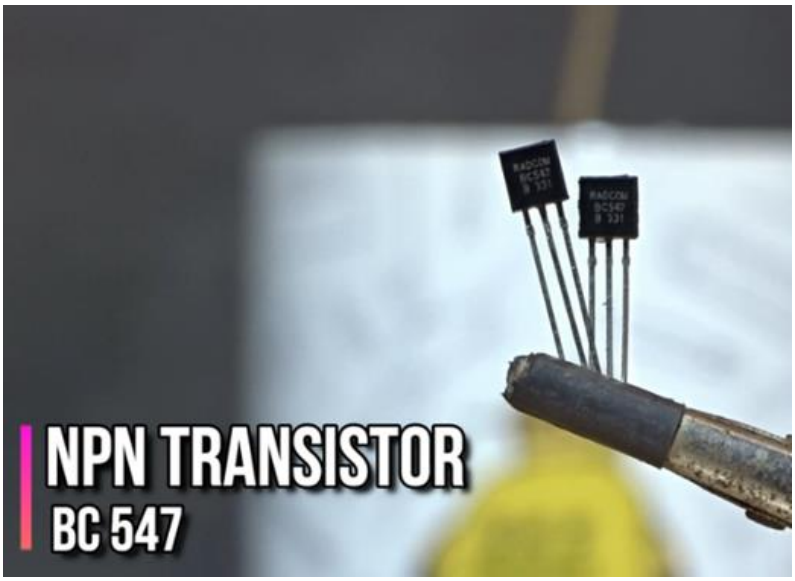


Figure 6.2-9: NPN Transistor BC547

In electronic circuits, BC547 transistors are commonly used as switches or amplifiers, including low-power amplifiers, audio preamplifiers, oscillators, and switching elements.

6.2.4 Vibrator

Figure 6.2-10: Vibrator

In mobile phones, joysticks, pagers, and other electronic devices, these motors vibrate when they receive signals. They have no sound, so they are mainly used to alert the user.

6.2.5 Buzzer 5V

Figure 6.2-11: Buzzer

Buzzers are electronic devices that produce audio by vibrating rapidly. They are commonly used in electronic circuits to provide audio feedback.

6.2.6 Resistors 4.7K

Figure 6.2-12: Resistors

Resistors are electronically made components that limit the flow of current in a circuit. They are commonly used in electronic circuits for reducing current flowing through an LED, biasing active elements, and terminating transmission lines, among other things.

6.2.7 Battery 3.7V

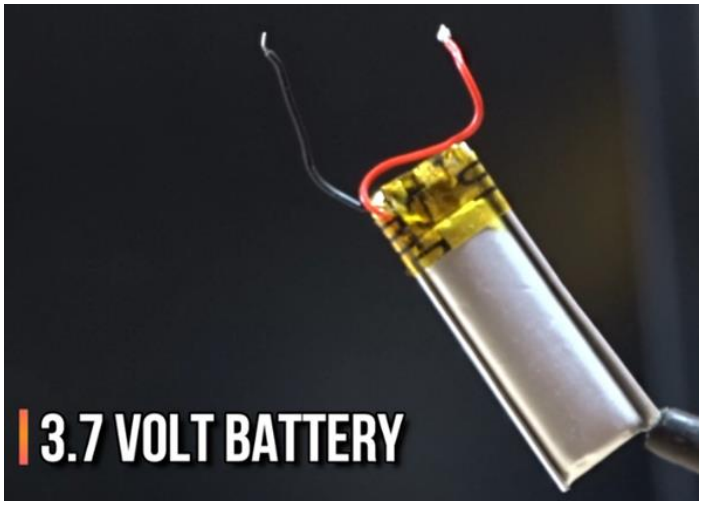


Figure 6.2-13: Battery

Arduino Pro Mini can be powered by a 3.7V battery, with a voltage regulator that can handle input voltages from 3.35V to 12V

6.2.8 Glasses Frame

Figure 6.2-14: Glasses Frame

We choose this frame because it is simple, strong frame, suitable for both male and female, and frame's sides are wide which will be helpful to stick the hardware

6.2.9 YP-05 FTDI

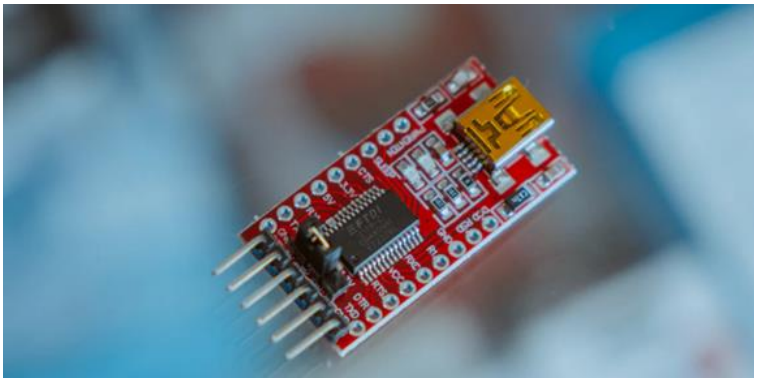


Figure 6.2-15: FTDI (YP-05)

For uploading sketches to the Arduino Pro Mini, an external USB-to-serial converter is required, as the Pro Mini does not have an on-board USB interface.

6.2.9.1 FDTI with Arduino Pro Mini Connection

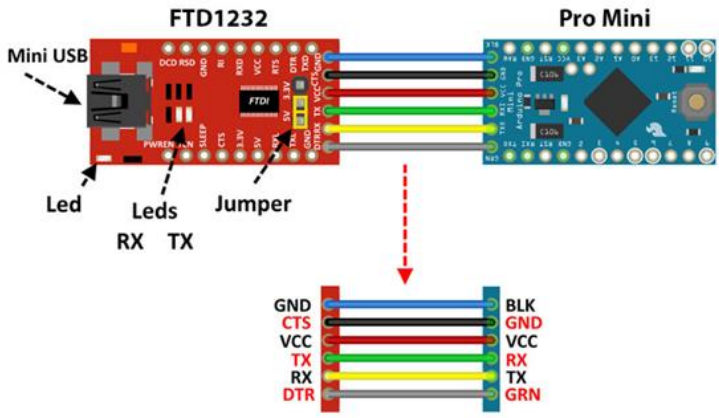


Figure 6.2-16: Circuit Diagram to program Arduino Pro Mini with FTDI (Anon, 2018)

In order to use the FTDI YP-05 with an Arduino Pro Mini, you will need to connect it to the Pro Mini's TX, RX, and GND pins. You should connect the DTR pin of the YP-05 to the Pro Mini's RESET pin.

6.3 Circuit Diagram of Anti Sleep Glasses

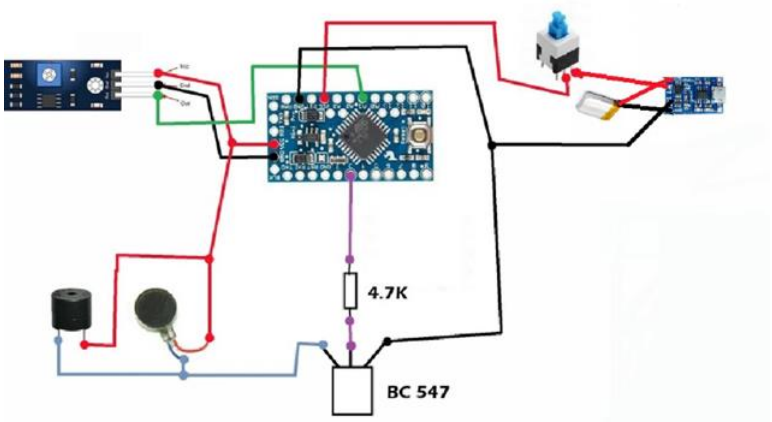


Figure 6.3-1: Circuit Diagram of Anti Sleep Glasses

This is the final and latest Circuit Diagram that includes each component used in this project which includes Arduino Pro Mini, IR Sensor, NPN Transistor BC547, Vibrator, Buzzer 5V, Resistors 4.7K, Battery 3.7V, and YP-05 FTDI furthermore all these components are attached on the glasses frame

6.4 Arduino IDE

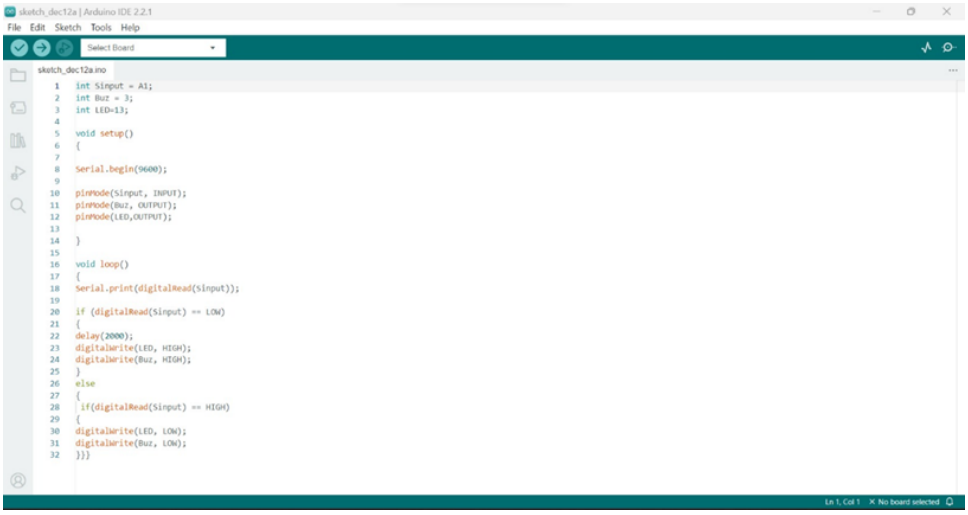


Figure 6.4-1:Arduino Program with simple code

Three integer variables are defined in this Arduino program, Sinput, Buz, and LED, with values of A1, 3, and 13, respectively. During setup(), the code sets the Sinput, Buz, and LED pins to be inputs, outputs, and outputs, respectively, and initializes the serial communication with a baud rate of 9600. As the Sinput pin is read and printed to the serial monitor in the loop() function, the code waits for 2 seconds and then turns on the LED and Buz pins, if Sinput is HIGH, the pins are turned off.

Chapter 7:System Implementation and Testing

7.1 Product Overview:

Wake Guard's anti-sleep glasses aim to improve driver alertness and prevent accidents caused by drowsiness. The product's features include:

- Special sensors: Designed to detect drowsiness.
- Comfortable design: Lightweight and ergonomic for extended wear.
- Durable construction: Built to withstand regular use and wear and tear.
- Stylish options: Available in various styles and colors to suit different preferences.

7.1.1 Implementation Steps:

Phase 1: Design and Development (1 months)

- Concept refinement: Finalize the design of the glasses based on market research, user feedback, and technical feasibility.
- sensor selection and testing: Choose the optimal sensors and material to achieve desired anti-sleep effects.
- Prototype development: Develop functional prototypes for testing and refinement.
- Compliance testing: Ensure adherence to relevant safety and quality standards.

Phase 2: Material and prototype (4 months)

Phase 2.1: Material sourcing: Secure high-quality materials and components for consistent prototyping.

Phase 2.1.1: hardware/software used.

Hardware:

- Arduino Pro Mini
- IR Sensor
- Transistor BC547
- Vibrator
- 5 Volt Buzzer
- Resistors 4.7K
- 3.7V Battery

- Glasses Frame
- FTDI driver (yp-05)

Software:

Software use to program to the Arduino pro mini was Arduino IDE version 2.2.1. and the code was uploaded on the Arduino pro mini using the FTDI driver (yp-05).

Codes:

```
int Sinput = A1;
int Buz = 3;
int LED=13;

void setup()
{

Serial.begin(9600);

pinMode(Sinput, INPUT);
pinMode(Buz, OUTPUT);
pinMode(LED,OUTPUT);

}

void loop()
{
Serial.print(digitalRead(Sinput));

if (digitalRead(Sinput) == LOW)
{
delay(2000);
digitalWrite(LED, HIGH);
digitalWrite(Buz, HIGH);
}
else
{
 if(digitalRead(Sinput) == HIGH)
{
digitalWrite(LED, LOW);
digitalWrite(Buz, LOW);
}}}
```

Phase 2.2: Prototype setup: Implement efficient production lines and quality control procedures.

NOTE: We have already talked about prototyping, hardware, software and codes in Chapter 6 "System design"

Phase 3: Quality Control and Testing (1 month)

- Implement rigorous quality control checks: Inspect each product for defects and ensure conformance to specifications.
- Conduct independent testing: Commission third-party labs to test the anti-sleep efficacy and safety of the glasses.
- Analyze test results and address any issues: Identify and rectify any performance or safety concerns.

Phase 4: Marketing and Launch (1 months)

- Develop a comprehensive marketing strategy: Identify target audience, craft messaging, and establish promotional channels.
- Build brand awareness: Implement marketing campaigns across various channels, including social media and online surveys.

5. Testing Plan:

Table 7.1-1 Testing Plan Table

	Description	Tools	Expected Outcome**
Functional Testing	Verify sensor performance, comfort, and durability.	Simulated driving conditions, user feedback surveys.	Sensors should effectively reduce sleepiness, glasses should be comfortable for extended wear, and withstand normal use.
Safety Testing	Assess potential risks and ensure product safety.	Independent lab testing, adherence to safety standards.	Glasses should not pose any health hazards and comply with relevant safety regulations.

Usability Testing	Evaluate user experience and ease of use.	User observation sessions, feedback interviews.	Glasses should be easy to wear, adjust, and use while driving.
Performance Testing	Measure the effectiveness of the anti-sleep technology.	sleep latency tests.	sensors should demonstrably improve alertness and reduce sleepiness during driving tasks.
Durability Testing	Evaluate the product's resilience to wear and tear.	Repeated wear tests, drop tests, environmental stress tests.	Glasses should remain functional and maintain their appearance after extended use.

6. Ongoing Monitoring and Improvement:

- Regularly collect customer feedback and reviews.
- Analyze sales data and market trends.
- Conduct periodic product reviews and testing.
- Continuously improve product design, manufacturing processes, and marketing strategies.

7. Success Criteria:

- Positive customer feedback and high customer satisfaction rates.
- Increased sales and market share for Wake Guard glasses.
- Recognition from safety organizations and positive media coverage.
- Measurable reduction in accidents caused by driver drowsiness.

8. Conclusion:

By implementing a systematic approach to product development, testing, and marketing, Wake Guard can position itself as a leader in the anti-sleep technology market. The company's dedication to quality, safety, and customer satisfaction will be key to achieving its goals and contributing to safer roads for everyone.

Chapter 8:Conclusion and Future Works

In conclusion, this senior project report presented the development and establishment of WakeGuard, a cutting-edge remedy for driver fatigue and an improvement in traffic safety. The project aimed to address the urgent need for a practical solution that can identify and prevent driver drowsiness, thereby reducing the risk of accidents and promoting safer driving conditions.

Through extensive research and analysis, we have identified the magnitude of the problem of sleepiness-related road accidents and the serious risks they pose to road safety. Existing methods of combating drowsiness while driving, such as drinking caffeinated drinks or listening to loud music, provide temporary solutions but fail to address the underlying problem effectively. Therefore, the development of an innovative solution like WakeGuard is crucial to enhance driver alertness and overall road safety.

The project encompassed various phases, including literature review, business planning, project management, requirement gathering and analysis, system design, implementation and testing. Each phase contributed to the overall understanding and development of WakeGuard. The research findings highlighted the potential benefits of anti-sleeping eyewear in reducing the dangers associated with driver drowsiness.

Moving forward, there are several areas for future work and improvement. Firstly, further research and development can be conducted to enhance the functionality and usability of WakeGuard. This includes refining the hardware and software components, optimizing the sensor technology, and exploring additional features that can contribute to driver alertness.

Additionally, market analysis and commercialization strategies should be explored to bring WakeGuard to a larger audience. This involves conducting market surveys, identifying target markets, establishing partnerships with relevant stakeholders, and implementing effective marketing campaigns.

In conclusion, the development of WakeGuard represents a significant step towards combating driver fatigue and improving road safety. Its innovative approach in detecting and preventing accidents caused by drowsiness has the potential to save lives and reduce injuries. We hope that this project

serves as a foundation for further advancements in the field and encourages future researchers to explore solutions that prioritize driver alertness and overall road safety.

Future Works

In this section, we will talk about how we want to grow our company and how we will expand through the markets into different industries. We plan on achieving those goals through different means like research and development, marketing and advertising, product expansion and partnerships among other things.

Research and Development

In research and development, we see how our product is right now and will further enhance the technology behind our anti-sleep glasses (WAKE-GUARD). Which will include finding new ways to make the product more comfortable either by changing the shape of the glasses or changing the material and improving our codes for making the glasses more efficient and effective and improving hardware and we also plan on developing a software to better to enhance the user experience and improving the accuracy with which the sensors detect drowsiness and also to add new features to our glasses and we also plan on developing a software to enhance user experience. We plan on developing software that will automatically send the GPS location of the user to their emergency contacts and to the emergency authorities if the user is ever in an accident.

Marketing and Advertising

In Marketing and Advertising our focus is to attract new users and to retain our current users by spreading awareness of the issues of falling asleep while driving and by increasing brand awareness to drive sales. We plan on doing this by running targeted ads on social media platforms, by partnering with influencers and celebrities to promote our product and by attending conferences related to transportation. By using such advertising tactics, we will be able to target the messes. To further develop the interest of the customers we can use the help of content marketing and make educational videos and make videos that show case our product in a positive way.

Product Expansion

In product expansion we will talk about how we can enter different product markets to support our main cause which is anti-sleeping glasses (WAKE-GUARD). We can do this by expanding our product line to include products from different categories like converting our anti-sleeping glasses into a modular device with the user can take anywhere (i.e., offices) and we can also convert our anti-sleeping glasses into a software that users can install on their phones and using phone mounts they can position the phone camera to themselves and whenever they fall asleep a high pitch sound will come out of the phone speaker. We'll also give the user verity of options from product style, shape, color etc.

Partnerships

In partnership we will talk about partnering with different organizations and companies which will help both of us grow and expand our business. We can partner with different car companies to give our products with the sale of every car or with trucking companies to provide our product (WAKE-GUARD) to their drivers. We can also partner with popular fashion brands to make custom and limited style of product to increase the hype of our product. We can partner with different organizations to give them our research so they can help benefit others with the same cause that we believe in.

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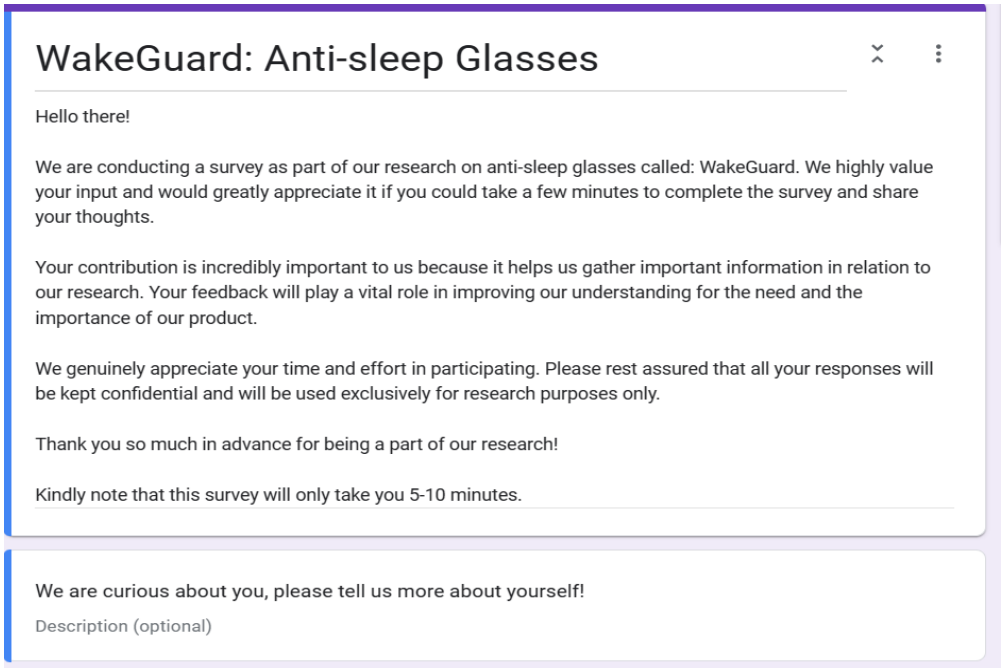
Appendix A
Customer Survey



WakeGuard: Anti-sleep Glasses

Hello there!

We are conducting a survey as part of our research on anti-sleep glasses called: WakeGuard. We highly value your input and would greatly appreciate it if you could take a few minutes to complete the survey and share your thoughts.

Your contribution is incredibly important to us because it helps us gather important information in relation to our research. Your feedback will play a vital role in improving our understanding for the need and the importance of our product.

We genuinely appreciate your time and effort in participating. Please rest assured that all your responses will be kept confidential and will be used exclusively for research purposes only.

Thank you so much in advance for being a part of our research!

Kindly note that this survey will only take you 5-10 minutes.

We are curious about you, please tell us more about yourself!

Description (optional)

Gender

- Female
- Male

Age *

- 18-25
- 25-35
- 35-45
- 45-50
- Above 50

Choose an occupation that applies to you: *

- University Student
- Employed
- Unemployed
- Other...

Data on Traffic Incidents

In this section, we are collecting data on your experience as a driver to better understand your struggles as a driver.

Have you ever been in a car accident while driving? If so, what was the cause of the accident? *

- ○ Road conditions
- ○ Environmental issues
- ○ Vehicle problems
- ○ Driver behavior (sleepiness, drowsiness, fatigue)
- ○ Other...

How long do you drive for? *

- ○ Short-distances
- ○ Moderate-distances
- ○ Long-distances

How often do you drive long distances? *

- ○ Daily
- ○ Weekly
- ○ Monthly
- ○ Rarely

Do you feel sleepy while driving long distances? *

- ( ) Yes
- ( ) No
- ( ) Maybe

What are your reasons for being sleepy? *

- [ ] Driving for too long
- [ ] Fatigue
- [ ] Lack of sleep
- [ ] Medication
- [ ] Health condition
- [ ] Time of driving
- [ ] Other...

How do you stay awake while driving? *

- Taking a break
- Singing/Dancing
- Listening to loud music
- Drinking caffeinated drinks
- Other...

Do these methods work for you? *

- Yes
- No
- Sometimes

WakeGuard: Anti-Sleeping Glasses Description

In this section, we would like to introduce you to our product: WakeGuard. WakeGuard is designed and engineered to use non-intrusive techniques to wake the driver up and keep them from falling asleep, such as: soft vibrations and auditory cues which will in turn reduce the risk of fatalities or injuries due to drowsiness when it comes to driving.

Have you heard of Anti-sleeping Glasses before? *

- Yes
- No

If you have not heard of anti-sleeping glasses before, here is a brief introduction of our proposed product - WakeGuard:

Anti-sleeping glasses integrates modern technology to reduce the likeliness of traffic accidents that stems from drowsiness or sleepiness while driving. Through the use of sensors, which are programmed to recognize when someone has fallen asleep, the device will emit vibrations and high-pitched sounds to bring the driver back to consciousness.

Would you be willing to use one? *

- Yes
- No
- Maybe

How important is the design of anti-sleeping glasses to you? *

	1	2	3	4	5	
Not important						Very important

How important is the weight of anti-sleeping glasses to you? *

	1	2	3	4	5	
Not important						Very important

Which of these would you think would help you stay awake? *

- High-pitched noise
- Vibrations
- Both
- Other...

How effective do you think anti-sleeping glasses would be in preventing accidents? *

	1	2	3	4	
Not effective					Highly effective

What factors will influence you to purchase anti-sleeping glasses *

- [ ] Comfort
- [ ] Effectiveness
- [ ] Price
- [ ] Style
- [ ] Brand
- [ ] Other...

How much would you be willing to spend on anti-sleeping glasses? *

- ( ) Less than 10BD
- ( ) 10BD-20BD
- ( ) 21BD-50BD
- ( ) More than 50BD

What features would you like to see in anti-sleeping glasses? *

Short-answer text

Appendix B
Arduino IDE Code

```
int Sinput = A1;
int Buz = 3;
int LED=13;

void setup()
{

Serial.begin(9600);

pinMode(Sinput, INPUT);
pinMode(Buz, OUTPUT);
pinMode(LED,OUTPUT);

}

void loop()
{
Serial.print(digitalRead(Sinput));

if (digitalRead(Sinput) == LOW)
{
delay(2000);
digitalWrite(LED, HIGH);
digitalWrite(Buz, HIGH);
}
else
{
 if(digitalRead(Sinput) == HIGH)
{
digitalWrite(LED, LOW);
digitalWrite(Buz, LOW);
}}}
```